

**EFFECT OF FORMATIVE EVALUATION IN MATHEMATICS  
ACHIEVEMENT AT BASIC LEVEL**

**A**

**THESIS**

**BY**

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## LETTER OF CERTIFICATE

This is to certify Mr. **KeshavBahadurBadaila**, a student of the academic year **2017/2018** AD with thesis number **1633** Exam Roll No. **7328387** Campus Roll No. **200**, and T. U Regd. No. **9-2-604-7-2012** has completed his thesis under my supervision during the prescribed by the rules and regulations of T. U Nepal. The thesis entitled “**Effect of Formative Evaluation in Mathematics Achievement at Basic Level**” embodies the result of his investigation conducted from **2020 to 2021** at the Department of Mathematics Education, University Campus, Tribhuvan University, Kirtipur, Kathmandu. I recommend and forward that his thesis is submitted for evaluation to award the Degree of Master of Education.

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Date: 29<sup>th</sup> July, 2021

**LETTER OF APPROVAL**

Thesis Submitted

By

**KeshavBahadurBadaila**

Entitled

**“Effect of Formative Evaluation in Mathematics Achievement at Basic Level”**

has been approved in partial fulfillment of the requirements of the

Degree of Master of Education.

**Viva-Voce Committee****Signature****Prof. Dr. Bed Raj Acharya**

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Date: 29<sup>th</sup> Shrawan, 207813<sup>th</sup> August, 2021

### RECOMMENDATION FOR ACCEPTANCE

This is to certify that Mr. **KeshavBahadurBadaila** has completed his M. Ed. thesis entitled “**Effect of Formative Evaluation in Mathematics Achievement at Basic Level**” under my supervision during the period prescribed the rules and regulations of Tribhuvan University, Kirtipur, Kathmandu, Nepal. I recommend and forward his thesis to the Department of Mathematics Education to organize the final viva-voce.

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**DEDICATION**

*This thesis is dedicated to my father **Mr. Jung Bahadur Badaila**,  
my mother **Mrs. Apsara Devi Badaila**, and my wife **Mrs. Kalawati Rokaya Badaila**.*

*Whose love, support, and encouragement have enriched my soul and  
inspired me to purpose and completed this research.*

## **DECLARATION**

This dissertation contains no material which has been accepted for the award of another degree in any institution. To the best of my knowledge and belief, this dissertation contains no material previously published by any authors except due acknowledgment has been made.

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**KeshavBahadurBadaila**



## Abstract

This study is entitled **“Effect of Formative Evaluation in Mathematics Achievement at Basic Level”**. The main aims of this study were to find out the effect of formative evaluation in teaching mathematics and to explore the feeling of student and their activities during teaching period formative evaluation. I followed quantitative method in this research. The research is based on constructivist view of learning and the design of this study was quasi-experimental design. By using purposive random sampling researcher selected two schools from the Sindhuli District. For the research purpose, I selected 26 students from Janapremi Secondary School(Experimental Group)and 26 students from Bengktshor Secondary School(control group).The experimental and control group of students were taught triangle, quadrilateral, polygon and sets by researcher himself through formative evaluation and without using formative evaluation respectively for 24 periods. Beforeexperiment researcher conducted a pilot test and after completion the experiment period, achievement test the chapter (consisting objective and subjective questions) was administrated to both groups and mean scores were calculated from the sample of 26 students in experimental and control groups. The difference in mean achievement scores were tested using t-test for determining statistical difference between them. Apart from qualitative outcomes the researcher observed the students’ regularity,interaction,co-operation, readiness for learning and interview was conducted.

In conclusion, the researcher found that the mean achievement scores of students taught by using formative evaluation becomes higher than the mean achievement scores of students without using formative evaluation in teaching mathematics. In qualitative aspects while using formative evaluation of teaching students felt learning easy, which increases their confidence regarding the mathematical learning.Students have positive perception towards formative evaluation assist teaching. Students were motivated in learning mathematics. Formative evaluationhelped to students for conceptual learning. The use of formative evaluation in learningtriangle, quadrilateral, polygon and sets increased overall student motivation, engagement and achievement. There was in-depth participation of students in classroom interaction and problem solving. Formative evaluation plays the

role of cognitive level high of the student and the level of the understanding was increasing. Formative evaluation helped to students to unlock the hidden talents. It would be better if mathematics teacher uses the formative evaluation in classroom teaching. The use of formative evaluation in teaching has learning triangle, quadrilateral, polygon and sets proven that best strategy in geometry teaching for the better construction and better understanding than conventional approach in the context of Nepal.

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## **CHAPTER- I**

### **INTRODUCTION**

#### **Background of the Study**

Formative evaluation refers to a wide variety of methods that teachers use to conduct in-process evaluations of student comprehension, learning needs, and academic progress during a lesson, unit, or course. Formative evaluations help teachers identify a concept that student is struggling to understand, skills they are having difficulty acquiring, learning standard they have not yet achieved so that adjustment can be made to lessons, instructional techniques, and academic support.

Yarmohammadian(2006) states that, Formative Evaluation is one of the important activities in the improvement and development of educational systems. It can determine weakness and ability points of educational systems or any programs of schools. Evaluation can define as process that studies performances and feedbacks of learners or users in learning process. The aim of education in any country is to change circumferences of teaching-learning procedures in institutes or schools. Evaluation can help instructor or teachers that analyzed the changes and differences between previous and next status in learner(s). Through this method, real performances will be indicated and teacher can study to self-teaching status.

Brown et al. (1997) [1] states that “any assessment system has certain weaknesses: overstressing students and the staff; too many tasks with the same deadline; insufficient time for students and teachers; inadequate or superficially provided student feedback; diffuse or inexistent assessment criteria; large variations in grading the requirements of various modules. Continuous summative assessment highlights even more the aforementioned weaknesses. There is even the danger that assessment will dominate teaching and learning, and there will be no more time for students and teachers for anything else”. Formative evaluation can include of several forms. All forms of formative evaluation can have general goal Schools are now more likely to encourage or require teachers to us formative evaluation strategies in the classroom and there are a growing number of professional development opportunities available to educators on the subject. While there is relatively little disagreement in

the education community about the utility of the formative evaluation, debates or disagreements may stem from differing interpretations of the term.

According to Sidhu, (1984), the main purpose of the evaluation program is to help provide more intelligent guidance in teaching and learning, to develop more effective curricula and educative experiences and to secure more intelligent and effective cooperation from parents and community.

Evaluation is a crucial aspect of educational progress and should be considered as an integral part of day to day instructional program. Student achievements in mathematics reveal their mathematical knowledge and skill after instructional activities.

The effectiveness of instruction is usually determined by measuring achievements against objectives undertaken. An efficient program of evaluation no longer comprises merely the effort to check the completed progress but rather in the continual appraisal of the students' progress towards the achievement of the pre-established aims.

Students' achievement in mathematics reveals their mathematics knowledge and skill after their students which represent their progress. It is measured since every course has its instructional objectives which have to be achieved. The procedures and techniques of judging students' achievement are understood as evaluation.

Morris, Nason, Tag, and Nevile(1963) state evaluation as: " Evaluation practice of today is based upon a changed philosophy in the elementary school. Continuity evaluation within a unit work is based upon observation self-evaluation by the public and group itself. The evaluation may be accompanied either by teacher-made tests or standardized tests. Both of these are likely to emphasize problem-solving abilities".

Day to day observation is an integral part of the formative evaluation system. It can elicit every important information regarding an individual students' learning process in terms of cognitive power, skill, social and emotional behaviors. Formative evaluation activities may be extended throughout the life of a programmer to help guide this evaluation. The successful formative evaluation depends not only on program



design and planning but also on the early adoption of effective data collection strategy. The implications of formative evaluation are, the awareness of individuals on a certain specific problem, to teach through concept, skills, principles, etc. with new strategies, help the student problem and to promote the students' achievement level.

The core purpose of formative evaluation in mathematics is to guide and direct the teachers for text construction effective teaching. For this, teachers need to be trained. Although the formative evaluation of the basic level in mathematics in practice, teachers measure the achievement of the student by administering the test with the help of using formative evaluation. The effort of formative evaluation in mathematics achievement at the basic level has not tested. This gap has created curiosity for the researcher and this led to finding the effect of formative evaluation in mathematics achievement at the basic level.

### **Statement of the Problem**

Teachers and students both considered a difficult subject at the school level. Because it takes time and energy many students have been failing in mathematics in school level exams and also have low achievement. In the classroom period, there is no sufficient teaching and learning and teacher do not use proper evaluation. Therefore, mathematics teaching and learning activities become challenging. Many factors affecting teaching and learning mathematics at basic level. It is difficult to hypothesize, and somewhat irresponsible to conclude that the use of formative assessments does not provide information to help improve instructional practices or student outcomes in classrooms. This manuscript provides a critical examination of the formative assessment literature in particular issues related to the formative assessment lexicon, Black and Wiliam's (1998) seminal work, and more recent research. Finally, this manuscript provides the foundation for a series of manuscripts on "best practices" for evaluating student achievement through the use of formative assessment. Therefore, researcher seeks to find out the appropriate type of formative evaluation for a mathematics teacher to use in his/her classroom. This study mainly concerned with the following investigating researchable questions:

1. Does the formative evaluation effect on students' achievement in teaching mathematics at a basic level?

2. How do students feel when they are taught with and without using formative evaluation?

### **Objectives of the Study**

The objectives of the study are as follows

1. To find the effect of formative evaluation on students' achievement at the basic level.
2. To explore feeling of students and their activities in the classroom while teaching them with formative evaluation.

### **Research Questions**

1. How is formative evaluation used students in learning?
2. How do formative evaluation effect on students' achievement at the basic level?
3. What is the perception of students and their activities in the classroom while teaching them with formative evaluation?

### **Justification of the study**

Evaluation is taken at varying intervals throughout a course to provide information and feedback that was help improve the quality of student learning and quality of the course itself. This study helps concern individuals and teachers for the effective use of formative evaluation in mathematics class of the Nepalese schools frequently. This study helps to identify the effect of formative evaluation in basic level. This study helps government to implement continues assessment system effectively at basic level. Formative evaluation is a technique to monitor students' learning to provide ongoing feedback that can be used by instructors to improve their teaching and by students to improve their learning. There are many tools of formative evaluation such as class work, homework, class discussion, observation, unit test; questioning, multiple-choice answer, think pair and share, visual representation, etc. These tools of formative evaluation give the students report to the teacher. According to the reports, the teacher makes the strategies about how to remove difficulties in teaching-learning and improve them by using the appropriate technique

of formative evaluation. In a classroom, different learning abilities students and how to improve their study knows from the facing formative evaluation. Such, mathematics teachers, schools, students, researchers, mathematics authors, policy makers, curriculum designer and interested with formative evaluation especially in mathematics achievement have taken benefits. About these:

- This study contributes new knowledge and experience on teaching mathematics.
- The mathematics teacher gets brief information with the help of this research in the content about triangle, quadrilateral, polygons and sets teaching activities using formative evaluation.
- This study helps those all schools who want to improvement or use of formative evaluation in teaching/learning mathematics mostly about triangle, quadrilateral, polygons and sets at Basic Level.
- This study helps to identify the effectiveness of teaching mathematical triangle, quadrilateral, polygons and sets. This study helps for further research or study about formative evaluation regarding on mathematics teaching at basic level.
- This study helps to teachers to choose the appropriate teaching materials for the content.
- The result of this study was very helpful to the educational planner to implement formative evaluation at Basic level, it also gives further prediction about updated education system.

#### **Delimitation of the Study**

- The study was conducted on experimental and control equivalent groups of the students of grade VII.
- The research was done on quasi-experimental design with purposive random sampling method.
- Two public secondary schools from Tinpatan rural municipality of Sindhuli district were elected for the study.
- The experiment was conducted in four-week duration.
- The control group of the student were taught only using without formative evaluation.
- Only grade VII students were included in the sample of the study.

- The experimental period of this research was based on completion of targeted chapters.
- Achievement test and interview guideline with observation note were tools of data collection

### **Hypothesis of the Study**

A hypothesis considered as tentative generation about the problem under investigation. Hypothesis provides direction to research and prevents the review of irrelevant literature and the collection of useless or excess data. Hypotheses are statements in quantitative research in which the investigation makes a prediction or a conjecture about the outcomes of a relationship among attributes or characteristics (Cresswell, 2012). The hypotheses of this study are as follows:

**Research Hypothesis:** Using Formative Evaluation provides effective result of the achievement of the students to compare using formative and without using formative evaluation.

**Statistical Hypothesis:** The null and alternative hypothesis as below:

- H<sub>0</sub>:** There is no significant difference between the achievement of students by using formative and without using formative evaluation at grade VII.
- H<sub>1</sub>:** There is significant difference between the achievement of students by using formative and without using formative evaluation at grade VII.

### **Operational Definitions of the Key Terms**

**Achievement** ÷ Achievement of the study defined in terms of the scores obtained by the students on mathematics tests consisting based on the study constructed by the researcher.

**Control Group** ÷ Control group is taught to students without using formative evaluation.

**Experimental Group** ÷ Experimental group is taught to students by using formative evaluation.

**Formative evaluation** ÷ Evaluation which constructed regularly in the classroom to achieve the objectives of the study such as class-work, homework, observation, Quiz, discussion, etc.

**Post-tests** ÷ The post-test is a test that measures the students' achievement after implementing the experiment.

**Pre-test** ÷ Pre-test is a test that measures the students' achievement before implementing the experiment.

## CHAPTER II

### REVIEW OF RELATED LITERATURE AND CONCEPTUAL FRAMEWORK

The review of related literature deals with theories or research studies. It helps to conduct new research systematically by providing a general outline of the research study and avoid unnecessary duplication. Realizing the importance review of related literature, the researcher studies the following literature before conducting this research.

#### **Empirical Literature**

Thomson et al (2007) did a research study on "Effects of evaluation feedback on the self-efficacy and math achievement of ninth grade algebra study." The researcher divides the total size of 46 into three treatment groups: self-referenced feedback, social-referenced feedback, and a control group. Self-referenced feedback composed the students' performance to that of the other students in the class. The control group did not receive comparative feedback. Mathematics models of grade self-efficiently indicated that the self-referenced feedback group had higher certain for achieving higher graded than the other two feedback groups even though the results were not significant. The social-referenced feedback group did not exhibit different grade self-efficiency far achieving higher grades in the course from the control group. Math achievement changed significantly by the treatment group. While this study indicated only minimal improvements in the diagnostic exam scores, the self-referenced feedback treatment group exhibited a rate of change more than five times of the control group, and more than one and a half time times that of the social-referenced feedback treatment group.

