

Chapter I

INTRODUCTION

Background of Study

Present era is an era of science and technology and reason as such, as everything is analyzed from scientific and technical point of view. There is great value of mathematics in the modern living in twenty-one century, which has revolutionized our life style and great change in our attitudes, way of thinking and outlook. It has great value of aspect as communication, transportation, agriculture, health, industry, kitchen, environment etc. It helps people to understand and interpret very important quantitative and qualitative aspect of living and natural phenomena. So, for understanding and interpreting of every discipline mathematics is essential. Since the primitive age, people have been utilizing mathematics to solve the difficulties arisen by natural calamities, political purpose, economic planning and other social events. Most of the mathematical structures, rules, formulae etc. were the outcome of the empirical observation and experiences of ancient period. But now, the empirical mathematics developed into abstract mathematical theory.

The word ‘mathematics’ has been derived from the ancient Greek word “Manthanein” which means ‘to learn’. This indicates that mathematics is taken as a process of learning and interpreting the natural phenomena of each individual. It has been explained in other ways such as it is the knowledge of numerical and calculation part of man’s life. Mathematics, as we know today, is the science of numbers and their operation, interrelation and combination of space configuration and their structure, measurement etc. (Courant, R. and Robbins, 1996)

Students’ achievement in mathematics reveals their mathematical knowledge and skill after their studies which represent their progresses. It is measured since

every course has its instructional objectives which have to be achieved. The procedures and techniques of judging students' achievement is understood as evaluation. Collier and Lerch (1969) state evaluation as:

“Evaluation is a crucial aspect of educational processes and should be considered an integral part of the day to day instructional program. Evaluation refers to the techniques and instruments used in appraising the outcomes of instruction.”

There are two types of evaluations; they are summative and Formative.

Summative evaluation defined as collection of data after instruction occurred to make judgments about the instruction such as grading, certification, evaluation of process, or research on effectiveness (Bloom et.al., 1971). Thus, any assessment that examines what a child has learned or did not learn from previous instruction could be conceptualized as part of a summative evaluation.

Formative evaluation is defined as a primarily building process which accumulates a series of components of new materials, skills and problems into an ultimate meaningful whole (Guyot, 1978). It is also on-going classroom process which is used to monitor learning process during instruction. Its purpose is to provide continuous feedback to both teachers and pupil's concerning learning success and failure. So that reinforcement of learning & correction of learning errors can effectively be done.

Formative evaluation is a kind of evaluation which is the means of obtaining specific information on the progress of students' learning on appropriate knowledge, skills and abilities. Formative evaluation can help to identify students who can do mental arithmetic problems in mathematics and those who cannot. In addition, the specific information obtained about the instructional process through formative

evaluation would help to improve learning. The techniques of formative evaluation are observation of students' activities, questioning students, etc. (Bernard, 2013).

Formative evaluation includes several types of evaluation, such as need assessment, evaluability assessment, structured conceptualization, implementation evaluation and process evaluation. Need assessment seeks to determine who needs the program, how great the need is, and what might work to meet the need; while Evaluability assessment attempts to determine whether an evaluation is feasible and stakeholders can help shape its usefulness (Alonge, 1986). Similarly, structured conceptualization helps stakeholders define the program or technology, the target population, and the possible outcomes. Furthermore, Implementation evaluation monitors the fidelity of the program or technology delivery.

Effect of formative evaluation in mathematics achievement means that how does the influence of mathematics achievement plays the role toward the students. The researcher gave the main focus in the achievement of the students and non-cognitive improvement of students in mathematics achievement at basic level.

In the previous research, the researcher did the research only in effect of formative evaluation in teaching mathematics at secondary level, Exploring the role of formative assessment in the secondary mathematics classroom, Influence of formative on learner performance in mathematics in secondary school in Embu country. But in this research the researcher did research in effect of formative evaluation on mathematics achievement as well as analyze the improvement in non-cognitive aspects of students.

Statement of the Problems

In our school level, teacher and students both think mathematics is a difficult subject. Many of the students have been failing in mathematics subject in school exams. Not only that but also they have low achievement in mathematics in the comparison of other subjects. Therefore, in school level mathematics teaching learning process becomes challengeable. There are many factors, which affect teaching and learning mathematics. Among them, regular evaluation is one of the most influencing factors in teaching learning of mathematics at basic level. Therefore, researcher seeks to find out appropriate type of formative evaluation for mathematics teacher to uses in his/her classroom.

According to educational report of economic survey the achievement of mathematics in class 8 was 43% and 35% at 2071 and 2072 respectively. From this report the researcher came to know that the achievement of mathematics was so bad. Many students were failure so the researcher thought to do research about this condition, and the researcher thought the formative evaluation can minimize this problem, so the researcher select this topic.

Finding of many studies succinctly indicate that gradual effect of formative evaluation in mathematics has positive impact on students' achievement in geometry. Therefore, the main concern of this study was to examine the following statements:

- Does formative evaluation effect the achievement of students in mathematics?
- Does the achievement of the students differ with and without using formative evaluation in mathematics teaching?
- How to analyze the non-cognitive behaviour of students?

Objective of the Study

The main objective of this study was to find the effect of formative evaluation on mathematics achievement at Basic level students. This was accomplished by the following objectives:

- To compare the mathematics achievements of students with and without using formative evaluation.
- To analyze the improvement in non-cognitive aspects of students.

Significance of the Study

Mathematics is a compulsory subject in our school education. Various kinds of researches were done in the different area of mathematics. The view of people towards mathematics is not positive till now, though many researches carried out. Mathematics is still considered as a complex subject on the view point of students and their parents. Most of the students failed in exam due to its cause. It means that it is a major issue in our educational society of Nepal. Some people consider mathematics as a complex subject that drive student not only from school but also from their actual life. Most of the students failed in District Level Examination due to the cause of mathematics. From the above discussion we can come in conclusion that people think mathematics as a hard subject, which is still a burning issue in mathematics teaching. So, the researcher intended to study the effect of formative evaluation in mathematics achievement as well as analyzed the improvement in the non-cognitive aspects of student at basic level.

So, the findings of this study intended to determine the effects of formative evaluation in mathematics achievement at Basic level. This study would be helpful direct the teachers for the effective teaching; this also would be helpful directly to the

curriculum planners, question setters and other concerned persons. Mainly the significance of this study was as follows:

- **Mathematics teachers:** This study provides important information to mathematics teachers about students learning process using formative evaluation that could lead valuable improving of students' achievement. It helps for the teachers to reform and improve their teaching strategies. Also this study analyzes the improvement of non-cognitive aspects of students.
- **Schools:** Result of this study may be beneficial to Basic Level public schools.
- **The Researcher:** This study helps to the researchers to find out the effect of formative evaluation on other field of mathematics.
- **Educational Planners:** Result of the study may be helpful to educational planners to conceptualize a policy for formative evaluation for Basic Level.
- **Students:** This study helps to improve the non-cognitive behaviour of students in teaching learning process. Also this study helps to improve their capacity and achievement.

Hypothesis of the Study

Hypothesis of the study refers to a prediction about what the researcher expect to find (Creswell, 2014). Thus, it is stated in the form of expected relationship between variables. Two types of hypothesis, research hypothesis and statistical hypothesis were used in this study.

Research Hypothesis

The use of formative evaluation provides effective result in terms of students' achievement in geometry compared to traditional teaching approach.

Statistical Hypothesis

The statistical hypothesis of this study was:

- Null Hypothesis (H_0): There was no significance differences between the mean achievements of the students those who would be taught by formative evaluation and traditional approach. i.e. $\mu_1 = \mu_2$
- Alternative hypothesis (H_1): The average achievement of the students taught by the formative evaluation is significantly higher than the average achievement of students taught by traditional method. i.e. $\mu_1 > \mu_2$

Delimitation of the Study

It is impossible to look after all the aspects related to research topic in a single specific research study. Therefore delimitation of the study should be made clear. This study was delimited in the following aspects.

- The study was conducted only to find out the effectiveness of formative evaluation in mathematics Achievement.
- The study was conducted only in the basic level especially in the grade VIII.
- This study was considered the students of Shree Saraswoti Secondary School of Bardiya district of grade VIII as experimental group and the students of Shree Deepjyoti Secondary school of same district as control groups.
- The study covers only one unit “geometry” (Line and Angle, triangle, Quadrilateral and polygons, Congruence and similarity of triangles and net geometrical figure) of the entire mathematics curriculum of Basic level in grade VIII.
- The experimentation period of this research was 30 days.
- Achievement test, class observation note and interview schedule were tools to collect the data.

- In this research the researcher used Class work, Homework, Feedback, Quiz and Assignment as the tools of formative evaluation.

Definition of the Terms

Achievement: In this study, the term "achievement" is defined in terms of the scores obtained by the students on the achievement test prepared by the researcher.

Control group: A group of students which was not taught by using formative evaluation.

Experimental group: A group of students which was taught by using formative evaluation.

Effect: The magnitude of the scores obtained by the experimental and control group in mathematics achievement test.

Formative evaluation: Formative evaluation is a kind of evaluation which is the means of obtaining specific information on the progress of students' learning on appropriate knowledge, skills and abilities.

Non-cognitive: Non-Cognitive are related to motivation, participation, regularity and attitudes.

Post-test: Posttest is a test which measures the students' achievement after implementing the experiment.

Pre-test: Pretest is a test which measures the student's achievement before implementing the experiment.

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

Chapter II

REVIEW OF THE RELATED LITERATURE

A literature review is a description of the literature relevant to a particular field or topic. It gives an overview of what has been said, who the key writers are, what are the prevailing theories and hypotheses, what questions are being asked and what methods and methodologies are appropriate and useful. As such, it is not in itself primary research, but rather it reports on other findings. (Best & Kahn, 2009).

A collective body done in earlier scientists is technically called the literature. Any scientific investigation starts with a review of the literature. In fact, working with the literature is an essential part of the research process which generates the idea, helps in developing significant question and is regarded as instrumental in the process of research design.

Empirical Literature Review

Neupane (1999) studied on the “Effectiveness of Homework on Mathematics Achievement of Lower Secondary School” with the aim of to find out the effect of homework on Lower Secondary School students. To fulfill the objectives of this research, the researcher selected the pretest-posttest equivalent group experimental design. 45 students at grade VIII of Shree Aadarsh Secondary School was selected as sample. Achievement test and interview schedule were the tools of the data collection. The researcher concluded that homework assigned with feedback caused better achievement than homework assigned without feedback.