CERID(2007) did a study and it collected the opinion of 162 in-service primary teachers from eight districts (Sindhupalchok, Dolakha, Rasuwa, Ramechhap, Kabhrepalanchok, Bhaktapur, Kathmandu, Tanahu ) in PTTC. Dhulikhel about the evaluation system and found that: Majority of the teachers (60%) are in favor of using monthly, quarterly, final and oral tests to maintain the student's evaluation as a continuous process. Twenty- four percent of teachers are satisfied with three times quarterly tests in a year and rest 16 percent are in favor of including the weight age of unit test or monthly test and quarterly tests.

Almost all the teachers agree that besides the quarterly test and many other evaluation techniques such as class observation, homework checking, monthly tests, and oral tests. This proves that most of the teachers are in favor of a formative evaluation system.

Joshi (2010) did research on "Effect of Formative Evaluation in Mathematics Achievement at Secondary Level". The objectives were to find the effect of formative evaluation in mathematics achievement at secondary level and to compare the mathematics achievements of students with and without using formative evaluation. to fulfill the objectives of this research, the researcher selected the pretest-posttest equivalent group experimental design. The population of this study consists of all the students of Kathmandu District. Grade IX students of Shree Adinath Secondary School were selected as sample. Two equivalent groups were defined based on the pretest result. The experimental and control groups were determined by tossing a coin. Both the experimental and control groups were taught by the researcher himself. The experimental group was taught by using the formation evaluation and the control group was taught without formative evaluation. For the data collection, the researcher developed two achievement test papers pre-test and post-test. The pre-test was administered before the experiment started. The duration of the experiment was two weeks. After the completion of the experiment, the posttest was administrated on both groups, and mean scores were calculated. Then the difference is the mean

Achievement of two groups were tested by the statistical method at 0.05 level of significance. There was significant difference Thus, the researcher concluded that the achievement of the experimental group is better than the achievement of the control groups. So, mathematics achievement of students taught by using formative evaluation was found better than without using formative evaluation at the secondary level

Chalise(2006) researched the topic "The Effectiveness of continuous Assessment for Improving Students' Achievement of mathematics on the private school of Chitwan district." The main objective of this study was to compare and analyze the effectiveness of continuous assessment system (CAS) in mathematics learning at grade VII. He adopted descriptive survey design and collected data from achievement test and interviewing the teachers in five school of Chitwan district. He

applied t-test to analyze the data and he concluded that continuous assessment has a positive impact on student's achievement. The study also proves that continuous assessment can be used effectively in the Nepalese classroom of private schools and is useful in reducing the number of failure students.

Hansen(1972) did a study on "An investigation of the Effects of Required Homework on Achievement in collage Mathematics." For his Doctoral Dissertation found that the homework group performed significantly better than the no homework groups two investigators designed examinations but equal to each other on the standardization test.

Neupane (1999) did research on "A study on the effectiveness of homework on mathematics achievement of lower secondary students" with the objectives to explore and compare the achievement of two groups of students when one is given homework without feedback: Pre-test, Post-test equivalent groups design was adopted. Two schools of Dhadingdistrict were sampled. The teacher taught both groups on experimental and control. The t-test was applied to conclude that the homework assigned with feedback caused better achievement that the homework assigned without feedback. The primary education curriculum, 2063 stressed the need for a continuous assessment system for students' evaluation. The main aim of continuous assessment is to 17 upgrade students who are involved in teaching-learning activities in a school year by observing the change in their behaviors. For the students who remain absent in a class and whose learning achievement is low can be upgraded as per the decision of the teacher, parents, and head-teacher for providing more learning opportunities. The pass mark is not determined in grades 1-3 because the continuous assessment is done in these grades.

Poudal (2016). Conducted his research study entitled "Effectiveness of Collaborative Learning in Mathematics". The main purpose of this study was to identify the effects of collaborative learning on students' mathematics achievement and attitudes towards mathematics in selected Gandhi Adarsha secondary school in Bhaktapur District. A total of 40 students of grade nine among them 20 students were experimental and 20 students were in the control group participated in this study where the experimental design was administered. Data were analyzed and interpreted by using statistical tools such as Mean, Standard deviations, and t-test. The results



showed that collaborative learning had significant effects on mathematics achievement and attitudes towards mathematics. It was found that students' performance in mathematics and attitudes towards mathematics were affected by exposure to collaborative learning. The findings of this study have shown a great improvement in mathematics achievement and attitudes towards mathematics. Therefore, collaborative learning can be successfully used to promote students' performance in mathematics in secondary school.

Yadav(2017) did research on "Effect of reinforcement mathematics achievement of lower secondary level students" is carried out to compare the achievement of the mathematics students taught by using reinforcement and without using reinforcement and analyze the behavior of students. The study adopted an experimental design. Achievement tests, lesson plans, and observation were used as a data collection tool for the study of this research. A pre-test, post-test, non-equivalent group design was adopted to fulfill the objective of the study. These two schools were selected by the convenience sampling method from the Sirahadistrict. The researcher has selected 40 students in the sample both the experimental and control group were taught by the researcher herself for 24 days by using and without using reinforcement respectively Researcher taught the selected units of mathematics textbook of grade VII prescribed by the government of Nepal Student's behavior was observed by the researcher during the experimentation After this an achievement test was administered on both groups. The result of the test was analyzed by using a t-test at 0.05 level of significance difference It is found that the mean achievement score of the students taught by using reinforcement is better than the mean achievement score of the students taught by without using reinforcement. From the observation, it is concluded that most of the students taught by using reinforcement were very competitive, active, regularly, concentrative, and laborious.

Yadav (2017) did research on "Student's Attitude Towards Homework". Homework is the beauty of learning mathematics. It is a process of practicing the same skills or the same concept over the same time. As homework is an important aspect of the learning process, many kinds of research were conducted to find the attitude of the students, teachers, and parents. On the same ground, this study was carried to find out the attitude of the students at the secondary level of Sirahadistrict.

Also, several factors are influencing the students' attitude towards homework. To find the effects of these variables this study was carried out. For the first objective of this study 150 students of the public and private schools were selected as sample by simple random sampling. To find out the attitude of the students the opinionative was implemented. Similarly, to achieve the second objective of this study two students were selected to examine the impacts of variables like home environment, school environment, peer influence, and the internal factor. To validate the data two teachers and the parents of the selected students were selected. The result of this study indicates that there is a positive attitude of the students towards homework. Many factors are influencing the attitude of students towards homework. There is significance in similarity to the impact of the variables related to the homework. It was found that there is a positive impact on the home environment, peers influence, school environment, and internal factors.

Nepal(2018) conducted his research study entitled "Effects of Continuous Assessment in Mathematics Achievement" were to find the effects of CAS in mathematics achievement and to explore the teachers' perception towards CAS in mathematics: This study was conducted in Lalitpur district. The samples of the study consist of class Six and seven students of selected schools. In total 340 students were consisting of 160 students from class seven and 180 from class six. A survey research design was used in this study. The researcher collected data from school's record. The data was scores obtained by students in mathematics in the final examination of the academic year 2073 B.S. And interviews from nine teachers to explore the perception of teachers towards CAS. The collected data were analyzed by two methods. At first, the quantitative data were analyzed by using the statistical method by finding the mean, standard deviation, and applying t-test. Secondly, the interview data were interpreted qualitatively by generating themes. This study found that the mean achievement of CAS is greater than the achievement of the non-CAS evaluation method. The test result suggested that CAS gives better achievement in mathematics. In the context of Nepal, CAS is not practiced seriously at school level. It can be concluded that when CAS is practiced at the school level seriously, the mathematics achievement would be increased than the previous non CAS system. The researcher recommended that CAS evaluation should be used in mathematics teaching and learning activities to get better achievement in mathematics.

William, Lee, Harrison, and Black (2004) explored the impact of 24 teachers' use of formative assessment after a six-month training period. While the results are promising, the authors themselves noted serious issues related to generalizability of the findings. First, they stated that due to the fact that each of their results reflects a separate "mini-experiment, care needs to be taken in drawing any general conclusions about the net effect of the adoption of formative assessment" (p. 60). They further note that the method of comparison was not the same in each "mini-experiment". For example, in one study they compared students' performance to the same teachers previous group of students from the preceding academic year. In another comparison, William and his colleagues compared the performance of one teacher's students in two separate classes. These inconsistencies within the research design of this study led the authors to conclude that the quantitative evidence they provided was "difficult to interpret" (William et al., 2004; p. 62).

Black and William (2003) later used this evidence to state that they could not "be sure that it was the increased emphasis on formative assessment that was William, Lee, Harrison, and Black (2004) explored the impact of 24 teachers' use of formative assessment after a six-month training period. While the results are promising, the authors themselves noted serious issues related to generalizability of the findings. First, they stated that due to the fact that each of their results reflects a separate "mini-experiment, care needs to be taken in drawing any general conclusions about the net effect of the adoption of formative assessment" (p. 60). They further note that the method of comparison was not the same in each "mini-experiment". For example, in one study they compared students' performance to the same teachers previous group of students from the preceding academic year. In another comparison, William and his colleagues compared the performance of one teacher's students in two separate classes. These inconsistencies within the research design of this study led the authors to conclude that the quantitative evidence they provided was "difficult to interpret" (William et al., 2004; p. 62).

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from 50 (institutional and community) schools, the researcher administered the questionnaire as the survey over 102 mathematics teachers. Then the researcher selected six teachers from 102 teachers based on a purposive sampling method to observe classroom: 30 lessons were observed while teachers were practicing mathematics in the actual classroom using observation protocol. Also, a semi-structured interview was conducted with six mathematics teachers whose mathematics classes were observed. The researchers analyzed the data using the inferential statistics performing SPSS 21.0. The findings of the study explored that mathematics teachers had perceived active learning positively in the mathematics classroom. Despite the positive perceptions, the implementations part of active learning was poor. Moreover, the most common factors affecting the implementation of active learning in mathematics were lack of sufficient time and a shortage of teaching aids in the classroom. It is affirmed that active learning in mathematics demands a new structure in the national curriculum and management of classroom setting because it calls for the use of a wide range of innovations in mathematics leaning. Therefore, it is necessary to restructure and up to date the education system following active learning.

### **Theoretical Literature**

A theoretical literature of study is the structure that can hold or support a theory of a research study. The theoretical literature of the study introduces and describes the theory that explains why the research problem under study exists.

There are many theories related to human development and their learning such as: Behaviorist theory, Cognitive theory, Constructivist theory, Social-constructivist theory, Psychological theory, Cultural theory, Conflict theory Humanit and intellectual theories. All theories have their own significant and vital rhythm in learning but this study will base on effectiveness and achievement of students. So, I would use social constructivist approach of learning. According to social constructivist theory Learning is an active process in which learners construct and internalize new concepts, idea, and knowledge based on their present and past knowledge and experience.

There are various learning theories to analyze and interpret the data such as classic conditioning, operant conditioning, Trial and Error, social Learning, social conditioning, cultural discontinuity theories, socio-cultural perspective and multiple intelligence and so on. All theories support the human situation and suggest them to promote human learning activities. The theoretical discussion is needed for the interactive finding of the study. To analyze and find a suitable solution in the area of “comparison of student achievement in learning mathematics at the basic level” and influencing of gender-wise mathematics achievement. So, different learning theories were found to be promising to be supportive of the present study take my study: Coleman, Hoffer and Kilgore’s model of student achievement. Coleman, Hoffer, and Kilgore proposed a general model of students achieved that explains that the school sector will affect student achievement. In their model, student achievement is influenced by the following six factors: Student own background, other student backgrounds, Student own behavior, other student behavior. School policies According to Coleman, Hoffer, and Kilgore “School policy, such as level of homework, curriculum, and discipline practices, indirectly affect a student’s achievement by influencing the student” (Mehta, 2017).

Social constructivist theory is most often associated with Vygotsky. So it is very supported to teaching and learning mathematics and also increases to students to do better. It is the best constructed when learners collaborate together and the role of the teacher as the facilitator. The theoretical perspective of this study will be social constructivist theory of learning. The social constructivist theory has been chosen because it builds on prior knowledge: students use what they already know to make connection to new knowledge of formative evaluation. When students make these connections, they learn new techniques and relate it to what they already know. In this study formative evaluation would be based on the constructivist theory of learning, because knowledge is actively constructed by the students while they are making constructions and analyzing figures instead of knowledge being passively received and accepted. Many educators today believe that the social constructivist theory is a relatively new theory in education. The social constructivist classroom presents the learner with opportunities to build on prior knowledge from experience. Learners are allowed to deal with problems and they find meanings in them because of their real-life context, in solving their problems, learners are encouraged to explore possibilities,

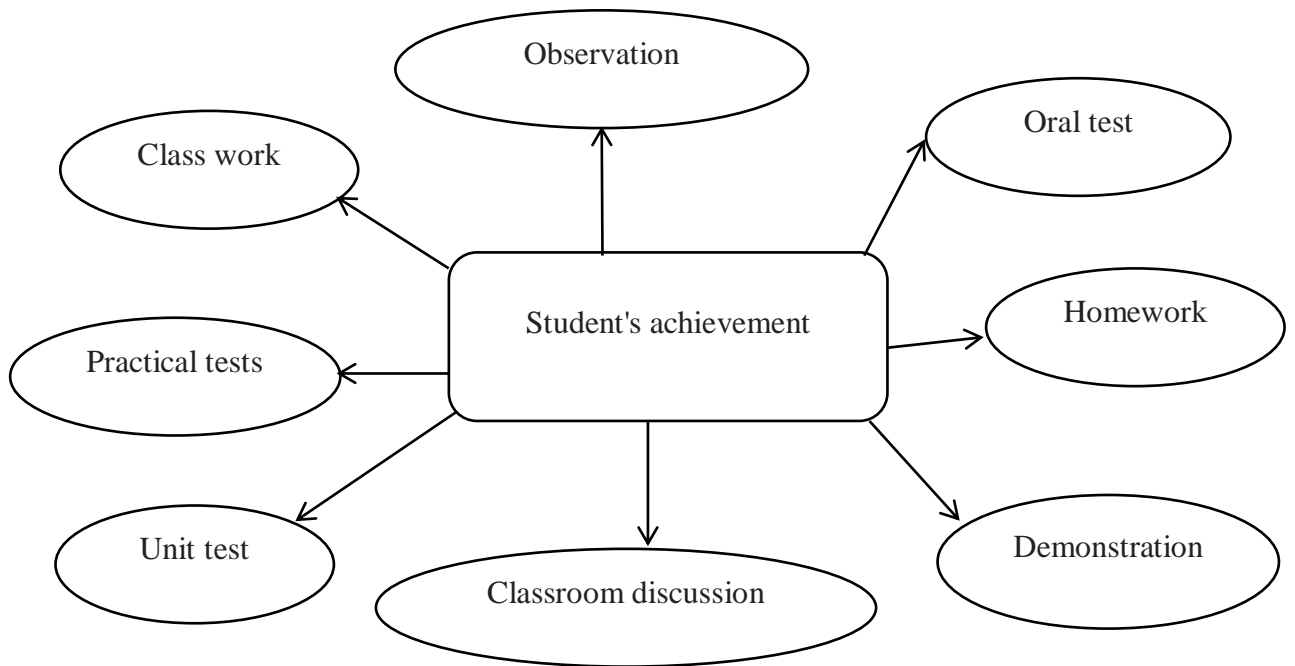
invent alternative solutions, collaboration with other learners and finally present the best solutions. It is also claiming that the learners are actively involved in learning process and teaching learning environment is democratic. Students' activities are interactive and teacher as facilitators that are also the main characteristics of social constructivist learning approach.

Vygotsky developed a "Zone of Proximal Development (ZPD)" which was the different between what a child is taught by together. He believed that children learn through social interaction and by learning to solve problems with others, he gave the name this process is called "Scaffolding" (Vygotsky, 1978). The study drawn up on the constructivist theory, social interaction for cognitive development. The main principles are the Proximal Development (ZPD) and Scaffolding. Students generally have challenges in understanding the mathematical concepts, therefore in this study formative evaluation introduce as a scaffold to enhance students understanding of achievement of test. Formative evaluation has acted as the primary scaffold in assisting and guiding the students to reach the ZPD.

Thus, curriculum should be developed in a spiral manner so that students can build upon what they have already learned. This review of literature includes the social constructivist theory of learning because the students in this study actively built on what they already knew in order to gain an understanding of mathematics. The students have also actively engaging in the process of scaffolding as they taught assistance from more advanced students in their mathematics classes by using formative evaluation.

### **Conceptual Framework**

In the experimental study, pre-test, post-test, and equivalent group design were adopted to find the effect of the independent variable on the dependent variable. In this study the intervening variables were manipulating to find its effect on student's achievement. The intervening variables are classroom discussion, observation, oral test, class work homework, demonstration, and practice tests, which directly affect the dependent variable. The researcher has used the following the conceptual framework. Figurative representation of the conceptual framework is presented below:



**Figure 3.1: Conceptual Framework**



## CHAPTER-III

### METHODS AND PROCEDURES

This chapter deals with the plan and process related to the study under the different headings which was used to achieve the objective of the study. The major producers will be described in this chapter are: Design of the studied, instrument, validity, reliability, data collection procedure, and data analysis procedure.

#### **Design of the Study**

Research design is the design of path about how the research will conduct. It is the detail path of the investigation. Thus research design comprises the overall strategy followed in collecting and analyzing data (Gay et al., 2012). This study focuses to find the effect of formative evaluation on students' achievement at the basic level. To explore feeling of students and their activities in the classroom while teaching them with formative evaluation at grade VII. My research was based on quantitative research method with experimental research design. Thus I have adopted pre-test, post-test non-equivalent quasi-experimental design to collect and analyze data because this design was often use in classroom experiments when experimental and control groups are such naturally assembled groups as interact classes. According to Best and Kahn (2012), 'experimental research describes, what happen when certain variable was carefully controlled and manipulated. Hence, in this research, the following experimental procedure was use.

This is an experimental study. This design is one of the most effective designs in minimizing the threats to experimental validity. Two groups were selected for this study. Two groups were made equivalent to the basics of pre-test results. Two groups were given achievement tests  $Q_1$  and  $Q_3$  before the treatment were given. After the formation of two equivalents groups, E and Cone group was experimental treatment, whereas the other was not given. Both groups were given achievement tests  $Q_2$  and  $Q_4$  on the same test paper. With the help of a pilot study, the researcher was refining the achievement test paper. The achievement test paper was consisted of objective and subjective questions. By using achievement test paper II, the mean standard deviation, of the score was found for both experimental and control groups. The mean difference and standard deviation were compared with the help of the statically formula. For this,

the significance of the difference between the mean and standard deviation was determined with the use of the t-test

**Table 1**

Groups	Pre-test	Treatment	Post-Test
E	Q <sub>1</sub>	X	Q <sub>2</sub>
C	Q <sub>3</sub>	–	Q <sub>4</sub>

Where,

E= Experimental group

C=Control group

X=Treatment given to an experimental group

Q<sub>1</sub>=Pre-test given to the experimental group

Q<sub>2</sub>=Post-test given to the experimental group

Q<sub>3</sub>=Pre-test given to the control group

Q<sub>4</sub>=Post-test given to the control group

### **Field of the Study**

I chose Tinpatan Rural municipality of Sindhuli district as the research site for my study. The reason to choose this site is that I could easily find the participants according to my need of my research problem.

### **Population of the Study**

All the students who are studying in grade VII, Tinpatan Rural municipality of Sindhuli district was taken as the population of the study in the academic year 2077.

### **Sample of the Study**

In this research work, I selected the students of grade VII from two public schools of Tinpatan rural municipality of Sindhuli district that was considered as sample of the study.

Bengktshwar higher secondary School and Shree Janapremi Secondary School were selected as the sample by Purposive sampling. Fiftytwo students were selected for the data collection. By tossing a coin 26 students of one school were selected for experimental group and another 26 students were selected for control group. The students of grade VII were selected from both schools. Both groups of studentswere homogeneous as possible by selecting schools of similar status and based on BLE result with focusing on same cognitive structure of students.

### **Variable of the Study**

The variables need to be specified in an experiment so that it is clear to readers what groups are receiving the experimental treatment and what outcomes are being measured (Creswell, 2012). In this research there were three types of variables, they are given below:

### **Variable Studies**

In the experimental research design, there are different types of variable which affect the validity of the experimental. So, we have needed to study the variables. In this research, we study the following variable.

### **Independent Variables**

In this study, the independent variable which was manipulated the experimentation method of formative evaluation on the instruction period.

### **Dependent variable**

In this study, students'achievement in mathematics was dependent variable.

### **Extraneous variable**

The independent variables except for formative evaluation which affects the dependent variable are extraneous variables. The possible extraneous variables were experimental environment, subject matter, teacher variable, evaluation process, and instruments.

### **Pretest (Achievement Test Paper I)**

The achievement test paper I administered to both experimental and control groups. This paper consisted of fifteen items in which 9 were objectives and 6 were subjective items. Among 9 objective questions, 3 questions were being related to understanding, 3 questions were related to skill and 3 questions were being related to the application. Among 6 subjective questions, 2 questions were related to understanding, 2 questions were related to skill, and 2 questions would be related to the application. The objective questions carry one mark each and short and long answers subjective questions carry 2 and 4 marks respectively. All the items were constructed based on the prescribed textbook of grade VII.

### **Posttest (Achievement Test Paper-II)**

The achievement test paper II was administered to both experimental and control groups. This paper consisted of fifteen items in which 9 were objectives and 6 were subjective items. Among 9 objective questions, 3 questions were related to understanding, 3 questions were related to skill and 3 questions would be related to the application. Among 6 subjective questions, 4 questions were related to understanding, 1 question was related to skill, and 1 question was related to the application. The objective questions carry one mark each and short and long answers subjective questions carry 2 and 4 marks respectively. All the items were constructed based on the prescribed textbook of grade VII.

### **Data Collection Tools and Techniques**

Data collection tools are the major part of the study. It depends on the research design. In this study, formative evaluation is the main tools of data collection and also the following data collection tools were used for the collection of data.

**Mathematics Achievement Test (MAT):** On the basis of objectives of the study, the researcher was prepared the mathematics achievement test as the main instruments of the data collection. The researchers prepared two types of test items (Subjective and Objective) and which was related to the formative evaluation. In this study, nine objectives and six subjective test item were used.

**Construction of Achievement Test:** Test item was prepared on basics of four level of knowledge it includes that Knowledge, Skill, Comprehension and Application. Also it will be included five different skills such as (verbal, visual, drawing, logical and application) according to the syllabus prepared by CDC, Government of Nepal.

**Observation Note:** Observation is one of the techniques to collect information any research. The researcher found many important aspects of study by observation. Observation conducted in natural setting gave more reliable data for the studies; pre-determined frame of observation form was used to collect the information. Here the researcher observed the classroom activities of students, interaction, performance, homework, regularity and interest in the subject matter and appearance in the classroom by means of observation tools, which reflects the effect of formative evaluation in teaching mathematic at basic level. The sample of the class observation form is showing the appendix this tool was administrated to find out the qualitative information of the students.

**Interview Guideline:** An interview is a conversation between two or more people where question was asked to obtain information about the interview. Interview is also means of data collection. A formal interview is face to face meeting in which the interviewer asked some questions to clients to get answer. There are many types of interview during this study, direct interview was conducted with the clients in the technique, and the researcher not only asked the questions but also observed all behavior and answering ways of the respondents. Here the researcher attempted to obtain information from the interviewee by experimental group unstructured interview.

### **Item Analysis**

To analyze the item, the researcher prepared achievement tests and administered to thirty, grade VII students of Bengtshor higher secondary School and Shree Janapremi Secondary School of Sindhuli district. The objective test item was scored '1' for the correct answer and '0' for the incorrect answer. The evaluation criteria for 2 marks and 4 marks subjective items were divided into two and four steps respectively. The correct answer of each step was marked with '1' and the incorrect with '0' Item difficult level and discriminating index of each item were calculated

from 27% of upper level (scorer) and 27% lower (scorer) of the 26 students. The pilot study was conducted on 25 students of grade VII. The item analysis chart is given in Appendix. From the item analysis chart out of twenty-four questions nineteen were accepted and five were rejected. Thus, the final refined posttest was confined to only nineteen questions.

### **Reliability and Validity of the Items**

Reliability of the test is very important of this study. In this study, the researcher conducted a pilot test to establish reliability of the test.

A test is said to be valid if it measures what is supposed to measure. To establish the validity of achievement test researcher was used specification grid, help of subject teacher and supervisor.

### **Data Collection Procedure**

Researcher collected the data for this research from primary source. For this purpose, the researcher had visited to each sampled school along with achievement test, requested letter from T.U. to get full support from administration. After that, the researcher requested to the headmaster and subject teacher for experiment. The researcher took pilot test at non-sampled school's students to ensure the reliability of test.

The researcher selected two higher secondary schools for pre-test which were homogenous. The researcher separated these schools respectively experimental and control groups by tossing the coin. The experimental group was treated with formative evaluation assists teaching methods and control group treated without formative evaluation. After the treatment on both groups, researcher took post-test from both groups had analyzed the post-test and pre-test result in mean, standard deviation and t-test.

After treatment of the experimental group, the research took the view of the students by using observation and interview and to know the perception of the students towards formative evaluation in teaching and learning triangle, quadrilateral, polygons and sets. Then, researcher had analyzed the student's perceptions by coding,

transcribed and analyzed. In this way, the necessary data was collected with the help of achievement-test and interview with observation note.

### **Data Analysis Procedure**

Researcher analyzed and interpreted the obtained data by using different statistical techniques. After the completion of data collection procedure, researcher had started data analysis. For the achievement test, the statistical device of mean, standard deviation and t-test were applied to find the difference in two groups. In fact, mean, standard deviation and t-test were used to compare the effect of formative evaluation in teaching triangle, quadrilateral, polygons and sets at grade VII. The difference of the test at the 0.05 level of significance so, that it was easy to compare which group is better.

For the analysis of data collected from interview were organized in different files. Recorded data were kept in separate folders. Then collected data were transcribed. Audio was transferred into written form. After the completion of transcription, by studying that they were written in coded form. By evaluating the coding date, it was generated the different themes and analyzed with the researcher's idea. There was used the help of theories for reporting finding of the data.

### **Ethical Consideration**

Ethical consideration is very important to be considered by researcher while collecting data and information. So, researcher would consider information personal matters and organizations own rules. The following consideration would be followed in my research: At first, researcher took permission from schools administrators, principal and subject teacher. The researcher built trust the respondent and respect the respondent answers. Also researcher didn't culturally, ethically, socially bias while selecting the schools as my research sample.

## **CHAPTER IV**

### **ANALYSIS AND INTERPRETATION OF DATA**

This chapter conveys the analysis and interpretation of the data collected through achievement test and interview. Each hypothesis is discussed and got finding from the data. For the purpose of analyzing all types of statistical data, statistical formulas were used setting at the 0.05 confidence level. Likewise, to interpret the collected data in qualitative research, the data were coded, transcribed and built the theme.

This is an experimental research related to effect of formative evaluation in teaching triangle, quadrilateral, polygons and sets at grade VII. The objectives of this research were to compare students' achievement of experimental and control groups, and explore students' feelings towards the formative evaluation in teaching mathematics at basic level.

For the data collection procedure, researcher administered the achievement test in one school. After testing the validity and reliability of test items, correct questions were used in Pre-test and Post-test of the experimental group and control group. To explore the feelings of students about formative evaluation, researcher had taken the interviews with four students of experimental group. Researcher had collected the above information and analyzed under the following headings;

- Comparison of the achievement of students in the with formative evaluation assist learning and without formative evaluation learning group in pretest.
- Comparison of the achievement of students in the with formative evaluation assist learning and without formative evaluation learning group in posttest.
- Explore the feelings of the students and their activities while teaching them with the formative evaluation in teaching mathematics.