Review of this literature indicates that homework assigned with feedback caused better achievement than homework assigned without feedback. This study only limited homework here the test, class-work and the students’ activities were not indicated. But in this research the researcher did research in effect of formative

evaluation on mathematics achievement as well as analyze the improvement in non-cognitive aspects of students.

Shute (2008) did a research on “Formative Feedback”. According to the researcher formative feedback should be non-valuable, supportive, timely & specific. Feedback was usually presented as information to a learner in response to some action on the learner’s part. 50 students at grade VIII of Shree Tribhuwan Secondary School was selected as sample. The tools of data collection were interview schedule and observation check list. Finally, several variables have been shown to interest with formative feedback’s success at promoting learning.

Review of this literature indicates that formative feedback gave better achievement in learning process. But there was not clearly explained that to what extent formative feedback positive impact has on students’ achievement as well as analyze the improvement in non-cognitive aspects of students.

Joshi (2010) did a research on “Effect of Formative evaluation on Mathematics Achievement at Secondary Level” with the aim to find the effect of formative evaluation in mathematics achievement at secondary level. 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. 42 students at grade IX of Shree Adinath Secondary School was selected as sample. Two equivalent groups were defined on the basis of the pretest result. For the data collection, the researcher developed two achievement test papers pretest and posttest. The duration of experiment was 15 days. For the result the difference was the mean achievement of two groups was tested by t-statistical method at 0.05 level of significance. He concluded that the achievement of the experimental group was 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 secondary level. But in this study, the researcher try to find out effect of formative evaluation on mathematics in basic level as well as to find out the analyze the improvement in non-cognitive aspects of students.

Moyosor, (2011) did a research on “The effect of formative assessment on student’s achievement in secondary school mathematics” with the aim of investigated the effect of formative Assessment on students’ achievement in secondary school Mathematics. To fulfill the motto of this study experimental research design was adopted. 120 Mathematics students in secondary II Art classes in two public schools in Iseyin Local Government of Oyo State, Nigeria selected through purposive technique made up the study sample. Formative Test I, II and III and Mathematics Achievement Test (MAT) were used for data collection. Data were analyzed using paired sample t-test and independent sample t-test statistical tools.

Review of this literature indicates that all School Administrators should emphasis the use of formative assessment by all teachers and they should allow, encourage and provide incentives for them to attend seminars, workshops, conference and in-services training to enhance their performance and to acquire necessary skills for constructing formative tests homework assigned with feedback caused better achievement than homework assigned without feedback. But in this research the researcher did research in effect of formative evaluation on mathematics achievement as well as analyze the improvement in non-cognitive aspects of students.

Joshi (2015) did a research on “Effect of Formative evaluation on Students’ Achievement in Geometry” with the aim to compare the mathematics achievement of grade X students taught with using formative evaluation and without using formative

evaluation and how do feel during teaching period with using formative evaluation. A pre-test post-test non-equivalent control group experimental design was adopted for the purpose of the study. For the sample of the study the researcher selected 26 student from two public schools of Bajhang District. Achievement test was the tools of this research. The duration of experiment was 30 days. The difference in mean achievement scores was tested using t-test for determining statistical difference between them. Therefore the researcher concluded that the main achievement scores of students taught by using formative evaluation becomes higher than the mean achievement scores of students taught without using formative evaluation in teaching mathematics. But there was not studying in basic level. So, mathematics achievement of students taught by using formative evaluation was found better than without using formative evaluation at secondary level. But in this study, the researcher try to find out effect of formative evaluation on mathematics in basic level as well as to find out the analyze the improvement in non-cognitive aspects of students.

Nunn (2014) did a research on “Exploring the Role of Formative Assessment in the Secondary Mathematics Classroom” with the aim to provide a summary of what students have learned already and serve as a measure by which students and schools were compared and ranked. This study took an exploratory look at a secondary mathematics classroom to develop a clearer understanding of the role formative assessment played in one secondary classroom for both teacher and students. The duration of research was 30 days. Data from classroom observations, interviews, and surveys were analyzed using mixed methods to create a portrait of the role formative assessments in the classroom. Key findings include: the teacher’s strength in her ability to gather formative information, the strong connection between assessment and personal relevance, and the roadblock that time presents to providing

meaningful formative assessments for all students. But there was not studying in basic level students' level as well as to find out the analyze the improvement in non-cognitive aspects of students.

Kivuti (2015) did a research on "Influence of Formative Evaluation on Learner Performance in Mathematics in Secondary school in Embu Country" with the aim of to investigate the influence of assignments on learners performance in mathematics, to determine the influence of continuous assessment tests on learners performance in mathematics, to find out the influence of frequency of formative evaluation on learners performance in mathematics and to investigate the influence of feedback on formative evaluation on learners. The study employed a descriptive survey research design. The target population for the study was 173 Secondary schools while simple random sampling technique was used to sample 130 respondents composing of 70 students and 60 teachers from five school one from each Sub-County. Questionnaires and tests were used to collect primary data. The study generated both qualitative and quantitative data where quantitative data was coded and entered into Statistical Packages for Social Scientists (SPSS Version 17.0) and analyzed using descriptive statistics. The study found that Mathematics teachers employed assignments test as a formative evaluation approach to way of measuring students' progress in mathematics performance which form an integral part of education system and that frequent assessment of students' performance has demonstrated to improve student outcomes. The study also found that assessment is a crucial tool for simultaneously improving classroom practice and students' performance, and that it can enhance teaching and learning by providing a more focused application for learners. The study concludes that formative evaluation enables teachers to adjust their teaching to meet individual student needs, and to better

help all students to reach high standards. But there was not studying in basic level students' as well as to find out the analyze the improvement in non-cognitive aspects of students.

Therefore, a number of researches mentioned above carried out different researches, website, and book written different scholars have directly or indirectly highlighted with the importance of the teaching materials. This study was certainly different from the other studies. This study would show the effect of formative evaluation on mathematics teaching in the context of Nepal. In this research work, the researcher would try to find out the effect of formative evaluation on mathematics achievement at Basic level as well as to find out the analyze the improvement in non-cognitive aspects of students. So the present study aimed to find out the effect of formative evaluation on mathematics achievement at basic level as well as to find out the analyze the improvement in non-cognitive aspects of students.

Theoretical Review

The Classical Conditioning Theory by Ivan Pavlov (1929-1936) guided this study. Pavlov performed an experiment on dogs and discovered that dogs learnt to salivate in response to a bell. Many trials had been given in each of which the bell was sounded and food was simultaneously (slightly later) presented. It was thought therefore that students in basic level was get good grades whenever the teacher taught and students were exposed to many trials of continuous assessment activities. According to Pavlov, Conditioned Response (CR) was the response developed during training and Conditioned Stimulus (CS) was the stimulus, which included training/teaching activities intended to evoke the CR (i.e. good grades in the final examination). Unconditioned Response (UR) was the same or almost the same response as the CR but it existed prior to training, normally being given whenever a

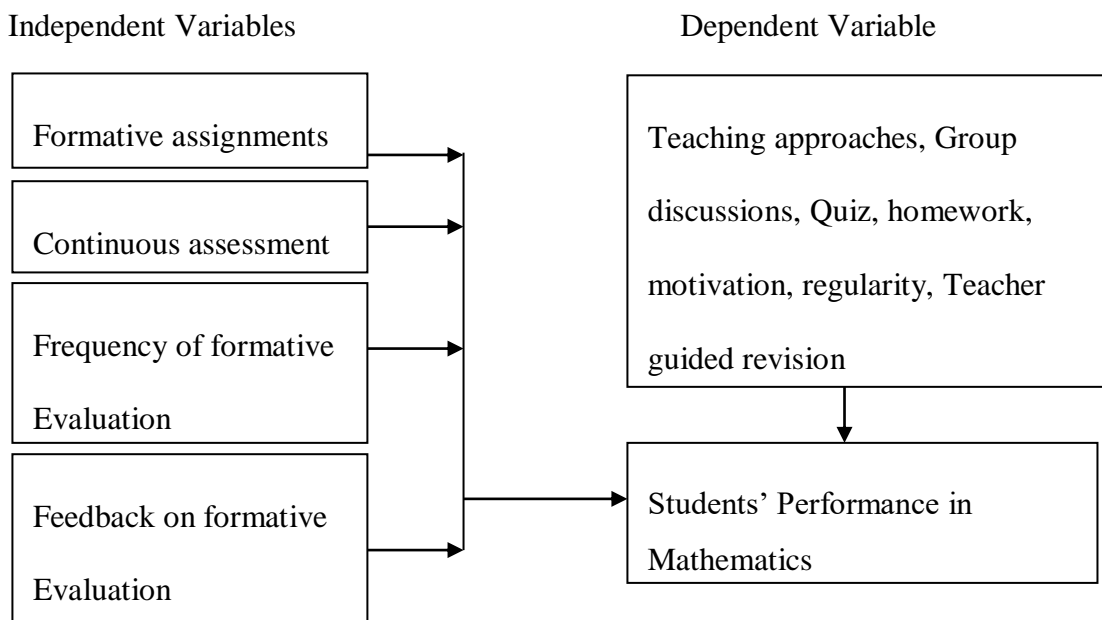
certain stimulus; the Unconditioned Stimulus (US) was presented. Responses in classical conditioning tend to be emotional and involuntarily in the sense that they are out of the conscious control of the learner. For learning to occur, the conditioned and unconditioned stimulus must be associated. The major contribution of the classical conditioning to learning is that the external environment is important in school for efficient learning. Secondly, the theory also shows that practice and exercise are essential in learning since these strengthen the Stimulus-Response (S-R) bond. Classical conditioning can be used for breaking bad habits and for developing positive attitudes.

In this study, the Conditioned Response (CR) was the attainment of good grades, which was evoked by the Conditioned Stimulus (CS), which was continuous assessment, and Unconditioned Stimulus was the teaching. To Pavlov, pairing food and the sound of the bell made the dog salivate and in this study, pairing of teaching and continuous assessment activities could make students perform better in terms of good grades in the final examinations. The theory of Pavlov that suggested conditioned stimulus and conditioned response was an important aspect to this study in helping us to understand the relationship between continuous assessment strategies being used (i.e. assignments, tests, frequency and feedback) as the stimuli and academic performance of students as respondents. The above theory mainly focused on how to enlarge a basket of knowledge through linkage of cognitive structure by using more and more relevant materials. So that, the different data collected by using prescribed tools should be explain based on these theories.