#### **Comparison of Achievement of Students in Pre-test**

In this section, researcher took the pre-test of experimental and control group. Administered test items were used in this pre-test. The purpose of the pre-test was to compare the achievement between two groups. The pre-test score of student of experimental group and control group were of two ways. They were computation of



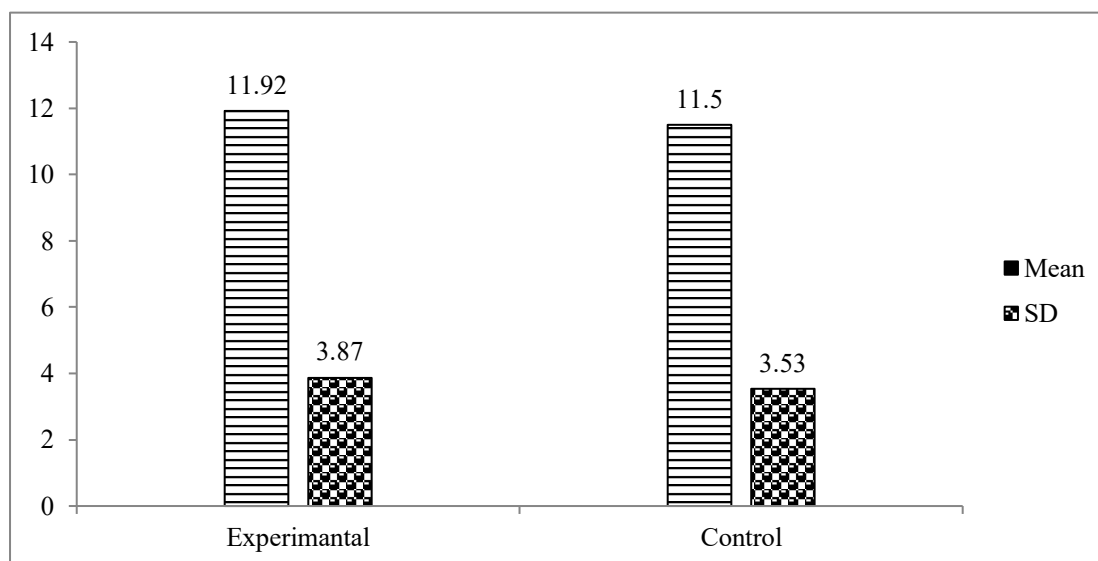
mean and standard deviation of the marks obtained by using formula. The calculated mean, standard deviation and t-value on the pre-test result were shown in the following table;

**Table 4.1: Comparison of student's achievement on pre-test**

Group Type	Sample	Mean	S. D.	Calculated t-value	Decision
Experimental	26	11.92	3.87	0.43	There is no significant difference
Control	26	11.50	3.53		

The above table 4.1 shows that, the mean and standard deviation of both experimental group and control groups on pre-test. The mean score of experimental group was 11.92 Out of 25 with the standard deviation of 3.87 and that of control group was 11.50 out of 25 with the standard deviation of 3.53. The calculated t-value was found 0.43. This shows that  $t = 0.43$  is less than the table value 1.96 at 0.05 level of significance. This indicated that the difference of average achievement between these two groups were not significant at 0.05 level of significance. Therefore, the experimental group and control group were treated as homogeneous and same level of achievement in this study.

**Figure 4.1: Comparison of student's achievement on pre-test**



The mean and standard deviation scores obtained by the students of each group in the achievement test (pre-test) score have been shown in the above diagram

(figure 4.1). This diagram is more interesting for comparison. This shows that there is no difference in achievement score of both groups of students on pre-test.

### **Comparison of Achievement of Students in Post-test**

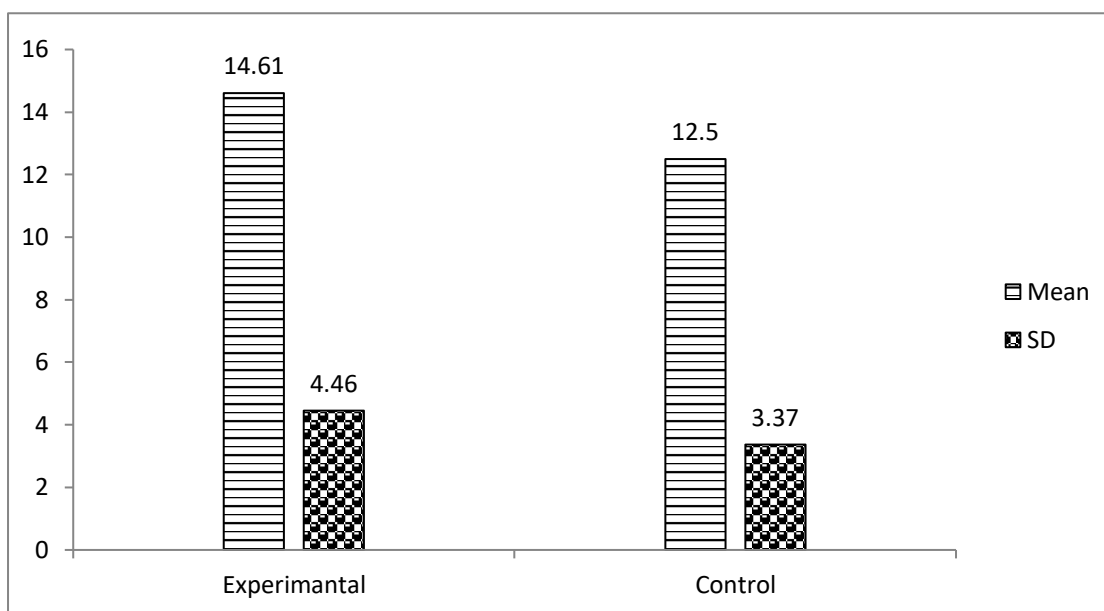
In this section, researcher took the post-test of experimental and control group. After the completion of experimental phase, with gap of eighteen days, the post-test was taken. Administered test items were used in post-test. The purpose of the post-test was to compare the achievement between two groups. The post-test score of student of experimental group and control group were of two ways. They were computation of mean and standard deviation of the marks obtained by using formula. The calculated mean, standard deviation and t-value on the post-test result were shown in the following table;

**Table 4.2: Comparison of student's achievement on post-test**

Group Type	Sample	Mean	S.D.	Calculated t-value	Decision
Experimental	26	14.61	4.46	2.084	There is significant difference.
Control	26	12.5	3.37		

The above table 4.2 shows that, the mean and standard deviation of both Experimental group and Control groups on post-test. The mean score of experimental group was 14.61 Out of 25 with the standard deviation of 4.46 and that of control group was 12.50 out of 25 with the standard deviation of 3.37. The calculated t-value of above data is 2.084. This shows that  $t = 2.084$ , which is greater than the table value 1.96 at 0.05 level of significance. So, the null hypothesis is rejected and concluded that there is significant difference between the average achievements of students taught with formative evaluation and without formative evaluation. Therefore, the formative evaluation learning group had better achievement than the without formative evaluation learning groups at the post-test.

**Figure 4.2: Comparison of student's achievement on post-test**



The mean and standard deviation scores obtained by the students of each group in the achievement test (post-test) score have been shown in the above diagram (figure 4.2). The column of experimental group of students is longer than that of control group students. This shows that there is a difference in average achievement scores between experimental and control group on post-test result. Therefore, the diagram (figure 4.2) indicates that, the achievement of students taught by using formative evaluation is better than traditional method in teaching mathematics at grade VII. This shows that the formative evaluation helps to increase the achievement of students and it has better impact on students learning.

### **Feeling of Students on Formative Evaluation Practices**

In the second problem of the research, the question “What is the feeling of the students on formative evaluation while teaching them with formative evaluation practices?” was asked. Students’ views on formative assessments practices regarding their attitudes in mathematics class, attitudes toward teachers, group works, quizzes, self and peer assessments and reward usage were gathered in face-to-face interviews. The data was analyzed with the help of the information collected through daily classroom observation of the both experimental and control groups. Feelings of student during formative evaluation were noted. Participation, interaction, attendance rate, motivational behaviors, homework, class work etc. of the students in both groups

during the experimental period was recorded on daily basis. In this study, researcher found formative evaluation very effect in teaching/ learning teaching mathematics at basis level. Proper use of formative evaluation in teaching mathematics at basic level holds prominent place in feedback.

Before the experimentation, the researcher took 5 classes and found that students were not curious and interested to learn mathematics. They felt mathematics as a difficult subject; attendance rate was low and they did not do their homework regularly. Few students had done their homework. Some of them were used to working as farmer so they could not come school daily. During the class none of the students asked question. They were passive in class work due to the lack of teacher and student's interaction. Some of the students were taking in the classroom while teacher was teaching. During the experimental period researcher tried to create proper environment for learning in the classroom. Researcher also found the attendance of girl students was very low because most of them were engaged in the household-work.

There was not active participation of students. That was the one of the main factor where they were found enjoying the classroom activities and doing class work/homework. Teacher was not taken as a fear factor. They equally involve in interaction and mutual participation. This definitely makes the high attendance rate in classroom.

Lenndunn explained that the positive reward includes literacy (verbal) reward such as 'that's great ', 'congratulation' through to more tangible reward such as change in the students' behavior (2002).?" The perception of students presented by the sample students were discussion on the following subheadings;

### **Students have good perceptions towards formative evaluation teaching**

After 24 teaching periods of formative evaluation, researcher found remarkable change in student's activities in different aspects. There were many changes in student's behavior, such as; interest in doing homework, class room participation, involving the submission of class work, interacting with friends as well as teacher. Such as, students were found to be more enthusiastic in subject matter. While the question asking in the interview, "Share your views and suggestions for

use of class room discussion, class work, quiz, etc. in teaching mathematics.”

Q1: *“I liked the teaching activities for learn mathematics. It provided us very clear concept about mathematics teaching. I am confident that I'll do better in coming examination. I felt it would be better, if we could learn always such activities in teaching mathematics”.*

Q 2: *"sir we easily understand the mathematical problems by the use of proper classroom discussion and different types of test".* It is the case of the effect of formative evaluation in learning.

All of the students interviewed responded “yes” to the question “Do you like mathematics class?” From this, it can be inferred that the students in the experimental group in which formative evaluation practices were performed enjoyed mathematics. Class and had positive attitudes toward it. In-class observations made by the researcher also support this result. The students were interested during the lesson and participated in the activities. In general, no negative attitudes toward the learning mathematics were observed.

Accordingly, formative assessment practices were inferred to contribute to the increase of the students’ love for the teachers. Formative evaluation touches the studentmind in learning. They were much benefited in learning triangle, quadrilateral, polygon and sets. Their confident level also increased by using formative evaluation. So, feeling of the students towards the use of formative evaluation was positive. Students can share their feelings in interactive class. Social interactive class increased the achievement of student and they become the positive in teaching and learning process (Vygotsky, 1973). There were positive perceptions of teacher's towards construction of geometrical figure in the research conducted in from my research also, due to the interactive environment student's confident level is becoming up and improved in achievement.

### **Formative evaluation for conceptual learning**

In every episode the researcher used formative evaluation. The researcher asked the questions to all interviewee. All the students responded positively to the question “What do you think about class work performed during the lesson?” Seven

students stated that class work increased their learning levels; seven students said that it provided cooperation; one student stated that it enabled sharing; and one student stated that it increased participation in the class. In-class observations made by the researcher also supported these findings. Examples of individual quotes from the students' views on class work are presented below:

*"Very good, we all worked together and this enabled us to understand better. I think it was much better to share with our friends. I find it good. We can help each other. Together we learn better".*

All students responded positively to the question "What do you think about the quizzes in the lesson?" Nine students stated that the quizzes increased their learning levels and six students said they had the chance to see their deficiencies. In-class observations made by the researcher also supported these findings. It was observed that the students were not bored by examinations made at the end of each topic; instead, they liked the quizzes made without grades and found them useful for seeing their errors. Examples of individual quotes of the students' views on quizzes are presented below:

*"It helps. Nice. I see my mistakes. I look at all. They enable me to learn better. They contribute a lot. Teacher's explanation of what we do wrong enables us to do correctly in the exams".*

For the question "What do you think about self and peer assessments in the lesson?" ten of the students found self and peer assessments useful. In addition, three students stated that self and peer assessments provided an opportunity to see their own situations; two students said the self and peer assessment gave them a chance to compare themselves with their friends, and one student mentioned the chance to see their deficiencies. According to the results obtained from the in-class observations, it was observed that students were generally willing in self and peer assessment practices, but rarely, some students got bored while filling out the forms. Examples of individual quotes of the students' views on self and peer assessments are presented below:

*"Very good, we take the subjects we do not understand home and study harder. We have a chance to fix them. Helpful, we evaluate our friends and*

*ourselves"*

For the question "What do you think about how your teacher rewards your efforts?" All students found the rewards helpful. In addition, six students stated that the use of rewards increased learning; three students said the rewards increased their interest in the lesson; one student said the lesson was more fun and one student stated the rewards increased their self-confidence. According to the in-class observations, it was observed that the students were quite satisfied with the rewards. They were happy to receive the rewards and their motivation toward the class increased. Individual quotes of the students' views on rewards are presented below:

*"I find it good. It is affecting us very well. When the teacher gives a reward, we learn better. I find it very good. I become very happy to receive a reward, I am learning better"*

For the question "When you think about all the practices applied during the lesson, would you like to retake the mathematics class like this?" all of the students stated that they wanted to take the mathematics class again. In accordance with this, it can be inferred that students were very positive about formative assessment practices and wanted to take classes in which these practices were applied. From the point of in-class observations, it was observed that students were generally satisfied with the class, and that they used expressions such as wanting all students to be similar to this one. So the formative evaluation makes a concept clear to understanding the mathematics.

### **Formative Evaluation as a motivator for Learning Mathematics**

In the Formative Evaluation assists class, students were involved in interacting and solving the mathematical problems with friends as well as teacher but in the control group, the researcher noticed that problems of irregularity of students in classes, students were reluctant to do homework and class work and they attend classes only due to the parental and teacher pressure. Environment of class was peace but most of the students were not sensitive to their learning activities. Most of the students did not do their homework when teacher asked them, they replied as " say *"we cannot do the problem because we have not understood well"*. They hesitated to show their homework copy to the researcher, as they were unable to solve the given

problem they only copy solution of problem from board that were solved by researcher.

The process of paying attention of students during teaching learning activities is called motivational behavior the concept of motivation is linked closely to other construct in education and psychology such as construct of attention, need, goals and interest which are all the contributing to stimulating students interest in learning and their intentions to engage in particular activities and achieved goals (Krause, K.L., Bochner, S and Duchense, S., 2003).

The researcher conducted unstructured interview to collect the feeling of students towards formative evaluation using on classroom teaching. The researcher asked some questions, how and what they felt about formative evaluation on learning period? Their views are as follows: *'they enjoyed learning mathematics by using formative evaluation and enjoyed sharing their ideas to each other and they felt easy and enjoyed in classroom activities during experimental period'*. Students were allowed to perform activities related with subject matter. Therefore, they were more motivated to formative evaluation. For examples; classroom discussion, quiz contest, oral test, class assignment, is the motivating factors. Along these activities students discuss enthusiastically. *'using formative evaluation in classroom teaching improved and their learning environment. It reduced the mathematics anxiety in classroom and focused the students on subject matter. It helped students to connect ideas and integrate their knowledge. So that they gained deep understanding and mathematical concepts'*.

*They did not complete their homework before using formative evaluation but after conducting formative evaluation in experiment group, they started to do their work regularly and started to do mathematical problem in home also. They enjoyed doing given problem after their teacher introduces the method'*.

From the above discussion it can be concluded that the students in experimental group were found more active, motivated, learner centered, excited, enthusiastic, doing class/homework than the students in control group. Furthermore, the students were actively participated in learning activities, the student felt suitable, and adoptable classroom environment that facilitated them for learning and problem



solving.

Motivation is major parts for the learning. Without motivation there aren't any possibilities of learning Deci and Ryan (2000) say that "To be motivated means to be moved to do something". So, Students should be motivated in learning. Without motivation no learning is possible. Students' perception of success in learning mathematics is highly related to their motivational attitudes. Teachers' actions, attitudes and instructional design quality for mathematics lessons have greatly influenced students' motivation (Middleton & Spanias, 1999). From the above responses, students are motivated to learn the mathematics. Therefore, formative evaluation is motivator factor increasing the student's performance and their activities.

### **Student's participation in classroom discussion is increased by using formative evaluation**

Formative evaluation enhances the learning mathematics. While formative evaluation assists class run by Researcher, most of the students were participated in teaching learning activities. Students were interested to learn more topics on the same day. They were shared their views with the researcher that *"Sir, nowadays, mathematics period is very short. I forget to do other work if I start to practice mathematics. Will you teach us other mathematics topics also"*?

The researcher noted the participation rate of students on observation note by daily classroom teaching, it showed that there was huge participation of students in learning in both group. Most of the students used to show their answer to teacher in the classroom. Students were motivated to do learning. So, they were involving in classroom activities. There was good co-operation between students to students and students to teacher. Schoenfeld (1985) proposed a framework including four categories of knowledge and behavior necessary for characterization of problem-solving performance: they are resources, heuristics, and control and belief system. So, it increases the participation of students. Formative evaluation helped to active participates of students towards learning mathematics.

## CHAPTER V

### FINDINGS, CONCLUSION AND IMPLICATIONS

This is concerned with the study of formative evaluation in mathematics achievement at basic level. The objectives of this research were to find the effect of formative evaluation on students' achievement at basic level and to explore student's feeling and their activities in the classroom in "triangle, quadrilateral, polygon and sets" at grade seven. The study was conducted based on quasi-experimental design selecting two public schools at Tinpatan in Sindhuli district. The researcher-developed test items with the help of prescribed curriculum and textbook of mathematics of grade VII. The researcher administered the pilot test in Shree Bengktshar secondary school of Sindhuli District.

For this study, the researcher selected Shree Janapremi Secondary school as an experimental and Shree Bengktshwar Secondary school as a control group. Mathematics achievement test observation note and interview were used as data collection tools. The reliability of these tools was determined by using statistical formulae. Validity of the tools was insured by expert judgment and basic level school mathematics curriculum.

The data collection process was involved the three steps. First, students of the both group were assessed in terms of pre-test in order to find out the level of the achievement of the students in the content which was going to be taught. Second, after certain treatment to experimental group, students of both groups were assessed in terms of same post-test. Third, Interviews and observation were conducted with twenty-six students of experimental group only. The obtained data was analyzed by using mean, SD and t- test at 0.05 level of significance after administrating the test. And interviewed data and observation note were analyzed by categorized, coded, transcribed and written theme in descriptive method. Based on the analysis of the data, use of formative evaluation has been established as a useful for teaching mathematics. Formative evaluation is one of the best motivational methods in teaching mathematics at school level. It gives clear concept of topics.

## Findings

This is an experimental research on two non-equivalent groups as experimental group and control group. Control Group was taught by conventional method and Experimental Group taught by using formative evaluation. Researcher took the interview and observation with students. Research was in three phases such as pre-experimental, experimental and post-experimental. Researcher had evaluated the environment of school, students as well as use of formative evaluation in basic level mathematics teaching. Use of formative evaluation was found the very effective in teaching learning mathematics. Students were very interested and participated in learning mathematical classes. Formative evaluation was found as motivator for the learners. Formative evaluation had generated positive perception for using in the mathematical teaching. The major findings of the study were;

- There is no significant difference between the mean achievement of control group and experimental group students in pre-test.
- There is significant difference between the mean achievement of students taught by conventional method and formative evaluation assist teaching in Post-test.

Similarly, from the data collected in interview and observation note, researcher got the following findings;

- Students were of more interested and participated to learn mathematics in experimental group, which found from the class observation.
- The opinion of students was score that formative evaluation makes easy to solve the mathematics problem.
- By the observation of students, all type of students (intelligent, average and weak) were engaged to learn mathematics.
- By the use of observation note, the researcher found that formative evaluation was useful for participate students in teaching learning in mathematics class.
- Formative evaluation creates the learning environment on classroom teaching.
- Students have positive perceptions towards formative evaluation assist teaching

- Formative evaluation motivates students for mathematical learning.
- Formative evaluation support students for conceptual learning.
- Formative evaluation increases the cognitive power of students.

## Conclusions

This research is one of the valuable researches in mathematics teaching. Formative evaluation plays significant role for the improvement of achievement in teaching mathematics. From the research found that the mean achievement score of pre-test was almost equal in both groups before experimental. However, the mean achievement score of the students taught with using formative evaluation has higher than the achievement score of the students taught without using formative evaluation. The researcher selected experimental and control group and taught the same topic.

The researcher conducted the achievement test than pre-test was administrated before the experiment. After completing the experiment an achievement test was administrated on both groups. The mean score and standard deviation score were calculated. By using statistical t-test at the 0.05 level of significance analyzing the difference between two groups. Also the researcher analyzed the behavior of students while teaching them with formative evaluation on classroom teaching, which was done qualitatively with help of information collected through daily classroom observation. During experimental period, teaching with formative evaluation, there researcher observed that attendance rate of student's high. Participant rate of experimental period was high than without using formative evaluation.

Students have positive perception towards formative evaluation assist teaching. Students were motivated in learning mathematics. Formative evaluation helped to students for conceptual learning. The use of formative evaluation in learning triangle, quadrilateral, polygon and sets increased overall student motivation, engagement and achievement. There was in-depth participation of students in class room interaction and problem solving. Formative evaluation plays the role of cognitive level high of the student and the level of the understanding was increasing. Formative evaluation helped to students to unlock the hidden talent. It would be better if mathematics teacher uses the formative evaluation in classroom teaching. The use of formative evaluation in teaching has learning triangle, quadrilateral, polygon and sets

proven that best strategy in geometry teaching for the better construction and better understanding than conventional approach in the context of Nepal.

### **Recommendation for Educational Implications**

Proper use of formative evaluation in teaching mathematics helps to inspire the students for the learning and improve the scores in mathematics. It is one of the innovative processes for teaching mathematics. It has many educational implications in the education field. The major educational implication was

- It could be used as the supportive materials for teacher.
- Formative evaluation can be used as the pedagogy of teaching.
- It can be used for the education policy maker.
- The classroom setting should be arranged in such a way that all students could equally and easily participate in the process of formative evaluation.
- The necessary training and workshops about the formative evaluation should be given to the teacher.
- The class work attempted by the students should be checked, evaluated, commented and suggested properly.
- Teacher should be created such types of an environment where students can learn by doing themselves and teacher only facilitate to the students.
- Teacher must record student's classroom activities and provide proper suggestion for further progress.

Since, formative evaluation is very important aspect for learner, teacher and students. After the completion of the research we conclude that there is positive role of use formative evaluation for the achievement of the students rather than the conventional method.

### **Implication for Further Study**

This study was limited to only two sample schools and the findings from this study may not be suitable for wider generalization at district, regional and national level due to its small sample size and location specially. Therefore, this study

suggests further researcher to attempt with large sample size from different locality. Thus after analyzing the findings and conclusion of this study following suggestions for further research has been made.

- This study is an experimental study limited to grade VII students of two public schools of Sindhuli district. Hence the similar researchers on the other schools and other classes should be conducted in order to establish the obtained result.
- Similar study should be carried out on the chapters of mathematics in grade VII.
- Such type of study should be carried out with a large sample and various schools of different parts of Nepal.
- This kind of studies should be conducted at all levels of schools and in other subjects as well.
- The problems and challenges of conducting formative evaluation in mathematics teaching should be identified.

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**Appendix**  
**Subjective and Objective Questions for Pilot Test**

Class: VII

FM: 40

Subject: Mathematics

Time: 1.15 min

Attempt all questions.

Objective questions (Tick the correct ( $\surd$ ) answer):[10 $\times$ 1=10 marks]

**Group-A (Knowledge)**

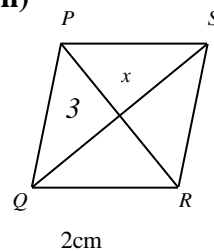
1. Which one of the following characteristics of parallelogram based on sides?
    - a) All sides are equal
    - b) opposite sides are equal
    - c) Opposite sides are parallel
    - d) opposite sides are parallel and equal
  
  2. Which one of the following characteristics of rectangle?
    - a) Each angle is  $90^\circ$
    - b) All sides are equal
    - c) Adjacent sides are equal
    - d) Diagonals are not equal
  
  3. In the given figure, what is the value of x?
    - a) 2 cm
    - b) 3cm
    - c) 4cm
    - d) None of the above
- 
4. Which one of the following are unique characteristics of rhombus?
    - a) Opposite sides are equal
    - b) opposite angles are equal
    - c) Diagonals are bisected each other
    - d) adjacent sides are equal
  
  5. Which one of the following is example of regular polygon?
    - a) Scalene triangle
    - b) Isosceles triangle
    - c) Equilateral triangle
    - d) all of the above
  
  6. What is the interior angle of regular pentagon?
    - a)  $60^\circ$
    - b)  $108^\circ$
    - c)  $180^\circ$
    - d)  $90^\circ$
  
  7. What is the exterior angle of regular hexagon?
    - a)  $60^\circ$
    - b)  $90^\circ$
    - c)  $180^\circ$
    - d)  $360^\circ$

8. Which one of the following is empty set?  
 a {2}                      b) {1,2}                      c { }                      d {1,2,3}
9. Which one of the following is subset of the given set  $A = \{1, 2, 3, 4, 5\}$   
 a) {6}                      b {7}                      c {0, 6}                      d {1,2, 3}
10. Which one of the following statements is not correct?  
 a) parallelogram is subset of quadrilateral  
 b) every quadrilateral are parallelograms  
 c) Parallelogram has opposite angles are equal  
 d) Every parallelogram is quadrilateral.

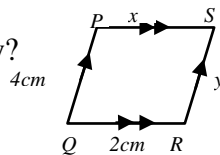
**Subjective questions (solve the following questions): [10×1=10 Marks]**

**Group-B (comprehension)**

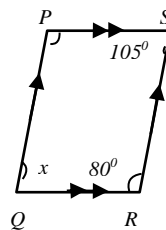
11. Find the value of x from the given rhombus.



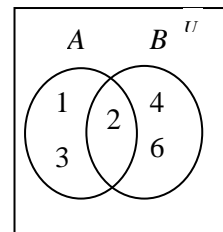
12. What is the value of x and y?



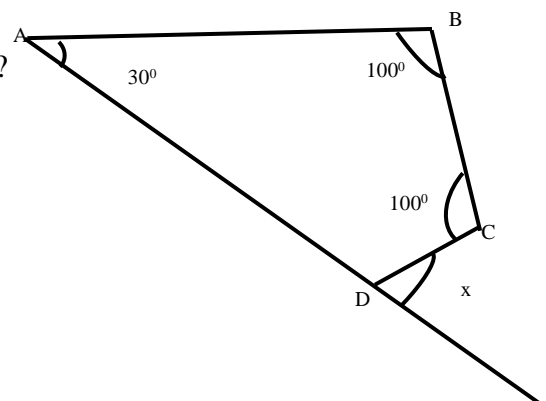
13. In the given figure, find the value of x.



14. If  $A = \{a, b, c, d\}$  and  $B = \{x, y, z\}$  then find  $A \cup B$ .  
 15. If  $P = \{1, 2, 3\}$  and  $Q = \{2, 3, 5\}$  then find  $A \cap B$ .  
 16. List out the prime numbers less than 15.  
 17. From the given Venn diagram find set A and B.



18. Find the value of x from the given figure?



19. Find each exterior angle of Nonagon.
20. If  $A = \{a, b, c\}$ ,  $B = \{b, c, d\}$  and  $C = \{c, d, e\}$  then find  $(A \cup B) \cup C$ .

**Group-C (Skills)****[3×4=12 marks]**

21. Prove that the diagonals of parallelogram bisect each other.
22. Prove that the diagonals of rhombus bisect each other at right angles.
23. If  $U = \{x: x \text{ is natural number less than } 10\}$ ,  $M = \{x: x \text{ is multiple of } 2\}$ ,  $N = \{x: x \text{ is factor of } 8\}$  and  $O = \{x: x \text{ is even number}\}$ , then prove that  $M \cap (N \cap O) = (M \cap N) \cap O$ .