Conceptual framework

A conceptual framework is a model presentation where a researcher conceptualizes or represents the relationship between variables in the study by showing the relationship diagrammatically. In experimental study, pre-test post-test non-equivalent group design was adopted to find the effect of 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 dependent variable. The effectiveness of formative evaluation is diagrammatically illustrated in figure 2.1 below.

Figure 2.1 Conceptual framework



(Source: Kivuti, N.B. (2015))

In this meaning, there are two variables one independent variables and other is dependent variables. Formative assignments, Continuous assessment, Frequency of formative evaluation and feedback on formative evaluation are independent variables and teaching approaches, group discussions, homework, motivation, regularity,

Teacher guided revision as well as students' performance in mathematics are dependent variables. These two variables help to find out effectiveness of formative evaluation.

For the non-cognitive aspect the following component are helps to do this study they are: Teaching approaches, Group discussions, homework, motivation, regularity, Teacher guided revision.

The above framework demonstrates that Formative evaluation can be used in each phases of learning such as in motivation. In fact, there is no hard and fast rule to abide these phases. However, for simplicity, in the initial phase contents had been presented and students had been engaged to recall preliminary information, previous experiences and concepts allied to the contents and then formative evaluation was used for the purpose of demystifying the concepts.

Chapter III

METHODS AND PROCEDURES

Methodology is a powerful means for carrying out any investigation successfully. Methods refer to techniques and procedures used in the process of data gathering, the aim of methodology then is, in Kaplan's words: to describe and analyze these methods, throwing light on their limitations and resources, clarifying their presuppositions and consequences, relating their potentialities to the twilight zone at the frontiers of knowledge. It is to venture generalizations from the success of particular techniques, suggesting new applications, and to unfold the specific bearings of logical and metaphysical principles on concrete problems, suggesting new formulations (Kaplan, 1973).

The present study is essentially enumeration of the effect of formative evaluation on mathematics in Basic level school. The major procedures followed in this study was Design of the study, Population of the study, Sample of the study, Variables of the study, Tools of Data collection, Validity and Reliability of the tools, Experimental Validity Treats, Phases of Experiment, Source of Data, Data collection procedure, Data analysis procedure and Ethical Consideration.

Design of the Study

The research adopted a mixed design i.e. quantitative and qualitative research. Having two group one is experimental and another control group. The researcher taught to experimental group using formative evaluation and on other hand control group was taught without using formative evaluation. The pre-test and post-test non-equivalent group design was adopted for the study. The independent variable was the treatment and the dependent variable was achievement of the students. The design of this study was as follows:

Table 3.1: Design of the Study

Groups	Pre-tests	Treatment	Post-tests
Experimental	O ₁	X	O ₂
Control	O ₃	-	O ₄

At the process of selecting the experimental and control group no randomization has used. This design is the most effective to minimize the treats to external validity. Two groups have made homogeneous as possible as by selecting school of similar status with respect to physical facilities and as per as possible group has made with focusing same cognitive structure of students.

In this design, O₁ and O₃ represent the pre-test for experimental group and control group, while , O₂ and O₄ represent the post-test for experimental group and control group, X represent manipulating variables of formative evaluation given to the experimental groups. Both groups have given the same pre-tests (as Appendix B and C) after being exposed to one of the teaching methods. Pre-test has used to assess similarities between groups. The researcher has implemented formative form in the treatment group and the traditional methods of teaching in the control group.

In the experimental group the researcher gave homework and checked their homework with feedback for duration of every 2 days. He gave classwork daily and checked their classwork with feedback. He gave assignments and checked with feedback for duration of every 1 week (as Appendix H). The researcher did cross question during the class and gave feedback to the poor students. The researcher conducted quiz contest in his teaching period (as Appendix G). The researchergave assignment(as Appendix H). Also did group discussion often in the class.

But in control group the researcher gave homework and checked their homework with feedback for duration of every 1 week. He often gave classwork and checked their classwork with feedback. He did not give assignments and checked with

feedback for duration of every 2 week. He did not conduct quiz contest in his teaching period. The researcher did not do group discussion in class.

After taking post test to compare effectiveness of formative evaluation has imposed to the students for measuring perception towards formative evaluation in mathematics. All students of grade VIII of Shree Saraswoti Secondary School, Bardiya taken as experimental group and Shree Deepjyoti Secondary School, Bardiya taken as control groups. The researcher taught the students of experimental group by using formative evaluation and the control group as usual.

Population and sample of the Study

As far as the population of this study, all basic level students' of Bardiya districts those were studying at grade VIII was taken as the population of the study. And the sample for the study was determined from the population. The researcher took only two schools namely Shree Saraswoti Secondary School and Shree Deepjyoti Secondary School to fulfill the motto of this study, selecting them by convenience sampling technique. One was supposed as control which comprised 35 students and next as experimental which comprised 30 students. The sample for experimental group has selected purposefully because the study become more valid and no artificial environment has created if the researcher himself does experiments in class. The sample for control group has also selected purposefully to make the equivalent group to experimental to avoid the possible effect of the manipulative variable on the control group. The determination of experimental and control group was carried out by tossing a coin. For the non-cognitive aspects the researcher selected only 5 students among 30 students of experimental group and 5 students among 35 students of control group by simple random sampling method.

Variables of the Study

Variables are key ideas that researcher seek to collect information on to address the purpose of their study. A concept which can take on different quantitative values is called a variable. Also variables are characteristic or attribute of an individual or an organization the researcher can measure or observe and varies among individuals or organizations studied .Different variables used in educational research.

Independent variable

The independent variables are the conditions or characteristics that the experimenter manipulates or controls in his or her attempt to ascertain their relationship to observed phenomena. In this study formative evaluation, continuous assessment, frequency of formative evaluation, feedback on formative evaluation was independent variables.

Dependent variable

The dependent variables are the conditions or characteristics that appear, disappear or change as the experimenter introduces, removes or changes independent variables (Best and Khan, 2006). In this study student's achievement in mathematics perceptions towards mathematics, Teaching approaches, Group discussions, homework, motivation, regularity, Teacher guided revision were dependent variables.

Extraneous Variables

Extraneous variables are those uncontrolled variables (i.e., variables not manipulated by the experimenter) that may have a significant influence on the results of a study. Selection of school, instructor/teacher, subject matter, group, experimental time, test, scoring, students' labor home environment, tuition, history and maturation are considered as extraneous variables in this study.

Some major affecting variable Controlled in the experiment

In this study, some non experimental variables such as teacher variables, subject matter, teaching aids, length of experiment, evaluation applied to students and school environment and group formation were controlled in order to minimize the effect on dependent variables. Since the experiment was conducted in one school, grade VIII students were taught by selected in naturally assembled class so that there was no artificiality constructed. Students were taught some topic of Geometry in both groups by giving equal time. To control the influence such type of variables following exercise were done.

Evaluation Applied: In this research work, after the end of experiment same test was given to evaluate the students of control and experimental groups.

Selection of school: Such two schools were selected in sample which is similar in socio-economic status, facilities and result of students.

Teacher: To control the teacher variables as behavior, personality, emotion and qualification, the researcher himself taught both the experimental and control groups.

Students: Students having the age between 11-16 & not having the regular extra class (tuition) of mathematics was selected in the sample.

Subject Matter: Some contents were taught to the both the experimental and control groups from the same text book presented by government of Nepal.

Equivalence of the groups: Experimental and control group of students was made comparable using their score on the pre-test, as mentioned above.

Length of the Experiment: Researcher had provided equal time duration (4 weeks) to teach both experimental and control group.

Test: Some test paper was conducted for the both group after the time of experimentation.

Scoring: Researcher himself gave the score of students in text paper appeared by the students of both group.

Module: To conduct the experiment, the researcher was developed a daily teaching module for the same topic of geometry.

Some uncontrollable affecting Variable in the experiment

Student's labor: Students may labor more or less than expected by the researcher & self study of the students may affect in the result of research which is out of control.

Student's home environment: Student's home environment has great effect on student's behavior and attitude but it cannot be controlled by the researcher.

Tuition: Tuition classes can increase the knowledge of students so it cannot be controlled by the researcher.

Maturation: The different level of maturation of students can build up the different capacity of grasps knowledge, so it cannot be controlled by the researcher.

History: The history of ethnic group and family background cannot be control by the researcher.

Tools for Data Collection

In this study, the researcher himself was visit the related schools to collect the data and information related to the study. If necessary, the researcher made a set or some sets of questionnaire to get the information on various variables as given in the index. The instrument has been used in this study is the achievement tests; pre-achievement test and post- achievement test. The achievement tests used to compare what they knew before in a pre-performance test and what have they experienced in the post- achievement test.

Achievement Test

The main purpose to use this tool was to find out the effect of formative evaluation in mathematics teaching. The main tools for the data collection were the test items used for both groups during the research study. For that, the researcher was constructed different level (Knowledge, Skill, and Problem solving) of test item, based on prescribed curriculum and textbook of grade eight. The researcher made 20 questions for pilot test, 6 questions are rejected from the pilot test, so 14 questions were taken in achievement test. These models of test items are presented in Appendix 'B' and 'C'. Specifically this tool was used for collection of quantitative data.

Class Observation Note

During the teaching period the researcher noted student's participation, performance, interaction, homework, regularity in the classes and motivation in learning. For the non-cognitive aspects the researcher selected only 5 students among 30 students of experimental group and 5 students among 35 students of control group by simple random sampling method including such elements as Appendix 'I'. It reflects the effect of formative evaluation in teaching mathematics. After maintaining the diary researcher described the students feeling their regularity and interest on the subject matter.

Interview schedule

Interview is a kind of widely used data collection method of educational research. It is also a kind of oral questionnaire, which helps us to understand participant's perception, reactions, views and his/her facial expression about the particular real situation. For the non-cognitive aspects the researcher selected only 5 students among 30 students of experimental group and 5 students among 35 students

of control group by simple random sampling method including such elements as Appendix 'J'.

Validity and Reliability of the Tools

To ensure the good quality of the test, validity was more important, what it means that the test must have the items which truly assess the skill and abilities as indicated by given learning outcomes. Validity of the achievement test was established by the help of subject teacher, expert and supervisor.

Reliability of the test was very important of this study. For this purpose, every test items were pilot test and reliability was checked before it was administered.

Test Items

The researcher had developed a set of 20 objective types of mathematics test items in reference with Educational Taxonomy and Gird list of grade eight. The set of test items was administered within a group of grade eight students at Shree Amar Jyoti Secondary School, Bardiya were not included in the sample of the study in order to test reliability of each items. Items were analyzed in terms of difficulty level and discrimination index and then moderate difficulty level items were selected. The reliability coefficient of a set of test items was tested by split half method, and the result was 0.55, which show the test item was reliability(as Appendix K). And content validity of the items was accounted by subject teacher, supervisor and the expert's judgment.

Interview

For the reliability of interview schedule, the students were selected by simple random sampling method for the interview and the interview was taken by interview guidelines.

Pilot test and item analysis

It is necessary to pilot a test before it is finally administered. It is not known what answer will be elicited by a question or a task unless it is tried out before hand. Pilot testing is necessary to be sure; that the test does what it is intended to do. Pilot testing is also to know how difficult a task or a question is. Furthermore, it is also necessary to pilot a test to know whether an item really works or not. To check what is intended and what happens in real sense piloting is necessary. An item analysis carried out for test improvement by identifying the too easy or too difficult items based on pilot study. It is a process which examines student's responses to individual test items in order to assess the quality of these items and of the test as a whole. Item analysis is the process of collecting, summarizing and using information from students' responses to assess the quality of test items, Difficulty index (P) and discrimination index (D) are two parameters which help to evaluate the standard of a test. The researcher conducted the test among 23 students of Shree Amar Jyoti Secondary School, Bardiya. For each test item, the correct answer was given '1' (one) mark and wrong answer was given '0' (zero) marks. Then the difficulty level (P) and discrimination index (D) of test items were calculated. The difficulty level ranging between 30% and 70% was considered acceptable and the discriminating indexes (D) above 0.20 to 0.80 were considered acceptable (Jabara, 2068). Thus, based on these P-value and D-value for achievement test, I have prepared 30 questions. Out of these questions, only 20 appropriate test items were selected. These test items were used to administer in the achievement test. The table of the test item analysis has been mentioned in the Appendix 'A'. The formula used for the calculating P-value and D-value were given below.

Difficulty Level (P) =

$$\frac{\text{No. of students getting correct answer}}{\text{Total no. of students participate in the item analysis}} \times 100$$

$$P = \frac{\frac{R}{N} \times 100}{R_u - R_l}$$

$$\text{Discriminating Index (D.I)} = \frac{N}{2}$$

Here,

R_u = Number of students in upper group giving right answer

R_l = Number of students in lower group giving right answer

N = No. of students participate in the achievement test

Experimental Validity Treats

Every researcher attempts to achieve maximum validity in his/her research work. To make a significant contribution to the development of knowledge, an experiment must be valid (Best and Khan, 2009). There are two types of experimental validity which are following discussed:

Internal Validity

An experimental has internal validity to the extent that the independent variables have been manipulated actually have genuine effect on the dependent variables. Many factors play key role to decrease effect of manipulated variables upon independent variables. Effects of controlling such type of variables ways are following discuss:

History

Events outside of the study experiment or between repeated measures of the dependent variable may affect participants' responses to experimental procedures. Often, these are large scale events (natural disaster, political change, etc.) that affect participants' attitudes and behaviors such that it becomes impossible to determine

whether any change on the dependent measures is due to the independent variable, or the historical event. But in this present study was done in short time period of time so these treat no more effect in my research.

Subject Characteristics

First of all, subject characteristics are one of the possible threats to internal validity in the present study. The characteristics of subjects which might affect the internal validity were students' ages and their socioeconomic status. Students who participated in the present study were at the same grade level, so their ages were close to each other. So, these characteristics did not influence the results accidentally.

Selection Bias

Selection bias which is likely to affect the internal validity results when the researcher makes a comparison between the non-equivalent experimental and control group. It is another treat to the experiment. But in this study, the equivalency of two groups at the beginning of this study was censured by the analysis of pretest result.

Experimental Mortality

Experimental mortality means the loss of subjects during the period of experimentation. But here, no participant of the experimental and the control group lost during the experiment. There were same number of respondent in the pre-test and post-test both groups.

External Validity

External validity is the extent to which the variable relationship can be generalized to other treatment variables, other measurement variables and other populations (Best and Khan, 2009). The possible factors that affect the external validity and their controls are discussed as below:

Artificial Situation of the Experiment

The researcher tried his/her best to control all extraneous variables so that they may produce any experimental change. As a consequence of this effort, the experimental situation became more artificial and less resembled of the life situation regarding which generalizations were to be made. But to control such problem the groups were formed in the naturally assembled class.

Interaction Effect of Testing

The use of a pretest at the beginning of a study may sensitize individuals by making them more aware of concealed purposes of the researcher and may serve as a stimulus to change. The study was doing short period of time as well as the researcher made question structure of pre and post-test differ.

Phases of Experiment

This experiment had been completed in the following three phases:

Pre Experimental Phase

This was the first phase of the experiment which had ranged from October 8, 2017 to November 10, 2017. In this phase, preparation of episodes, slides of teaching, preparation of materials, validations of these episodes by the help of the subject expert were completed. Furthermore, the researcher had completed planning, preparation and piloting the mathematics achievement test for the pre-test, administration of pre-test, analysis of pre-test result in this phase.

Experimental Phase

The tenure of the experimental phase was ranged from November 15, 2017 to December 20, 2017. During this tenure, the students of Shree Saraswoti Secondary School were taught by the researcher by using Formative Evaluation whereas,

students of Shree Deepjyoti Secondary School were taught by the researcher by using Traditional Approach.

Post Experimental Phase

In the final phase of the experiment the post mathematics achievement test was administered in both groups. And then interview were administered only on experimental group and the results obtained from both groups were analyzed and interpreted.

Source of Data

The two main sources of data in social mathematics research are People and paper. The responses to questions put to people constitute the major sources of data in social research. These sources refer to the primary sources of data. A large amount of data is already formative evaluation able in the forms of paper sources. This includes documents, historical records, diaries, biographies, statistical records and the like. The paper sources have commonly known as secondary sources of data (Pokharel, 2006). In this research study, the researcher was used both the primary and secondary sources for the collection of data. The sources are as follows:

Primary Source of Data

The primary source of data for this study was achievement test obtained by the students in pre- test and post-test on the experiment. Similarly, the data collected from each selected mathematics teacher and head teacher of these schools through unstructured questionnaire were taken as a primary source of data.

Secondary Sources of Data

The secondary data was obtained from the review of various related books, document, website, national and journal, forum and unpublished master's thesis etc.

Data Collection Procedure

For this research work, first, researcher prepared a set of tools then researcher went to the field. After visiting 10 schools the researcher got 2 schools which have same category in school structure and students achievement of class 8 result of 2072 by the permission letter. Researcher built rapport with the respondents and explained them about the purpose. Then after researcher distributed the students in different two groups for the purpose of quantitative study i.e., controlled group and experimental group with the help of tossing coin. A pre-test administered to determine the proficiency level of students in the selected topic before treatment. Both groups taught the same lesson by the researcher only 45 mins in a day during 30 days with teaching plan with the help of respective mathematics teacher. The control groups were taught by using conventional method and experimental groups was taught by using formative evaluation. At the end of every teaching learning session of the selected lessons the students of experimental and controlled group were administer the same standardized achievement test i.e., post-test. The result obtained from pre-test and post-test of both group were compare and analyzed with the help of statistical devices then determine the relative effectiveness of the use of formative evaluation in mathematics teaching of the selected teaching lessons at basic level, grade VIII. Similarly, for the collection of qualitative data the researcher took interview to 10 students and use classroom observation note. Finally, the researcher interpreted achievement test, triangulated the data based on conceptual framework, data collected from observation and interview schedule over the selected schools ' students.

Data Analysis Procedure

Data analysis is considered to be important step and heart of research in research work. The data analysis for this research was done by quantitatively as well

as qualitatively with the help of both descriptive and inferential statistics. Thus, achievement test scores have been analyzed using inferential statistics (as Appendix L). After collecting the necessary data, the researcher used the mean, standard deviation and variance were calculated for both the groups with their secured mark in the test. After that, z-test for the independent samples was used 0.05 level of significance to determine the significant difference between students achievement taught by using formative evaluation and without using formative evaluation. By using achievement test paper-1, the mean, variance and standard deviation of the scores were found for both experimental and control groups. These mean difference and standard deviation were compared with the help of the test statistics formula. For the analyze of the non-cognitive behaviour of students by classroom observation note and interview schedule related students. Finally, the researcher interpreted and triangulated the data based on literature review, theoretical review and the data collected from observation and interview schedule over the selected schools ' students.

Ethical Consideration

In the research work, a numerous ethical issues were considered in order to make standardization in data collection procedures and conformity in report writing.

In this experimental design the following ethical issues were considered:

- Institutional Approach: Researcher has granted permission from institutions planning or conduction experiment providing accurate information and experiment was conducted in accordance with the approved research protocol.
- Language: Researcher had used appropriate language that was reasonably understandable to all participants and researcher has not fabricated data or falsifies result in his publication.

- Informed Consent: Before collecting required data or conducting actual experiment, participants had been clearly informed about the purpose of the study, use of its results, duration of the experiment and possible risk factors in this experiment as well as responsibilities of each party. After making consent with the participants, the experiment was started.

Chapter IV

ANALYSIS AND INTERPRETATION

The analysis and interpretation of data consists of organizing, tabulating, performing statistical analysis and drawing references. The main purpose of such analysis is to obtain answer to research questions or to test the hypothesis.

This is an experimental research. The main focus of this study was to explore the effectiveness of formative evaluation in mathematics achievement at basic level. Achievement of the students is the main parameter to explore the effectiveness of formative evaluation. For this purpose achievement of basic level students were collected. So this chapter deals with the statistical analysis and interpretation of data obtained from the achievement scores of the students. These data were analyzed by using mean, variance, standard deviation and z-test. The data of the achievement test scores was analyzed under the following topics headings.