**Group-D(Application)****[2×4=8 Marks]**

24. If  $A = \{1, 2, 3, 4, 5\}$ ,  $B = \{2, 4, 6, 8, 10\}$  then represent  $A \cap B$  in Venn diagram and shadow it.
25. Construct a triangle XYZ, where  $\angle X = 45^\circ$ ,  $\angle Y = 30^\circ$  and  $XY = 6\text{cm}$

Answer key for Objectives Questions:

**Group-A**

1	2	3	4	5	6	7	8	9	10
d	a	b	d	c	b	a	c	d	b

Answer key for Subjective Questions:

**Group-B**

11	12	13	14	15	16	17	18	19	20
3	4	$105^\circ$	{ }	{1,2,3,5}	{2,3,5,7,11,13}	2	$50^\circ$	$40^\circ$	{a, b, c, d, e}

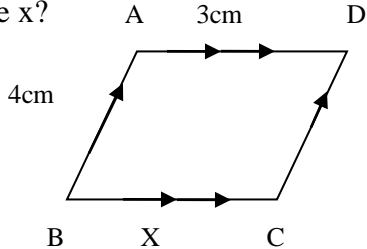
**Group-C**

Q.N	Answer	Marks
21.	i) Make three different size of parallelogram ABCD	1
	ii) Make diagonals on each // <sup>gm</sup> cutting in point O.	1
	iii) Measure AO, OC, BO and OD	1
	iv) $AO = OC$ and $BO = OD$	1
22.	i) Make three different size of rhombus ABCD	1

	ii) Make diagonals on each rhombus cutting in point O. In which $AO=OC$ and $BO=OD$	1
	iii) Measure $\angle AOD$ , $\angle COD$ , $\angle BOA$ and $\angle COB$	1
	iv) $\angle AOD = \angle COD = \angle BOA = \angle COB = 90^\circ$	1
23.	I) Write, $U = \{1, 2, 3, \dots, \dots, 10\}$ , $M = \{2, 4, 6, 8, 10\}$ , $N = \{1, 2, 4, 8\}$ and $O = \{2, 4, 6, 8, 10\}$	1
	ii) $N \cap O = \{2, 4, 8\}$ , $M \cap (N \cap O) = \{2, 4, 8\}$	1
	iii) $M \cap N = \{2, 4, 8\}$ , $(M \cap N) \cap O = \{2, 4, 8\}$	1
	iv) $M \cap (N \cap O) = (M \cap N) \cap O = \{2, 4, 8\}$	1
24.	I) find $A \cap B = \{2, 4\}$	1
	ii) Make correct Venn diagram for $A \cap B$	1
	iii) Represent $A \cap B$ in Venn diagram	1
	iv) Shadow $A \cap B$	1
25.	I) Draw a line in which $XY = 6\text{c.m}$	1
	ii) Draw an $\angle X = 45^\circ$	1
	iii) Draw an $\angle Y = 30^\circ$	1
	iv) Name the cutting point Z and join them	1

**Pre-test****Class:** Seven**F.M.:** 25**Subject:** Mathematics**Time:** 45 min**Group-A****Objectives Questions****9×1=9 Marks**

- Which of the following is correct for parallelogram on the basis of sides?
  - All sides are equal
  - opposite sides are equal
  - Opposite sides are parallel
  - Opposite sides are parallel and equal
- Which of the following is characteristics of rectangle?
  - All angles are  $90^0$
  - All sides are equal
  - Adjacent sides are equal
  - Diagonals are not equal
- From the given figure, what is the value x?
  - 2cm
  - 4cm
  - 3cm
  - None of the above


- Which of the following is example of regular polygon?
  - Scalene triangle
  - isosceles triangle
  - equilateral triangle
  - none of the above
- Which of the following is interior angle of regular pentagon?
  - $60^0$
  - $108^0$
  - $180^0$
  - $90^0$
- Which of the following is exterior angle of regular hexagon?
  - $60^0$
  - $90^0$
  - $180^0$
  - $90^0$
- Which of the following is example of empty set?
  - {2}
  - {1, 2}
  - { }
  - {1, 2, 3}
- Which of the following is subset of the set  $A = \{1, 2, 3, 4\}$ ?
  - {6}
  - {7}
  - {0, 6}
  - {1, 2, 3}

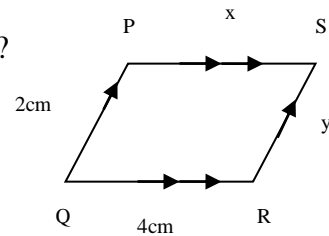
9. Which of the following is not correct?  
 a) Parallelogram is subset of quadrilateral  
 b) every quadrilateral is parallelogram  
 c) Parallelogram has opposite sides are equal  
 d) every parallelogram is subset of quadrilateral

**Group –B**

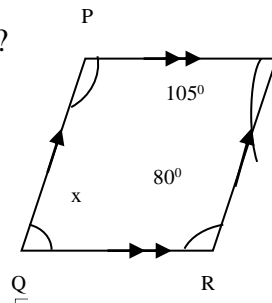
**Subjective questions**

[4×2=8]

10. From the given figure, what is the value of x and y?

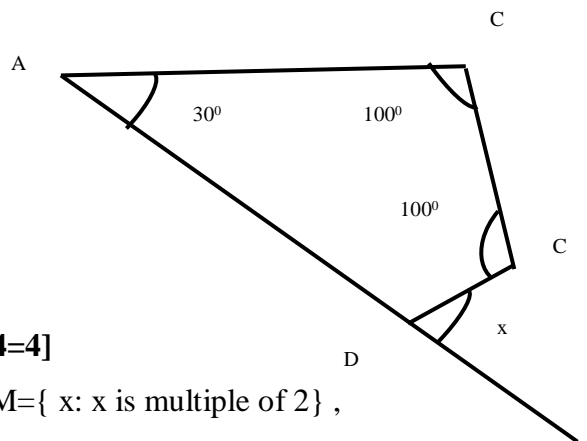


11. What is the value of x from the given figure?



12. If  $A = \{1, 2, 3\}$  and  $B = \{2, 3, 5\}$  then find  $A \cup B$ .

13. From the given figure find the value of x?



**Group C (Skill)[1×4=4]**

14. If  $U = \{x: x \text{ is natural number less than } 10\}$ ,  $M = \{x: x \text{ is multiple of } 2\}$ ,  $N = \{x: x \text{ is factor of } 8\}$  and  $O = \{x: x \text{ is even number}\}$ , then prove that  $M \cap (N \cap O) = (M \cap N) \cap O$ .

**Group D (Application)[1×4=4]**

15. Construct a triangle XYZ, where  $\angle X = 45^\circ$ ,  $\angle Y = 30^\circ$  and  $XY = 6\text{cm}$ .

**Post test**

**Group A**

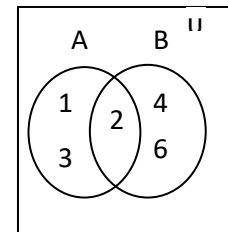
**9×1=9 marks**

1. Which of the following is subset of given set  $A = \{a, e, I, o, u\}$ ?

- a)  $\{b\}$       b)  $\{c\}$       c)  $\{d\}$       d)  $\{a, e, i\}$

2. Which of the following are elements of set A?

- a)  $\{1,2\}$       b)  $\{2,3\}$       c)  $\{1,3\}$       d)  $\{1,2,3\}$



3. If  $A = \{a, b, c\}$  and  $B = \{b, d\}$  then what is the correct for  $A \cap B$ ?

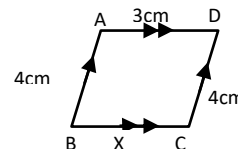
- a)  $\{a, b, c\}$     b)  $\{b, d\}$     c)  $\{b\}$     d)  $\{a, b, c, d\}$

4. Which of the following is exterior angle of regular pentagon?

- a)  $60^\circ$       b)  $72^\circ$       c)  $108^\circ$       d)  $90^\circ$

5. Which of the following value of x?

- A) 2cm                      b) 4cm  
c) 3cm                      d) None of the above



6. Which of the following is characteristic of rectangle?

- a) Each angle is  $90^\circ$                       b) all sides are equal  
c) Adjacent sides are equal              d) diagonals are not equal

7. Which of the following is unique characteristic of rhombus?

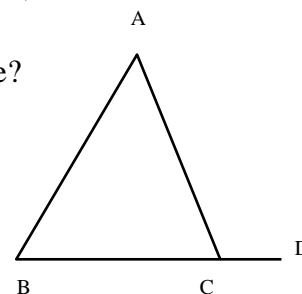
- a) Adjacent sides are equal              b) opposite sides are equal  
c) Opposite angles are equal              d) diagonals are bisect each other

8. What is the interior angle sum of regular hexagon?

- a)  $180^\circ$                       b)  $360^\circ$     c)  $540^\circ$                       d)  $720^\circ$

9. What is the exterior angle of the given figure?

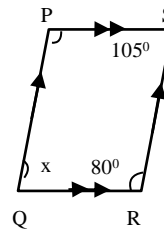
- a)  $\angle ABC$                       b)  $\angle ACD$   
c)  $\angle BAC$                       d)  $\angle BCA$



**Group-B****Subjective Questions****4×2= 8Marks**

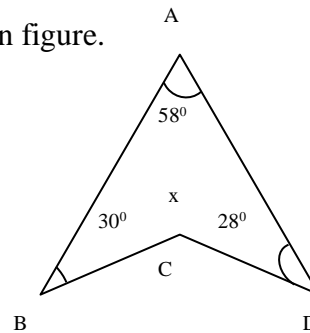
10. Write the formula of each interior angle of regular polygon.

11. Find the value of  $x$  from the given figure.



12. If  $A = \{1, 2, 3\}$  and  $B = \{2, 3, 5\}$  then find  $A \cap B$ .

13. Find the value of  $x$  from the given figure.

**Group-C (Skills)****1×4=4 marks**

14. If  $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ ,  $M = \{2, 4, 6, 8\}$ ,  $N = \{1, 2, 4, 8\}$  and  $O = \{2, 4, 6, 8\}$  then find  $(M \cap N) \cap O$ .

**Group-D (Application)****1×4= 4 marks**

15. Construct a triangle PQR in which  $PQ = 5\text{cm}$ ,  $QR = 6\text{cm}$  and  $PR = 8\text{cm}$ .



## Teaching Episode 1

Class: VII

No of students: 30

Topic: Construction of Triangle

Time: 45 min

1. Specific objectives: On the completion of this lesson students will be able to:

- Construct of triangle, two sides and one angle is given

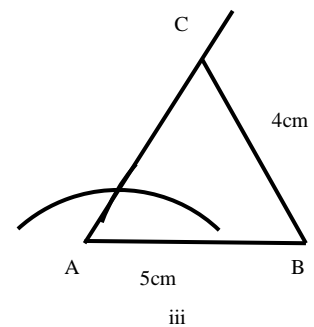
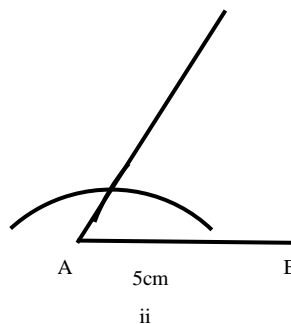
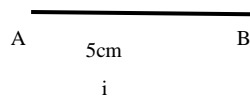
2. Required materials:

- Daily using materials
- Geometry box

3. Classroom activities:

Activity1. Warm up and divide them into five groups also check their pre knowledge about triangle on the basis of sides and angles.

Activity2. With teacher every group draw a line segment of 5cm and name A and B. And with the help of compass draw an angle of  $60^\circ$  in point A. Also draw a line of 4cm from point B and join them.



Activity3. Give a question  $AB=6\text{cm}$ ,  $BC=5\text{cm}$  and  $\angle ABC=75^\circ$  and discuss with students

4. Evaluation: Draw a triangle PQR IN which  $PQ=3.5\text{cm}$ ,  $QR=4\text{cm}$  and  $\angle PQR=45^\circ$ .

5. Homework: Draw a triangle ABC in which  $AB=5\text{cm}$ ,  $BC=5.5\text{cm}$  and  $\angle ABC=90^\circ$ .

## Teaching Episode 2

**Class:** VII

No of students: 30

**Topic:** construction of triangle

Time:45min

1. Specific objectives: on the completion of this lesson student will be able to:

- Construct a triangle if two angles and one side is given
- Construct a triangle if three sides are given

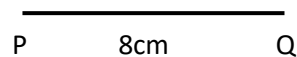
2. Teaching materials:

- Model of triangle
- Geometry box

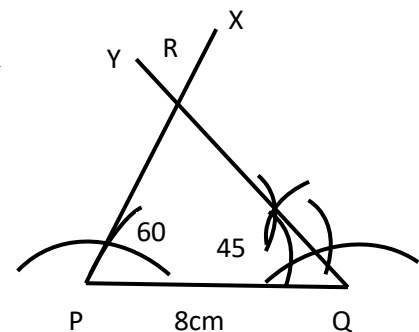
3. Teaching activities:

Activity1: Collect the homework and check also give them feedback.

Activity2: Using a ruler every student will draw a line like  $PQ=8\text{cm}$  and think what type of triangle will have made in point P and Q.

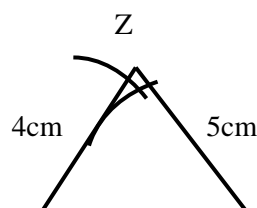


Activity3: Using a compass draw the  $\angle YPQ=45^\circ$  and  $\angle XPQ=60^\circ$  in point P&Q.



Activity4. Show the different model of triangle to the students and if three sides are given how do we construct think.

Activity 5. Using a ruler draw base XY like  $XY=6\text{cm}$ , using a compass take an arc of any length from point X and also draw an arc from point Y like  $XZ=4\text{cm}$  and  $YZ=5\text{cm}$ . Also join them.



4. Evaluation: Draw a triangle PQR X whi  $\{6\text{cm} \} = 5\text{cm} Y \quad \angle = 75^\circ$  and  $\angle Y = 45^\circ$ .