Comparison of the achievement score of students in the pre-test

Pretest was taken as the purpose to find out the gap between the experimental and control groups and to establish test the null hypothesis of this study. In order to test the null hypothesis, the researcher established two equivalent groups of the students on the basis of coin tossing. The two tailed z-test was used in order to ascertain that the difference between two tailed z-test was used in order to ascertain that the difference between two groups was statistically significant or not. The mathematics achievement test in pretest was taken as Appendix "B and D". The pretest raw scores of the experimental and control groups were presented in Appendix "E". And the statistical calculation of the pretest of both groups was given in table below.

Table No. 4.1: Result of pre-test

Group	Sample size	Mean	S.D.	Variance	z-value	Remarks
Control group	35	8.8	2.24	5	0.18	0.18 < 2.00
Experimental group	30	8.9	2.23	4.97		

Degree of freedom (df)₆₃, $z = 2.00$

The above table shows that, the number of students in control group and experimental group were 35 and 30 respectively. In pre-test total, mean score of the control groups and experimental groups were 8.8 and 8.9 respectively from this result shows both group of students were same level. The calculated standard deviation for control and experimental group were 2.24 and 2.23 respectively from this result it shows both group of students were same level. Similarly, the variance of experimental group was 4.97 and control group was 5 from this result shows both group of students are same level. The calculated z-value (0.18) at degree of freedom 63 was less than the tabulated value (2.00). Thus, the difference in mean score of experimental and control group on pre-test score was found to be insignificant at 0.05 levels with degree of freedom at 63.

The total mean score, standard deviation, and variance of both groups were found to be nearly equal. It means the divided two groups (experimental and control group) were equivalent or homogeneous in nature before using treatment. Similarly, the calculated z-value of total pre-test result show that, the null hypothesis was accepted and alternative hypothesis was rejected. Thus, the students of experimental and control group were equivalent in the understanding of teaching lesson before the experimentation.

Comparison of the achievement score of students in the post-test

The mathematics achievement test in post-test was taken as Appendix "C and D". The post-test of total mean score, standard deviation, variance, and z -value of score obtained by experimental and control group of two schools. The post-test raw score of the experimental and control group were presented as Appendix "F" and the statistical calculation of the post-test of both group have been given as below.

Table No. 4.2: Result of post-test

Group	Sample size	Mean	S.D.	Variance	z -value	Remarks
Control group	35	9.6	2.52	6.35	2.13	2.13 > 2.00
Experimental group	30	11.2	3.41	11.63		

Degree of freedom (df)₆₃, $z = 2.00$

This table shows the number of students were 35 and 30. The mean score of the students in control group and experimental group were found to be 9.6 and 11.2 respectively from this result the students of experimental group got more marks than control group. The standard deviation of the students in control and experimental groups were 2.52 and 3.41 respectively from this result the students of experimental group got more marks than control group. Similarly, the variance of students of control and experimental group were 6.35 and 11.63 from this result the students of experimental group got more marks than control group. The calculated z -value was 2.13 at 0.05, level of significance with 63 degree of freedom. From above data it shows that, the calculated z -value (2.13) was greater than the tabulated z -value 2.00. Thus, there was significant difference between experimental and control group due to experimental treatment provided to that of experimental group and conventional treatment for the control group. Hence, the null hypothesis was rejected and the alternative hypothesis was accepted. It concluded that the achievement of experimental group was significantly better than the control group.

Therefore, the researcher analyzed that the formative evaluation played the vital role in teaching learning activities because with the help of formative evaluation learners can get chance to see as well as hear from which they can learn many more.

Comparison between result of pre-test and post-test

To find out differences, the researcher used both the methods i.e., conventional method and experimental method, both of these methods were used for treatment to find out more effectiveness of formative evaluation. To find out which method is more effective the researcher has used this produce comparatively. By doing comparative analysis of pre-test and post-test result, the researcher would find out the better one. Results of pre-test and post-test were compared under the following sub headings.

Scores in mathematics teaching obtained by control group

The pre-test and post-test mean score, standard deviation, variance and corresponding t-value obtained by control group of students has been given below.

Table No. 4.3: Scores in mathematics teaching obtained by control group

Group	Sample size	Mean	S.D.	Variance	z-value	Remarks
Pre test	35	8.8	2.24	5	1.36	1.36 < 2.00
Post test	35	9.6	2.52	6.35		

Degree of freedom (df)₆₈, $z = 2.00$

The above table shows the comparative study of the pre-test and post-test of control group. The pre-test and post-test mean score of students in control group (taught without using formative evaluation) which were found to be 8.8 and 9.6 respectively. The standard deviation and variance were 2.24 and 5 for pre-test, 2.52 and 6.35 for post-test. The calculated z-value was found to be 1.36, which was less than tabulated z-value (2.00) at 0.05 level of significance with degree of freedom 68.

It shows that, there is no a significance difference between two mean achievement score in pre-test and post-test.

Hence, the alternative hypothesis was rejected and the null hypothesis was accepted i.e., there is a significant difference between pre-test and post-test was slightly increased in the absence of formative evaluation than pre-test.

Scores in mathematics teaching obtained by experimental group

The pre-test and post-test mean score, standard deviation, variance and corresponding z-value obtained by experimental group of students has been given below.

Table No. 4.4: Scores in mathematics teaching obtained by experimental group

Group	Sample size	Mean	S.D.	Variance	z-value	Remarks
Pre-test	30	8.9	2.23	4.97	3.07	3.07 > 2.00
Post-test	30	11.2	3.41	11.63		

Degree of freedom (df)₅₈ z = 2.00

The above table shows the comparative study of the pre-test and post test result of the students. The number of students involved in pre-test and post-test were nineteen. The mean score obtained in pre-test was 8.9 and post-test was 11.2. The standard deviation and variance of the scores obtained in pre-test were 2.23 and 4.97 respectively. Similarly, the standard deviation and variance of the scores obtained in post-test were 3.41 and 11.63 respectively. The calculated z-value was 3.07 in two-tailed test at 0.05 level of significance with degree of freedom 58, which was greater than the tabulated t-value.

Hence, the null hypothesis was rejected and alternative hypothesis was accepted. It has concluded that the pre-test and post-test achievement of experimental was significantly better than the control group. So that, the researcher concluded that the formative evaluation plays the vital role in teaching learning activities because

with the help of formative evaluation learners can get chance to see as well as hear from which they can learn many more.

Thus, the researcher concluded that the student's mean achievement of experimental group who were taught by using formative evaluation was found better than that of control group, who were taught without using formative evaluation in teaching mathematics at basic level.

The researcher fixed 30 days time period for this study. In which, the researcher taught the experimental group by giving the treatment and control group without giving treatment. During this teaching, it was seen that presence of the students of experimental group also increased. The teachers of that school were also positive towards the formative evaluation and they really helped a lot while concluding the experiment. There was a little bit discussion between the researcher and the students at the time of group division. Then, the researcher had described purpose and important of formative evaluation to the students. After mentioning them about the formative evaluation, they took it easily and understood its value. The experimental group was taught with formative evaluation and control group was taught as usual way. During the experimental teaching, the progress of the experimental group was found better than that of the control group. The use of formative evaluation in teaching had really made the researcher fully devoted in teaching with well preparation.

In this research the researcher linkage to the classical conditioning theory by Ivan Pavlov. Conditioned Stimulus (CS) was the response developed by using formative evaluation and students' achievement were the Conditioned Response (CR). Similarly the Unconditioned Stimulus (US) was the response developed by without using formative evaluation and students' achievement were the Unconditioned

Response (UR). Also in Pavlov theory bell and food are Unconditioned Stimulus (US) and saliva is Unconditioned Response (UR). Likewise in this research teachers activity in class are Unconditioned Stimulus (US) and the students' motivation, interest, interaction and attitude are Unconditioned Response (UR).

In this way, the researcher concluded class tests, unit tests, classroom assignments and the student's performance was checked. When researcher took posttest after 30 days experiment. He found that the achievement level of experimental groups was better than the control group. Therefore, it can be easily claimed that an application of formative evaluation in teaching is better of the weakness students.

Responses of students about formative evaluation in teaching mathematics for non-cognitive aspect.

Qualitative analysis is prepared on the basis of classroom observation note which is made by researcher himself. Observation is a kind of tool that helps to seek information and knowledge through the use of sense organs. In the research work, observation is an effective and suitable method for reliable primary data collection tools. It provides researcher with ways to check for non verbal expression of feelings, determine who interacts with whom, grasp how participants communicate with each other. The participant observation is used as a way of increase validity of the study. On the basis of classroom instruction, the researcher observes the student's activities noted daily on him notebook. The researcher noted activities of students, student's participation, regularity and problem solving capacity of the students. In this study, researcher carried out the effect of formative evaluation in teaching mathematics as well as their non-cognitive aspect at basic level.

The researcher went to both schools and he taught in those schools for 30 days using formative evaluation without using formative evaluation. In control group the students felt mathematics subject is so difficult subject. Their attendance was low and they did not do their homework regularly. They used to be busy in working at home. So they did not come at school regularly. During the class, no one asked the question and they felt very bored in mathematics period.

Researcher taught experimental group for 30 days by using formative evaluation. Then the researcher found that the students' activities were changed in different aspects. Students told that, "*Sir, we understand easily about triangle, rectangle and the angle by using of manipulative materials.*" The active participation of the students is highly noted factor where they were found enjoying the classroom activities, doing class work/homework.

In experience the researcher found that his teaching was effective by the analysis of the classroom observation note of experimental group because most of the students of experimental group were curious and interested.

At the experimental period, researchers collected some students' views like that:

"Our teacher teaching boring method while teaching, but now a day we are present regularly". (Students)

In this view shows the student regularity in their class, if student satisfy for learning then they present school regularly. If student cannot learn what teacher teach then they feeling boring.

"Our friends behavior is not good, they come to school without using uniform and irregular, but now a day student are present school in regularly" (Students)

In above view shows that students regularity in the school. As well as student nature. From this view the researcher concluded that while teaching and motivating the student, then their behavior was changed.

“In teaching geometry, our mathematics teacher did not use formative evaluation. So we felt difficult to understand the theme of content.” (Students)

“Home assignment make us easy to learn and easy to understand in geomery.”
(Students)

While teaching the mathematics teacher, he can't use formative evaluation. So the students can't understand clearly, as well as they feel boring to their study.

“We cannot solve the problem of the content because we did not understand properly. Use of formative evaluation helps us to understand the contents better.”
(Students)

“We are feeling more interesting and learn many things about geometry from the quiz contest” (Students)

The above view indicates that the teaching of mathematics at basic level without using formative evaluation is not meaningful teaching. Such kind of learning may not be permanent. Without using formative evaluation in teaching mathematics at basic level the teaching is incomplete and bored for the students also. A student namely Ramesh Poudel from experimental group got 11 out of 20 in pre-test but in posttest he got 17 marks out of 20. Similarly a student namely Kiran B.K. from control group got 10 out of 20 in pre-test but in posttest he got 12 marks out of 20.

For the classroom observation note and interview the researcher selected 5 students from random sampling method among 30 students of experimental group and 5 students from lottery method among 35 students of control group. To take observation note the researcher observed selected student by the observation

guidelines and for interview the researcher took interview of selected students by the help of interview guidelines.

The researcher concluded that it was possible to use formative evaluation while teaching the students daily. The researcher had found that teaching materials group was not effective as much as teaching experimental group because students of control group were not curious and interested to read chapter seriously. They neglected both subject teacher and researcher. In control group the researcher noticed the problem of irregularity of students in class, no regular homework and class work. They attend classes only due to parents and teachers pressure. Most of the students didn't ask any question in classroom. They only wrote the solution of problem in their copies which was solved by teacher. The participation of students in learning activities was passive, weak performance of students was observed but the students of experimental group were performance of students observed but the students of experimental group were excited for learning, motivated, curious when treatment was started students were rarely absents. Thus researcher observed the participation, feelings, motivation, regularity and performance of students good and active. The interpretation of qualitative data the researcher triangulates from the theoretical review, classroom observation note and interview schedule.

Chapter V

SUMMARY, FINDINGS, CONCLUSION AND RECOMMENDATIONS

Summary

This research aimed to find the effectiveness of formative evaluation in mathematics achievement at Basic level. Also, it aimed to compare the mathematics achievements of students with and without using formative evaluation and to analyze the improvement in non-Cognitive aspects.

For this study a pretest posttest non equivalent group design was adopted. Grade VIII students of Shree Deepjyoti Secondary School and Shree Saraswoti Secondary School were selected as sample. The researcher developed two achievement test papers and established the item difficulty level, discrimination power and reliability of achievement tests before their administration two equivalent groups were established on the basis of the pretest result. The researcher himself taught the selected unit to both experimental and control groups. After 30 days instruction period a posttest was administered to both groups. Then they obtained data were analyzed and interpreted by using z-test a 0.05 significance level.

Finding of the study

The statistical analysis of the data indicated the following findings of the study.

- The effect of formative evaluation on mathematics achievement at basic level was found positive.
- The experimental and control groups were equivalent on the basis of the pretest result. The difference in mean achievement of both groups was not found significant at 0.05 level of significance. The mean achievement of experimental group was found better than that of control group on posttest.

Also it was found that there was significance difference between the mean achievement of experimental group and control group at 0.05 level of significance.

- The participation of students in learning activities was passive, weak performance of students in control group. But the students of experimental group were excited for learning, motivated, curious when treatment was started students were rarely absent.

Conclusion of the study

From the result of this study the mean achievement scores of taught by using formative evaluation was better than the mean achievement score of taught without using formative evaluation. Formative evaluation helps students to give the concept of mathematics meaningfully. It also helps the students to motivate in mathematics learning. It encourages the students to learn mathematics. The statistical interpretation of the data indicated that the achievement of experimental group better than that of control group. Teaching mathematics with using formative evaluation is appropriate for better achievement in mathematics. In the control group the participation of students in learning activities was passive, weak performance of students was observed but the students of experimental group were performance of students observed but the students of experimental group were excited for learning, motivated, curious when treatment was started students were rarely absent. Thus researcher observed the participation, feelings, motivation, regularity and performance of students good and active.

Recommendations

From the result of experimental study the researcher suggested the followings recommendations.

- The classroom setting should be arranged in such a way that the all students could equally and easily participate in the process of formative evaluation.
- Formative evaluation should be applied in the classroom teaching frequently.
- The necessary trainings and workshops about the formative evaluation should give to the teachers.
- The class work attempted by the students should be checked, evaluated, commented and suggested properly.

Suggestions for Further Study

From the result of experimental study the researcher suggested the followings study for the further study.

- This study is an experimental study limited to grade VIII students of two public school of Bardiya 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 with a large sample and various schools of different parts on Nepal.
- This kind of students should be conducted at all levels of school and in other subject as well.
- The problems and challenges of conducting formative evaluation in mathematics teaching should be identified.

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Appendix- A

Item Analysis for Test items

Student/	Upper Level 27% giving right							Lower Level 27% giving right answer								P%	D.I	Remarks
	1	2	3	4	5	6	Total	1	2	3	4	5	6	Total				
1	1	1	0	1	1	1	5	1	0	0	0	0	0	1	0.50	0.67	Accepted	
2	1	1	1	1	0	1	5	1	1	1	1	1	0	5	0.83	0.00	Rejected	
3	0	1	1	1	1	1	5	0	1	0	1	0	0	2	0.58	0.50	Accepted	
4	1	1	1	1	1	1	6	1	1	1	0	0	1	4	0.83	0.33	Rejected	
5	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0.17	0.00	Rejected	
6	0	1	1	1	1	1	5	0	0	0	0	0	0	0	0.24	0.83	Accepted	
7	1	1	1	1	1	1	6	1	0	0	0	0	0	1	0.58	0.83	Accepted	
8	1	0	0	1	0	0	2	0	0	0	0	0	0	0	0.17	0.33	Rejected	
9	1	1	0	1	0	1	4	1	1	1	1	0	1	5	0.75	0.17	Accepted	
10	1	1	1	1	1	0	5	0	0	0	0	1	1	2	0.67	0.67	Accepted	
11	1	0	0	0	0	1	2	1	0	0	0	0	0	1	0.25	0.17	Accepted	
12	1	1	1	0	1	1	5	1	1	1	0	1	1	5	0.83	0.00	Rejected	
13	1	1	1	1	1	1	6	0	0	0	1	1	0	2	0.67	0.67	Accepted	
14	1	0	0	1	1	0	3	0	0	0	0	0	0	0	0.25	0.50	Accepted	
15	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0.08	0.17	Rejected	
16	0	1	1	1	1	1	5	0	1	0	0	1	0	2	0.58	0.50	Accepted	
17	1	1	1	1	0	1	5	1	1	0	0	1	0	3	0.67	0.33	Accepted	
18	1	1	1	1	1	0	5	1	1	0	0	0	1	3	0.67	0.33	Accepted	
19	1	1	1	1	1	1	6	1	0	0	0	0	0	1	0.58	0.83	Accepted	
20	1	1	1	0	0	1	4	0	0	0	1	0	0	1	0.42	0.50	Accepted	

Appendix - B

Mathematics Achievement Test in Pre-test

Class – VIII

Full mark: 20

Sub: C. Mathematics

Pass mark: 8

Give the circle (O) for the correct answer.

1. If $\angle BGC = 120^\circ$ and $\angle AGC = 50^\circ$, then $\angle BGC + \angle AGC =$

(a) 170°

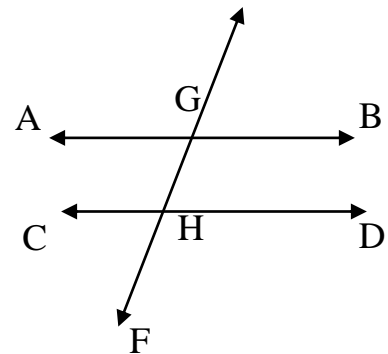
2. In the figure, $\angle BGC = 120^\circ$ and $\angle AGC = 50^\circ$. Find $\angle BGC + \angle AGC$.

(a) 170°

(c) 170°

(b) 120°

(d) 120°



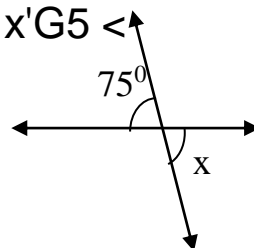
3. If $\angle BGC = 120^\circ$ and $\angle AGC = 50^\circ$, then $\angle BGC + \angle AGC =$

(a) 75°

(c) 90°

(b) 45°

(d) 135°



4. If $\angle BGC = 120^\circ$ and $\angle AGC = 50^\circ$, then $\angle BGC + \angle AGC =$

(a) 170°

(b) 120°

(c) 170°

(d) 120°

(e) 170°

(f) 120°

5. If $\angle BGC = 120^\circ$ and $\angle AGC = 50^\circ$, then $\angle BGC + \angle AGC =$

(a) 100°

(b) 90°

(c) 140°

(d) 135°

$\angle = 100^\circ$ or 90° or 180° or 200° ?

- a. 100° b. 90° c. 180° d. 200°

$\angle = 270^\circ$ or 180° or 90° or 360° ?

- a. 1 b. 2 c. 3 d. 4

$\angle = 120^\circ$ or 60° or 30° or 150° ?

- a. 120° b. 60° c. 30° d. 150°

$\angle = 120^\circ$

$\angle = 120^\circ$ or 60° or 30° or 150° ?

- a. 120° or 60° or 30° or 150° . d. 120° or 60° or 30° or 150° .

$\angle = 120^\circ$

- b. 120° or 60° or 30° or 150° .

- c. 120° or 60° or 30° or 150° .

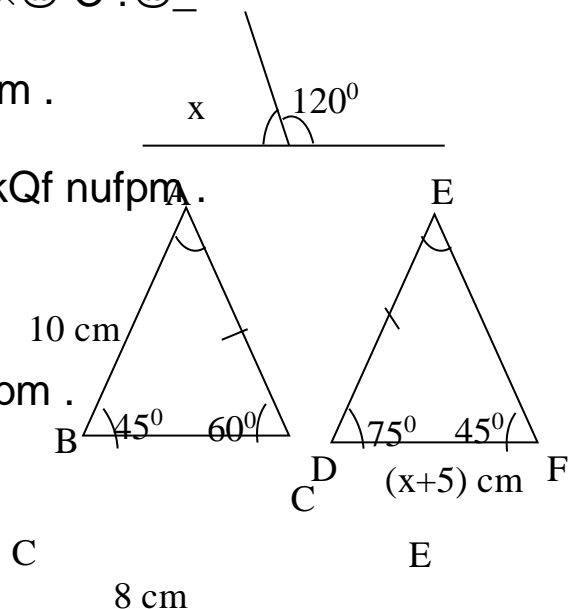
$\angle = 120^\circ$

$\angle = 120^\circ$ or 60° or 30° or 150° .