5. Homework: Draw a triangle XYZ in which  $XY=5\text{cm}$ ,  $XZ=6\text{cm}$  and  $YZ=7\text{cm}$ .

### Teaching Episode 3

Class: VII

No of students: 30

Topic: Parallelogram

Time: 45 min

1. Specific objectives: On the completion of this lesson student will able to:

- Define parallelogram
- Prove that opposite angles are equal

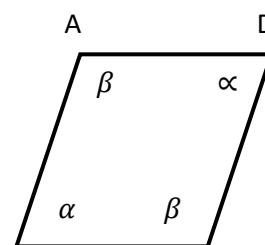
2. Teaching materials:

- Daily use materials
- Model of parallelogram
- Geometry box

3. Teaching activities:

Activity1: At first, teacher will ask the questions how many sides? how many angles? how many lines are there in parallelogram? And according to the response of students discuss about parallelogram. Show the model of parallelogram and write the definition of parallelogram, "Quadrilaterals whose opposite sides and angles are equal".

Activity2: Every student will draw a parallelogram and measure the all angles and teacher will observe them.



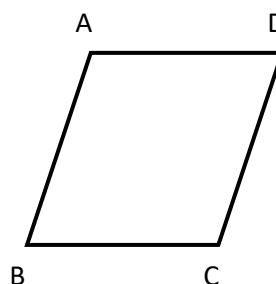
Activity3: Student will measure all the angles by the help of protractor

$\angle A$	$\angle B$	$\angle C$	$\angle D$	Result
$\beta$	$\alpha$	$\beta$	$\alpha$	$\angle A = \angle C$ and $\angle B = \angle D$

Activity4: Student will prove and conclude that opposite angles of parallelogram are equal.

4. Evaluation:

- Define parallelogram
- Prove that the opposite angles of the given parallelogram are equal;



5. Homework: draw a parallelogram and measure all angles and conclude.

### Teaching Episode 4

Class: VII

No of students: 30

Topic: Parallelogram

Time: 45 min

1. Specific objective: On the completion of this lesson student will able to:

- Verify the opposite sides of parallelogram are equal.

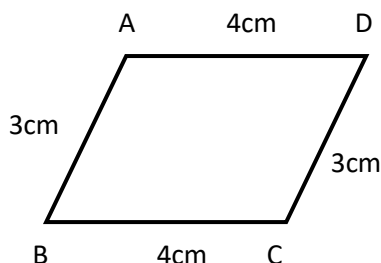
2. Teaching materials:

- Daily use material
- Model of parallelogram
- Geometry box

3. Teaching activities:

Activity1: Collect the homework and give them feedback also students will write the definition of parallelogram and discuss on their bench.

Activity2: Student will have divided in group and every group will draw different size of parallelogram.

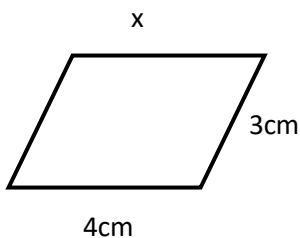


Activity3: Every group will measure the sides AB, BC, CD, and DA;

AB	BC	CD	DA	Result
3cm	4cm	3cm	4cm	$AB=CD$ and $BC=AD$

Activity4: Present the model of parallelogram on the basis of sides and conclude that opposite sides of parallelogram are equal.

4. Evaluation: find the value of x from the given parallelogram;



5. Homework: draw a parallelogram and prove that opposite sides are equal.

### Teaching Episode 5

Class: VII

No of students

Topic: Parallelogram

Time: 45 min

1. Specific objectives: On the completion of the lesson student will able to:

- Prove diagonals of parallelogram bisect each other

2. Teaching materials:

- Model of parallelogram with diagonals
- Geometry box.

3. Teaching activity;

Activity1: Divide the students in group and they will make different size of parallelogram ABCD and draw the diagonals AC and BD. Name the intersecting point O.

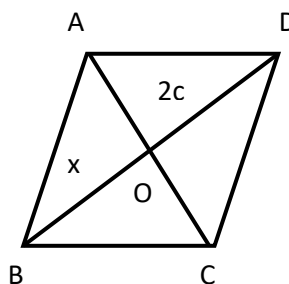
Activity2: Teacher will help them and demonstrate the model of parallelogram and discuss in brief

Activity3: Every group will make the table and measure AO, OC, BO and OD as following.

AO	OC	BO	OD	Result
x cm	x cm	y cm	y cm	AO=OC and BO=OD

Activity4: Students observe the result and teacher will watch them for help and find out the conclusion, the diagonals of parallelogram are bisecting each other.

4. Evaluation: find the value of x from the given parallelogram



5. Homework: proof that the diagonals of parallelogram bisect each other.

## Teaching Episode 6

Class: VII

No of students: 30

Topic: Rectangle

Time: 45 min

1. Specific objectives: On the completion of this lesson student will able to;

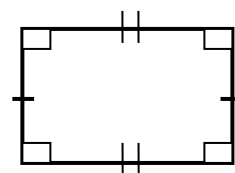
- Define rectangle
- Prove diagonals of rectangle bisect each other

2. Teaching materials:

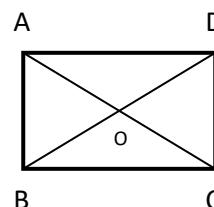
- Daily use materials
- Model of rectangle and geometry box

3. Teaching activity:

Activity1: At first teacher will collect the home work and give them feedback. After that teacher will represent different model of rectangle and ask question, what is this? After reaction of student discuss about rectangle and its characteristics like a rectangle is quadrilateral, whose opposite sides are equal and each interior angle is equal to  $90^{\circ}$ .



Activity2: After discussing about rectangle, teacher and students will draw a rectangle and two diagonals on it.



Activity3: Measure AO, OC, BO and OD with the help of ruler.

AO	OC	BO	OD	Result
x cm	x cm	y cm	y cm	AO=OC and BO=OD

Activity4: Students observe the result and teacher will watch them for help and find out the conclusion, the diagonals of rectangle are bisecting each other.

4. Evaluation: what is rectangle? Write its characteristics.
5. Homework: proof that the diagonals of rectangle bisect each other.

## Teaching Episode 7

Class: VII

No of students: 30

Topic: Square and rhombus

Time: 45 min

1. Specific objectives: On the completion of this lesson student will able to:

- Differentiate between square and rhombus
- Prove that the diagonals of rhombus bisect each other at right angle

2. Teaching materials:

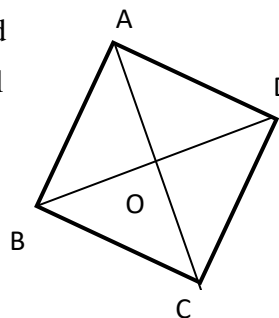
- Daily use material and geometry box
- Model of square and rhombus

3. Teaching activities:

Activity1: Warm up and ask question to the students, what is square? What is rhombus? And what is difference between square and rhombus?

Activity2: After student's reaction teacher will demonstrate the model of square and rhombus. Teacher will present the definition of square and rhombus "A square is quadrilateral that's all sides are equal and each angle is right angle whereas rhombus has not all angle is right angle. Also diagonals of square are equal but rhombus have not.

Activity3: After discussing about square and rhombus teacher and student will draw a rhombus



Activity4: Teacher and student will measure the angles and conclude in such a way;

$\angle AOB$	$\angle BOC$	$\angle COD$	$\angle AOD$	Result
$90^0$	$90^0$	$90^0$	$90^0$	$\angle AOB, \angle BOC, \angle COD, \angle AOD = 90^0$

Activity5: Teacher and student will conclude that; diagonals of rhombus bisect each other at right angle.

4. Evaluation:

- What is rhombus?
- Are diagonals of rhombus bisecting each other at right angle?

5. Homework: draw a rhombus and proof its diagonals bisect each other at right angle.

### Teaching Episode 8

Class: VII

No of students: 30

Topic: Construction of parallelogram

Time: 45 min

1. Specific objectives: on the completion of this lesson student will able to:

- Construct parallelogram if adjacent sides and one angle is given.

2. Teaching materials:

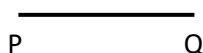
- Daily use material
- Model of parallelogram and geometry box

3. Teaching activities:

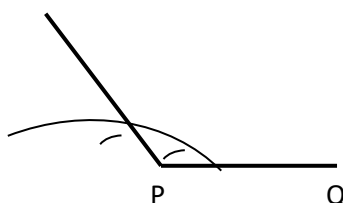
Activity1: Warm up the students and discuss about previous chapter about characteristics of parallelogram

Activity2: To construct parallelogram when adjacent sides and one angle is given like two adjacent sides are 6cm, 5cm and angle between them is  $120^\circ$  given process will apply.

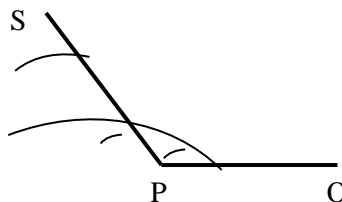
Activity3: Draw a line segment  $PQ = 6\text{cm}$



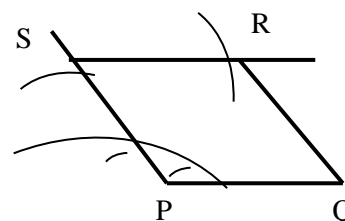
Activity4: From the point P draw an angle of  $120^\circ$  with the help of compass.



Activity5: From point P take an arc of 5cm and name it S.



Activity6: From the point S take an arc of 6 cm and name it R. join and here is parallelogram.



Activity7: Discuss the construction process in more detail with students.

4. Evaluation: draw a parallelogram where  $AB = 4\text{cm}$ ,  $BC = 5\text{cm}$  and  $\angle ABC = 75^\circ$ .
5. Homework: construct a parallelogram  $PQ = 5\text{cm}$ ,  $QR = 3.5\text{cm}$  and  $\angle PQR = 60^\circ$ .



## Teaching Episode 9

Class: VII

No of students: 30

Topic: Interior angle of regular polygon

Time: 45 min

1. Specific objectives: On the completion of this lesson student will be able to:

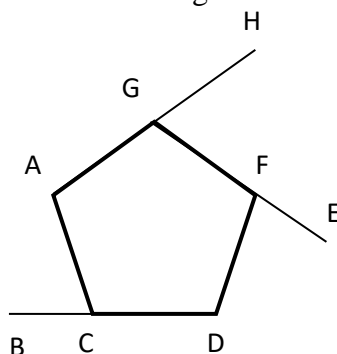
- Differentiate between interior and exterior angle
- Find out the interior angle

2. Teaching materials:

- Geometry box
- Model of regular polygon, match stick and thread



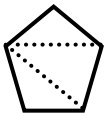
3. Teaching activities:

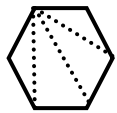
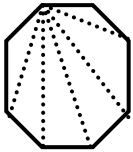
Activity1: Warm up the students, check their homework and give them feedback.

Activity2: Present the model of polygon and discuss about interior angle and exterior angle. Here  $\angle ACB$  is exterior angle and  $\angle ACD$  is interior angle.

Activity3: Discuss more in activity 2 and teacher will say the interior angle of triangle is two right angles. And make different type of regular polygon with the help of match stick and thread.

Activity4: Make the following table to find interior angle sum

Polygons name	shape	No. of sides	Triangles number	Interior angle sum
Triangle		3	$3-2=1$	$180^0 \times (3-2) = 180^0$
Quadrilateral		4	$4-2=2$	$180^0 \times (4-2) = 360^0$
Pentagon		5	$5-2=3$	$180^0 \times (5-2) = 540^0$

Hexagon		6	$6-2=4$	$180^{\circ} \times (6-2) = 720^{\circ}$
.....		.....		.....
		n	n-2	$180^{\circ} \times (n-2)$

Activity5: From the above table conclude that in any polygon if number of sides are given then interior angle sum  $180^{\circ} \times (n-2)$ .

Activity6: Teacher will tell them also measurement of interior angle=

$$\frac{\text{sum of interior angle}}{\text{number of sides}} \text{ that means } \frac{180^{\circ} \times (n-2)}{n}.$$

4. Evaluation: Find the interior angle sum of regular pentagon.
5. Homework: Find the interior angle sum and interior angle of regular pentagon, hexagon, heptagon and octagon.

## Teaching Episode 10

Class: VII

No of students: 30

Topic: exterior angle of regular polygon

Time: 45 min

1. Specific objectives: On the completion of this lesson student will able to:

- Find exterior angle of regular polygon

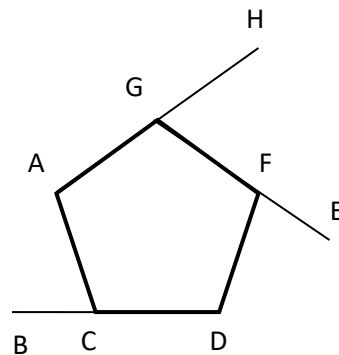
2. Teaching materials:

- Geometry box
- Model of regular polygon, match stick and thread

3. Teaching activities:

Activity1: Warm up the students and check their homework also give feedback

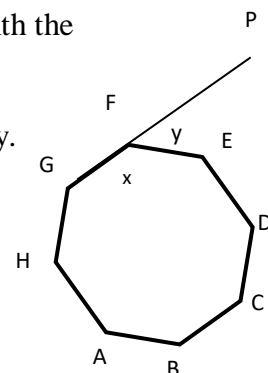
Activity2: In previous chapter student know about interior angle and exterior angle, in this chapter also discuss about exterior angle



In this regular polygon  $\angle FGH$ ,  $\angle DFE$  and  $\angle BCA$  are exterior angle.

Make different type of regular polygon with the help of match stick and thread.

Activity3: Students will make this figure in their copy.

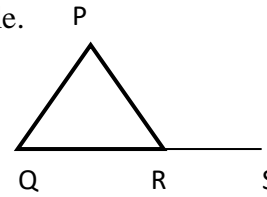


Activity4: Student will measure the angle sum of  $x$  and  $y$ . teacher will ask what the value  $y$  is? And what is formula of interior angle?