$\angle = 120^\circ$ or 60° or 30° or 150° .

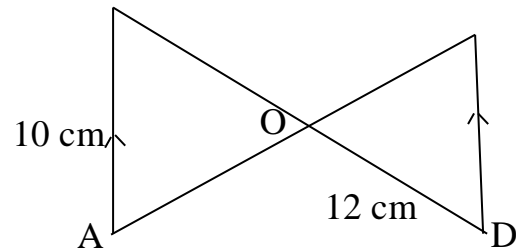
$\angle = 120^\circ$ or 60° or 30° or 150° .

$\angle = 120^\circ$ or 60° or 30° or 150° .



!@= olb $\triangle ACO / \triangle BOD$;d?k eP

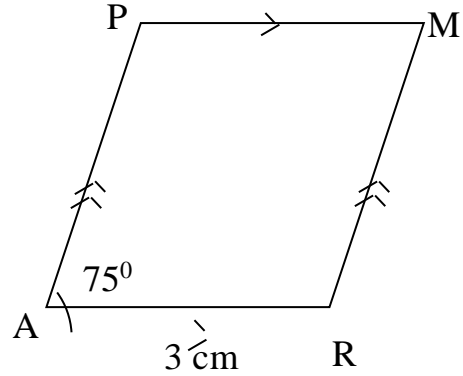
BD sf] dfg kQf nufpm .



!#= lraqdf PARM Ppf6f ;dfgfGt/ rt'{e}{h xf] .

olb $AR = 3 \text{ cm} / \angle PAM = 75^\circ \angle ARM$

/ PM sf] dfgkQf nufpm .



!\$= lgDg7f]; a:t'sf] hfnL agfpm.

s_ ;f]nL v_ lqe'hfsf/ lk|Hd

Appendix - C

Mathematics Achievement Test in Post-test

Class – VIII

Full mark: 20

Sub: C. Mathematics

Pass mark: 8

Give the correct answer.

Give the circle (O) for the correct answer.

1. In the figure, two parallel lines are intersected by a transversal. Find the value of x .

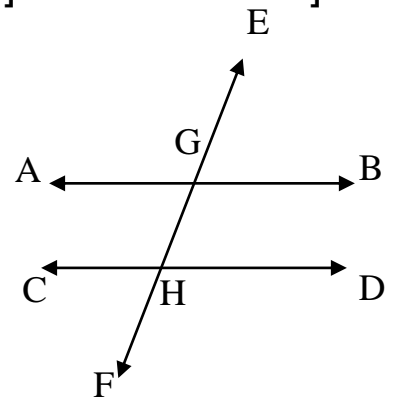
2. In the figure, two parallel lines are intersected by a transversal. Find the value of x .

3. In the figure, two parallel lines are intersected by a transversal. Find the value of x .

- a. 35° b. 100° c. 140° d. 135°

4. In the figure, two parallel lines are intersected by a transversal. Find the value of x .

- a. $\angle GHC$ c. $\angle AGC$
 b. $\angle CGH$ d. $\angle ACG$



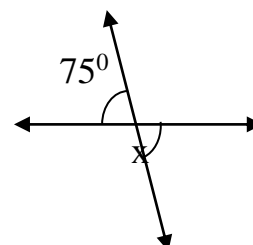
5. In the figure, two parallel lines are intersected by a transversal. Find the value of x .

6. In the figure, two parallel lines are intersected by a transversal. Find the value of x .

- a. 35° b. 100° c. 140° d. 135°

7. In the figure, two parallel lines are intersected by a transversal. Find the value of x .

- a. 45° c. 90°
 b. 75° d. 135°



$\angle = 180^\circ$ or 90° or 100° or 200° <

- a. 180° b. 90° c. 100° d. 200°

$\angle = 270^\circ$ or 180° or 90° or 360° <

- a. 1 b. 2 c. 3 d. 4

$\angle = 180^\circ$ or 90° or 100° or 200° <

- a. 180° or 90° or 100° or 200° . d. 180° or 90° or 100° or 200° .

- b. 180° or 90° or 100° or 200° .

- c. 180° or 90° or 100° or 200° .

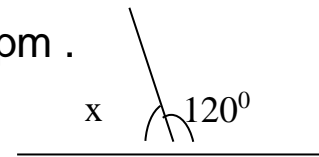
$\angle = 180^\circ$ or 90° or 100° or 200° <

- a. 180° b. 90° or 100° c. 180° or 90° d. 180° or 90° or 100° or 200°

$\angle = 180^\circ$ or 90° or 100° or 200°

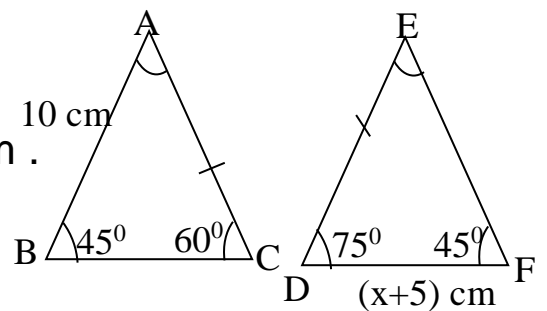
$\angle = 180^\circ$ or 90° or 100° or 200° .

$\angle = 180^\circ$ or 90° or 100° or 200° .

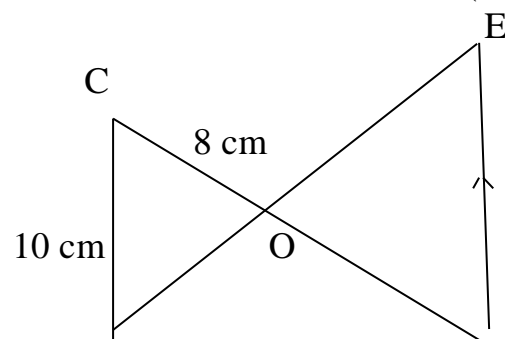


$\angle = 180^\circ$ or 90° or 100° or 200° .

$\angle = 180^\circ$ or 90° or 100° or 200° .



$\angle = 180^\circ$ or 90° or 100° or 200° .



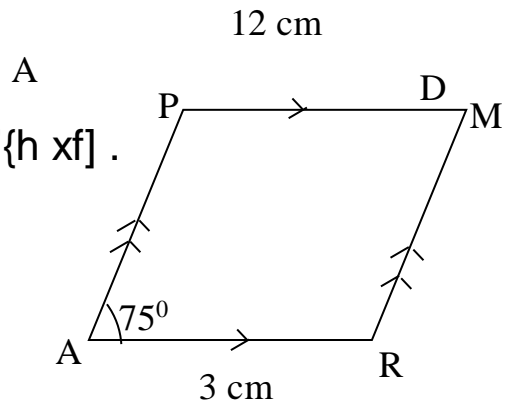
BD sf] dfg kQf nufpm .

^

!#= lraqdf PARM Ppf6f ;dfgfGt/ rt'{e'{h xf] .

olb $AR = 3 \text{ cm} / \angle PAM = 75^\circ \angle ARM$

/ PM sf] dfg kQfnufpm .



!\$= lgDg7f]; a:t'sf] hfnLagfpm . s_ ;f]nL v_ lqe'hfsf/ lk|Hd

Appendix -D**Answer Key of Pre-test**

S.N	Answer	S.N	Answer
1	a	5	c
2	a	6	c
3	c	7	d
4	a	8	d

Answer Key of Post-test

S.N	Answer	S.N	Answer
1	a	5	a
2	a	6	c
3	b	7	d
4	b	8	b

Appendix - E

Score of Pretest

S.N.	Scores of students in Control group	Scores of students in Experimental Group
1	10	10
2	9	11
3	11	9
4	9	8
5	10	7
6	7	10
7	11	9
8	10	8
9	11	7
10	11	6
11	9	5
12	9	10
13	8	10
14	8	11
15	11	10
16	13	9
17	9	8
18	8	7
19	8	11
20	11	7
21	10	9
22	9	8
23	8	10
24	7	9
25	8	8
26	5	10
27	7	9
28	8	11
29	6	9
30	9	11
31	7	
32	8	
33	9	
34	7	
35	7	
	$\sum X = 308, \bar{x} = 8.6, s^2 = 2.24$ $s = 5$	$\sum X = 267, \bar{x} = 8.9, s^2 = 2.23$ $s = 4.98$

Appendix - F

Score of Posttest

S.N.	Scores of students in Control group	Scores of students in Experimental Group
1	11	14
2	12	12
3	12	16
4	11	9
5	11	8
6	7	13
7	11	9
8	12	8
9	12	9
10	11	7
11	9	8
12	11	10
13	11	14
14	10	15
15	11	12
16	14	11
17	10	10
18	8	8
19	8	16
20	11	14
21	10	9
22	9	13
23	8	13
24	7	10
25	6	8
26	8	10
27	7	10
28	8	11
29	6	13
30	9	17
31	9	
32	7	
33	9	
34	8	
35	11	
	$\sum X = 335, x = 9.6, \sigma^2 = 2.52, \sigma = 1.59$	$\sum X = 337, x = 11.2, \sigma^2 = 3.41, \sigma = 1.85$

Appendix – G

Mathematics Quiz test

!= lqe'hsf lelq sf]0fx?sf] of]ukmn slt x'G5 <

pQ/ M !*)'

@= 270° l8u|L sf]0fdf sltj6f ;dsf]0f x'G5g <

pQ/ M #

#= b'O{]6f sf]0fx?sf] of]ukmn !*)' eP lt sf]0fx?nfO{ s:tf] sf]0f

elgG5 <

pQ/ M ;dk'/s sf]0f

\$= cf;Gg sf]0fsf] gfkx? 135° / (x + 35°) eP x sf] gfk sltxf]nf <

pQ/ M 100°

%= PsfGt/ sf]0fx? cfk;df s:tf x'G5g <

pQ/ M a/fa/

^= s|dfut leqL sf]0fsf] of]ukmn slt x'G5 <

pQ/ M !*)'

&= lqe'hsf sltj6f lelq sf]0fx?sf] x'G5g <

pQ/ M #

*= Ps ;dsf]0fdf slt l8u|L x'G5 <

pQ/ M ()'

$(= \rho Q / M) \cdot \frac{1}{2} \pi r^2$

$\rho Q / M$

$(= \rho Q / M) \cdot \frac{1}{2} \pi r^2$

$\rho Q / M$

$\rho Q / M$

$(= \rho Q / M) \cdot \frac{1}{2} \pi r^2$

$\rho Q / M$

$(= \rho Q / M) \cdot \frac{1}{2} \pi r^2$

$\rho Q / M$

$(= \rho Q / M) \cdot \frac{1}{2} \pi r^2$

$\rho Q / M$

$(= \rho Q / M) \cdot \frac{1}{2} \pi r^2$

$\rho Q / M$

$(= \rho Q / M) \cdot \frac{1}{2} \pi r^2$

$\rho Q / M$

$(= \rho Q / M) \cdot \frac{1}{2} \pi r^2$

$\rho Q / M$

$\rho Q / M$

$(= \rho Q / M) \cdot \frac{1}{2} \pi r^2$

pQ/ M ;Dd'v e'hf a/fa/ / ;dfgfGt/ x'g'k5{

!*= tnsfdWo] s'gjfSol7s 5 <

pQ/x? M a. ;a} ju{ Pscfk;df cg'?k x'G5g\ .

b. ;a} ;dafx' lqe'h Ps cfk;df cg'?k x'G5g\ .

c. ;d?k cfs[ltx? cg'?k x'G5g\ .

d. cg'?k cfs[ltx? ;d?k x'G5g\ .