Activity5: Observe the students behavior and teacher will tell them side  $GF$  is extended to  $P$  and there is an exterior angle  $\angle PFE = y$ , adjacent angle

$\angle GFE = x$  so,  $x + y = \angle GFE$  (whole part axiom) or,  $x + y = 180^\circ$  (straight angle) or,  $y = 180 - 180^\circ \times (n-2)/n$  after solving  $360^\circ/n$ .

4. Evaluation: In the given figure write exterior angle.



5. Homework: find the exterior angle of regular pentagon, heptagon and nonagon.

## Teaching Episode 11

Class: VII

No of students: 30

Topic: Universal sets and subsets

Time: 45 min

1. Specific objectives: On the completion of this lesson student will able to:

- Make universal sets of sets
- Make subset of universal sets

2. Teaching materials:

- Daily use materials
- Box and piece of paper

3. Teaching activities:

Activity1: Check their pre knowledge about introduction of sets, types of sets and symbol of sets and discuss with students.

Activity2: Give one piece of paper to the whole students and students will write their one food, vegetable, fruits, cool drink etc and pick in front of class.

Activity3: 5 students will read and distribute what they are like vegetable, fruits, food and cool drink.

Activity4: Collect and put in different box and discuss about set of vegetable, set of fruit, set of food and set of cool drink.

Activity5: Conclude they all are types of universal set and discuss more examples.

Activity6: One student will pick out the piece of paper from the box and another student will write on board like  $U = \{\text{set of vegetable}\}$  and  $A = \{\text{onion, potato}\}$ . Discuss here set of  $U$  is universal set and  $A$  is set of subset of universal set.

Activity7: Give another example like set of natural number less than 10. Here  $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$  and  $A = \{1, 2\}$ ,  $B = \{2, 4, 6\}$ . Discuss here universal set is natural number less than 10,  $A$  and  $B$  etc are subset of universal set.

Activity8: Give them definition a universal set is a set which contains all the elements of another sets, including its own elements. It is denoted by  $U$ . suppose  $A = \{2, 4, 6, 8\}$  and  $B = \{1, 3, 5, 7, 9\}$  then  $U = \{1, 2, 3, 4, 5,$

6, 7, 8, 9}. Also a subset is a set whose elements are member of another set.

4. Evaluation: write on example of universal set.
5. Homework: if  $U = \{1, 2, 3, 4, 5, 6\}$  then make any three subsets from the given universal set.

## Teaching Episode 12

Class: VII

No of students: 30

Topic: Proper set, improper set and Venn diagram

Time: 45 min

1. Specific objectives: On the completion of this lesson student will able to:
  - a. Differentiate between proper and improper set
  - b. Represent set in Venn diagram
2. Teaching materials:
  - Model of Venn diagram
  - Daily use material and card
3. Teaching activities:

Activity1: First teacher will warm up the students and check their homework also discuss.

Activity2: Provide the card where book, copy, pencil, erasure, chalk, marker, geometry box is written and they observe.

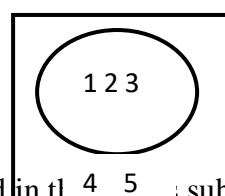
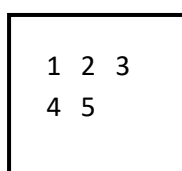
Activity3: One student will write on board whole of above and another student will write only book, pencil, chalk. Other student and teacher will watch.

Activity4: Teacher will tell them among the above thing {book, copy, pencil, erasure, chalk, marker, geometry box} is improper set and {book, pencil, chalk} is proper set.

Activity5: Teacher will present another example like  $U = \{1, 2, 3, 4\}$ ,  $A = \{1, 2, 3, 4\}$  and  $B = \{2, 4\}$ . Here A is improper subset of U and B is proper subset of U, also discuss about its sign.

Activity6: Divide the students in two groups. First group will tell one universal set and another group will make one proper and one improper set, if it is correct teacher will provide 1 mark. Same process of second process will repeat. In final that got more marks will victory group.

Activity7: Teacher will present on example like  $U = \{1, 2, 3, 4, 5\}$ . Student will copy it in their own copy and give rectangular box and one student will write on board as following,



And teacher will tell them this Venn diagram and in it  $\{1, 2, 3\}$  subset.

4. Evaluation: If  $A = \{1, 2, 3, 4\}$  then write any two proper and one improper set.
5. Homework: If  $P = \{a, e, i, o, u\}$  then make any three proper set and represent it in Venn diagram.



### Teaching Episode 13

Class: VII

No of students: 30

Topic: Disjoint set

Time: 45 min

1. Specific objectives: On the completion of lesson student will able to:

- define disjoint set
- differentiate disjoint set

2. Teaching materials:

- daily use materials
- word card

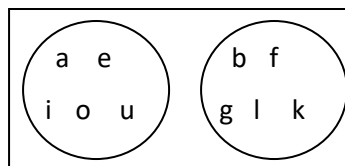
3. Teaching activities:

Activity1: Warm up the students and check their homework also give feedback

Activity2: From the whole students, two students will appear in front of class and one student write one set of word card and another student will write another set of card like  $A = \{a, e, i, o, u\}$  and  $B = \{b, f, g, l, k\}$ .

Activity3: Students observe the activities. Teacher will ask them is above set is disjoint? Discuss and present definition of disjoint set.

Activity4: Represent the above set in Venn diagram and discuss.



Activity5: Every student will make one universal set and two disjoint set. Teacher watches and give feedback

Activity6: Some other example will present and make classroom much interesting.

4. Evaluation: give one example of disjoint set.

5. Homework: make any five disjoint sets and represent in class.

### Teaching Episode 14

Class: VII

No of students: 30

Topic: Intersecting set

Time: 45 min

1. Specific objectives: On the completion of this lesson student will able to:

- define intersecting set
- differentiate between disjoint and intersecting set

2. Teaching materials

- daily use materials
- word card

3. Teaching activity:

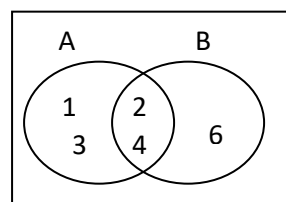
Activity1: According to the previous chapter teacher ask question do you know intersecting set? Students think and tell the answer.

Activity2: Teacher will demonstrate the word card in which two sets were appear like  $A = \{1, 2, 3, 4\}$   $B = \{2, 4, 6\}$ .

Activity3: Students think and say this is intersecting set if they are unable to say teacher will help.

Activity4: Teacher will tell about intersecting set, if A and B are two non-empty set some elements of set A in set B is called intersecting set.

Activity5: Demonstrate in Venn diagram as following and discuss.



4. Evaluation: if  $A = \{2, 4, 6, 8\}$  and  $B = \{1, 2, 3, 4\}$  then which type of sets A and B?

5. Homework: make any five examples of intersecting set.

## Teaching Episode 15

Class: VII

No of students: 30

Topic: union of sets and intersection of sets

Time: 45 min

1. Specific objectives: On the completion of this lesson student will able to:

- union of two sets
- intersection of two sets

2. Teaching materials:

- daily use materials
- circle shape paper, tape, word card

3. Teaching activities:

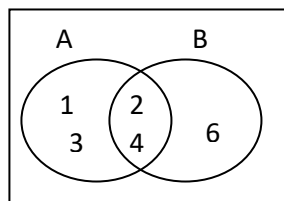
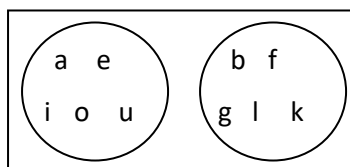
Activity1: Provide circle shape paper to the students, they will write member of any set. Present the written card on board with the help of tape and check the sets are disjoint or intersecting.

Activity2: Student will write three sets of disjoint and intersecting on their copy with the help of teacher. Show them word card.

Activity3: We denote  $\cup$  sign to denote union of set and teacher will present example if  $A = \{1, 2, 3, 4\}$  and  $B = \{5, 6, 7, 8\}$  then  $A \cup B = \{1, 2, 3, 4, 5, 6, 7, 8\}$ .

Activity4: To write the intersection of set we use  $\cap$  sign and teacher will present example if  $A = \{1, 2, 3\}$  and  $B = \{2, 3, 4, 5\}$  then  $A \cap B = \{2, 3\}$  only because in set A and B there are 2 and 3 are only in both sets.

Activity 5: Teachers will represent Venn diagram for disjoint set and union of set also for intersection of set.



4. Evaluation: write any two disjoint sets and union it.

5. Homework: If  $A = \{p, q, r, s\}$  and  $B = \{s, t, u, v\}$  then find  $A \cup B$  and  $A \cap B$ .

Pre Test			Post test	
S.N	Control Group	Experimental Group	Control Group	Experimental Group
1	12	17	15	21
2	17	16	17	16
3	9	15	16	19
4	10	14	15	20
5	8	7	8	19
6	7	11	10	18
7	5	12	11	15
8	13	11	13	10
9	8	3	8	9
10	13	8	10	11
11	10	9	7	17
12	12	13	12	6
13	8	14	11	15
14	12	14	17	13
15	18	16	18	15
16	10	18	19	23
17	13	14	13	16
18	5	6	8	7
19	15	17	14	19
20	16	10	11	17
21	10	15	16	17
22	10	12	9	12
23	15	13	14	10
24	16	9	13	12
25	14	6	10	9
26	13	10	9	14
Sum	299	310	325	380
Mean	11.5	11.92	12.5	14.61
Variance	12.5	15.005	11.38	19.92
S.D	3.53	3.87	3.37	4.46
t-value		0.43	2.084	

### Observation Daily Note

Student's Name:

Date:

Roll No:

Class:

The observation of students would take on the basis of following topics and noted in details every day

- Participation
- Interaction behavior
- Attendance rate
- Motivational behavior
- Class work/homework

#### Item analysis of objective Test Items

Q.N.	Number of students																				Right answers	P% value	D value	Remarks
	Upper (27%)					Average (46%)										Lower (27%)								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20				
1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	18	90	0.2	Reject
2	1	1	1	1	1	1	1	1	1	0	0	1	0	1	0	1	0	1	0	1	14	70	0.4	Accept
3	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	19	95	0	Reject
4	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	7	35	0.2	Reject
5	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	0	1	0	14	70	0.8	Accept
6	1	1	1	1	1	1	1	0	0	1	0	0	1	1	1	0	0	0	0	0	11	55	1	Accept
7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	0	16	80	0.8	Accept
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	15	75	1	Accept
9	1	1	1	0	0	1	1	0	1	0	1	1	0	1	0	0	0	0	0	0	9	45	0.6	Accept
10	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	5	25	-0.2	Reject
11	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	0	0	16	80	0.8	Accept
12	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	14	70	0.8	Accept
13	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	17	85	0.4	Accept
14	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	7	35	0.2	Reject
15	1	1	1	1	1	1	0	0	0	0	1	0	0	0	0	1	1	0	0	0	9	45	0.6	Accept
16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	19	95	0.2	Reject
17	1	1	1	1	1	0	1	1	1	0	0	1	1	0	1	1	1	1	0	0	14	70	0.4	Accept
18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	19	95	0.2	Reject
19	1	1	1	1	1	0	0	1	1	1	1	1	0	1	0	0	0	0	0	0	11	55	1	Accept
20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20	100	0	Reject
Total score	20	19	19	18	17	15	14	14	14	13	13	13	13	13	12	10	10	10	9	8				

Interpretation criteria for P value		Interpretation criteria for D value	
Indicator (%)	Meaning	Degree	Meaning
0-39	Very Difficult	-1-0.19	Negligible
40-60	General	0.20-0.29	General
61-75	Substantial	0.30-0.39	Good
76-90	Easy	0.40-1	Very Good
91-100	Very Easy		

Source:Khanal (2071).

Q.N	Number of Students																				Right Answer	P value	D Value	Remarks	
	Upper (27%)					Average (46%)										Lower (27%)									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20					
21	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20	100	0	Reject	
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	17	85	0.4		
	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	0	1	0	1	16	80	0.4		
	1	1	1	1	1	1	0	0	1	0	1	0	1	0	0	1	1	1	1	0	13	65	0.2		
<b>Total</b>																				<b>16.5</b>	<b>82.5</b>	<b>0.25</b>			
22	1	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1	0	0	1	0	10	50	0.4	Reject
	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	5	25	0	
	1	1	1	0	0	0	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	8	40	0.6	
	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	6	30	0	
<b>Total</b>																				<b>7.25</b>	<b>36.25</b>	<b>0.25</b>			
23	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	19	95	0.2	Accept
	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	0	1	1	0	0	14	70	0.6	
	1	1	0	1	1	1	1	1	0	0	1	0	0	1	1	0	0	0	0	0	0	9	45	0.8	
	1	1	1	1	1	1	1	0	1	1	0	0	0	1	0	0	0	1	0	0	0	10	50	0.8	
<b>Total</b>																				<b>13</b>	<b>65</b>	<b>0.6</b>			
<b>Total</b>	<b>12</b>	<b>11</b>	<b>10</b>	<b>10</b>	<b>09</b>	<b>09</b>	<b>08</b>	<b>07</b>	<b>07</b>	<b>07</b>	<b>06</b>	<b>06</b>	<b>06</b>	<b>06</b>	<b>06</b>	<b>06</b>	<b>06</b>	<b>05</b>	<b>05</b>	<b>05</b>					
24	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20	100	0	Reject
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	18	90	0.4	
	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	0	17	85	0.4	
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	19	95	0.2	
<b>Total</b>																				<b>18.5</b>	<b>92.5</b>	<b>0.25</b>			
25	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	1	17	85	0.4	Accept
	1	1	1	1	1	1	1	1	0	0	1	0	1	0	0	0	0	0	0	1	0	10	50	0.8	
	1	1	1	1	0	0	0	0	1	1	1	1	0	0	1	0	0	0	1	0	0	10	50	0.6	
	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	14	70	0.8	
<b>Total</b>																				<b>13.25</b>	<b>63.75</b>	<b>0.65</b>			
<b>Total</b>	<b>08</b>	<b>08</b>	<b>08</b>	<b>07</b>	<b>07</b>	<b>07</b>	<b>07</b>	<b>07</b>	<b>07</b>	<b>07</b>	<b>07</b>	<b>07</b>	<b>06</b>	<b>06</b>	<b>05</b>	<b>05</b>	<b>05</b>	<b>04</b>	<b>03</b>	<b>03</b>					