!(= s:tf] lqe'hnfO{ cg'?k lqe'h elgG5 <

pQ/ M ;Dd'v e'hf / sf]0f a/fa/ ePsf]

@)= lqe'h cg'?k x'g] cj:yfx? s] s] x'g <

pQ/x? M a. SAS b. ASA c. RHS d. ASA e. dflysf ;a}

@!=olb s'g} b'O{j6f lqe'hsf] Pp6f sf]0f / 5]psf e'hfx? a/fa/ 5g

eg] lt lqe'hx? cfk;df s'g tYo cg';f/ cg'?k x'G5g <

pQ/x? M a. SAS

@@= s:tf] lqe'hnfO{ ;d?k lqe'h elgG5 <

pQ/ M ;Dd'v sf]0f a/fa/ ePsf] / ;Dd'v e'hfsf] cg'kft a/fa/ ePsf]

@#= lqe'h ;d?k x'g] cj:yfx? s] s] x'g <

pQ/x? M a. s'g} b'O{j6f sf]0fx? cfk;df a/fa/ ePdf

b. Itgj6} e'hfx? ;dfg'kflts ePdf

c. dflysf ;a}

@\$= cw{Jof; !)) dL6/ ePsf] j[Ttfsf/ wfjg dfu{df efjsn] Ps rSs/
nufpFbf slt ld6/ b'/L kf/ u5{ xf]nf <

pQ/ M 628 m

@%= cfwf/sf] kl/lw !%& ld6/ ePsf] j[Ttfsf/ ejgsf] Jof; slt xf]nf
<

pQ/ M 100 m

@^= Pp6f j[Ttsf] lf]qkmn 154 m² 5 eg] pSt j[Ttsf] cw{Jof; slt
x'G5 <

pQ/ M 7 m

@&= s:tf Hofldlto cfs[ltnfO{ cg'?k elgG5 <

pQ/ M s'g} b'O{ Hofldlto cfs[ltx? p:t} cfsf/ / Pp6} gfksf 5g
eg]

@*= s:tf Hofldlto cfs[ltnfO{ ;d?k elgG5 <

pQ/ M s'g} b'O{ Hofldlto cfs[ltx? p:t} cfsf/sf 5g eg]

@(= ;dl4afx' lqe'hsf cfwf/sf sf]0fx? s:tf x'G5g <

pQ/ M a/fa/

#)= ;dafx' lqe'hsf ;a} leqL sf]0fx? a/fa/ x'G5g eg] k|To]ssf]

dfg slt x'G5 <

pQ/ M 60°

#!= b'O{ ;/n /]vfv08 Ps cfk;df sf6bf olb Pp6f sf]0f csf]{
sf]0fsf] lakl/t lbzfdf 5 eg] To:tf] sf]0fnfO{ s] elgG5 <

pQ/ M lzif{led'v sf]0f

#@= lzif{led'v sf]0fx? Ps cfk;df s] x'G5g <

pQ/ M a/fa/

##= b'O{ ;/n /]vfnfO{ 5]bsn] sf6bf 5]bssf] b'a}lt/ k/]sf lelq

cgf;Gg sf]0fx?nfO{ s:tf] sf]0f elgG5 <

pQ/ M PsfGt/ sf]0f

#\$= b'O{ ;/n /]vfnfO{ 5]bsn] sf6bf 5]bssf] Ps}lt/ k/]sf lelq

cgf;Gg sf]0fx?nfO{ s:tf] sf]0f elgG5 <

pQ/ M s|dfut lelq sf]0f

#%= b'O{ ;/n /]vfnfO{ 5]bsn] sf6bf 5]bssf] Ps}lt/ k/]sf Pp6f

lelq / csf]{ adlx/L cgf;Gg sf]0fx?nfO{ s:tf] sf]0f elgG5 <

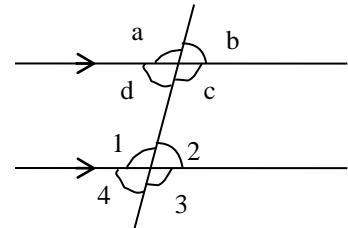
pQ/ M ;^a\ut sf]0f

Appendix – H

Assignment Test

;d'x -s_ -\$x@ Ö * _

! = l;Gsfsf] k|of]u u/L lbPsf] lrq h:t} 5]bsn] sf6\bf ToxfF
 aGg] PsfGt/ sf]0f, ;+3t sf]0f / qmdfut leqL sf]0f kQf
 nufpm .



@ = l;Gsfsf] k|of]u u/L Itg km/s km/s gfkfsf] lqe'h agfO{
 ItgLx?sf] leqL sf]0fx?sf] of]ukmnfoO{ tflnsfa4 u/Lb]vfpm
 .

= rf6{ k]k/sf] k|of]u u/L cg'?k lqe'hsf k|To]s Axiom cg';f/
 cg'?k x'g] lqe'jgx? lgdf{0f u/ .

\$ = sf8{af]8{sf] k|of]u u/L Cube, Cubiod, Pyramid, Cone, Prism x?sf]
 hfIn agfP/ To;af6 7f]; j:t"x?sf] lgdf{0f u/ .

Appendix -I

Classroom observation note guidelines for researcher

Schools' Name:

Students' Name:

The Classroom observation note guidelines for researcher on the basis of following topics:

- Students' regularity in classroom.
- Students' behavior in classroom.
- Students' motivation in classroom.
- Students' perception in classroom.
- Students' group discussion in classroom.
- Students' performance in mathematics.
- Participation in homework.
- Participation in class work.

Appendix -J

Interview Schedule with Students

Students' Name:

Schools' Name:

The interview with the student on the basis of following topics:

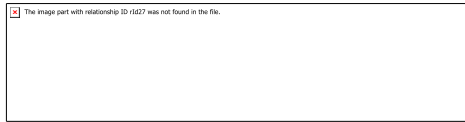
- Environment at school for learning
- Teaching techniques of mathematics teacher in geometry class.
- Participation in the classroom
- Problems in geometry.
- Basis knowledge about geometry.
- Cause of learning problems in geometry.
- Evaluation techniques used by teacher
- Teaching materials used by mathematics teachers

Appendix-K

Split Half Reliability of the test

S.N.	Scores on odd items (X)	Scores on even items (Y)	X ²	Y ²	XY
1	10	11	100	121	110
2	12	9	144	81	108
3	7	8	49	64	56
4	9	10	81	100	90
5	9	7	81	49	63
6	8	7	64	49	56
7	10	7	100	49	70
8	13	9	169	81	117
9	14	12	196	144	168
10	8	11	64	121	88
N=10	Σx= 100	Σy=91	ΣX ² =1058	ΣY ² =859	ΣXY= 926

Correlation Coefficient (r_{xy}) =



=



= 0.38

Reliability Coefficient (r) = $\frac{2r_{xy}}{1 + r_{xy}}$

$$= \frac{2 \times 0.38}{1 + 0.38}$$

= 0.55

Appendix - L

STATISTICAL FORMULA USED FOR QUANTITATIVE DATA ANALYSIS

For individual series

$$1. \quad (\bar{X}) = \frac{\Sigma X}{N} \quad \text{Where, } (\bar{X}) = \text{Mean}$$


X = Score obtained by individual student


ΣX = Sum of all score

N = Total no. of students

$$2. \quad \text{Standard Deviation } (\sigma) = \sqrt{\frac{\Sigma X^2}{N} - \left(\frac{\Sigma X}{N}\right)^2}$$

Where,

 = Sum of the square of each score

 = Sum of each score,

N = Number of students

$$3. \quad \text{Variance } (\sigma^2) = \frac{\Sigma X^2}{N} - \left(\frac{\Sigma X}{N}\right)^2$$

$$4. \quad \text{For (Z-test), } Z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}}}$$

Here, \bar{X}_1 = Mean of first group

\bar{X}_2 = Mean of second group

S_1^2 = Square of the standard deviation of first group

S_2^2 = Square of the standard deviation of second group

N_1 = Total number of students in participates in first group

N_2 = Total number of students in participates in second group

5. Degree of freedom (df) = $N_1 + N_2 - 2$

Where,

N_1 = Number of students in first group

N_2 = Number of students in second group

6. Difficulty Level (P) = $\frac{R}{N} \times 100$

Where,

R = No. of students getting correct answer

N = Total no. of students participate in the item analysis

7. Discriminating Index (D.I) = $\frac{R_u - R_l}{\frac{N}{2}}$

Where,

R_u = Number of students in upper group giving right answer

R_l = Number of students in lower group giving right answer

N = No. of students participate in the achievement test

8. Correlation Coefficient (r_{xy}) = $\frac{N \sum XY - \sum X \cdot \sum Y}{\sqrt{N \sum X^2 - (\sum X)^2} \sqrt{N \sum Y^2 - (\sum Y)^2}}$

9. Reliability Coefficient (r) = $\frac{2r_{xy}}{1 + r_{xy}}$