

## Chapter-I

### INTRODUCTION

#### Background of the Study

Mathematics has played a vital role in the development of all human civilization. Mathematics is the mirror of the civilization. The place of mathematics in the life of any nation cannot be overemphasized because it is linked with the place of development in that nation. Science, Technology and Mathematics Education have been widely acclaimed to be the index of measuring any nation's socio-economic and geo-political development. Among science and technology course, according to the National policy on Education, 'Mathematics is one of the core subjects to be offered by all students till the tertiary level of education. This is compulsory nature of mathematics carries with it the assumption that the knowledge of the subject is essential for all members of our society. Mathematics competence is a critical determinant of the post-secondary educational and career options available to young people.'

"Mathematics provides the knowledge. Mathematics is the body of knowledge and information related with the concept of quantity, structure, space and change and also the academic discipline that studies them."(Michaels, Grossman and Scott, 1967)

"Mathematics is the science, which draws necessary conclusions."(Pierce)

"Mathematics is a free innovation of the human intellect."(Einstein)

Mathematics is the study of pattern. It is through mathematical description that regularities and similarities in nature can often be clarified mathematics is the language of science and as such user carefully defined terms and symbolic

representation that enhance our ability to communicate. Mathematics in each proposition follows as logical consequences of proved proposition of assumption and mathematical structure characterized by undefined term assumption and rules of logic.

The factual answer to what is geometry is necessarily incomplete. Geometry is the branch of mathematics that is concerned with the properties of configurations of geometric object-points, straight lines and circles being the most basic of these. Geometry includes an enormous range of ideas and can be viewed in many different ways. Throughout its development during the past twenty five centuries geometry has been interlocked with many other subjects and different kinds of human activities. So as the background the researcher has focused at geometry in the most common sense as the way to see something of the naturalness of geometric ideas, their interests, verities and importance.

To some, teaching is a passion or a vocation as though teaching is life; other it is a profession and the school is just a machine that produces product with big heads ready for cognitive enterprises. (Milton, 2012), with my experience of teaching learning in different private and government schools, I found that parents, family, community, even teacher also think that mathematics is difficult subject and only god-gifted student can be able to understand and learn mathematics. Perhaps, this belief is strongly rooted in our educational practice.

Nowadays, among many people the practice of giving math tuitions has ever increased. If school secure 100% result and student gain more and more percentage in SLC that school and student is counted in a list of success. Other all are treated as unsuccessful and useless.

## Statement of the Problem

There is increasing evidence that many students in the middle years (11-15) of schooling have tremendous misconceptions concerning a number of important geometry ideas (Burger et al, 1996). There are many possible reasons for effective teaching and learning of geometry. As my experience, I feel that students are weak to solve geometry problem in mathematics when I tried to search the problem I asked many teachers who are teaching in government and private schools. One main problem they suggested is that geometry is based on study of figure and study of imaginary lines and figure so it becomes little difficult to understand the concept of geometry for students and another problems is that we don't have sufficient teaching materials so it is a problem to teach geometry in school level.

Every one common problem is kept at the end of the textbook in most of textbook so almost all schools and teachers are unable to complete the course and they leave last chapter geometry without teaching. Students don't have basic knowledge of geometry so they feel very difficult to understand the geometry part in secondary and lower secondary level. Despite all these noble effects, the problem of poor achievement in mathematics has continued to rear its head.

The new curriculum of mathematics (geometry) in school level has been implemented in Nepal since 2055B.S and the student seen average have become under the achievement. So it is well appropriate to discuss about the difficulties and suggest the probable strategies in teaching and learning geometry. This study should answer the following questions:-

- What are the difficulties faced by students in learning geometry?
- What are the causes responsible for the difficulties in learning geometry?

### **Signification of the Study**

Geometry began as the conceptual components part of mathematics. The result of this study was provided true information about the difficulties faced by students in learning geometry. It was provided the appropriate information about the difficulty faced by the students in learning geometry. The findings were supported to improve for the mathematical achievement of students and understanding in geometry. This study was helped to the teacher for improving their teaching. It was provided teaching method, evaluation technique for the curriculum designers, subject expert and researchers it reflects the status of the study of the school level geometry portion. At the time of research which would be one of the representative to indicate the present condition of learning geometry and would enforce the formative supervision for the progress of geometry portion in school level.

### **Objectives of the Study**

This study is aimed to:

- To explore the difficulties in learning geometry.
- To analyze the causes of difficulties in learning geometry.

### **Delimitation of the Study**

This study was limited in the following boundaries:

- This study was concerned with only the exploring learning difficulties in school level geometry,
- It included 10 mathematics teachers and 200 students who currently related in teaching learning activities at secondary level mathematics classes,

- The study was limited on the teachers and students of government school especially grade IX.
- The study was conducted in urban area carrying about three months,
- The study was limited on Hetauda, Sub-Metropolitan city.

**Operational definition of key-terms**

**Difficulties:** Difficulties refers to the hurdles of students in Experimental Verification, Construction, Reasoning and Theorem proving.

**Teaching and learning:** Activities done inside a classroom for gaining and sharing of knowledge based in fixed curriculum.

## Chapter-II

### REVIEW OF RELATED LITERATURE

This section includes review of related literature and focuses on the different aspects that create problems in instruction of mathematics. The researcher tried to find the literature on the topic that related to "Exploring learning difficulty in school level geometry in teaching mathematics." Furthermore, it deals with review of empirical literature, implication of the studies and conceptual framework. The review of related literature deals with the theories of research studies which have been conducted earlier. There are various literatures on teaching and learning mathematics, numbers of books, research reports, papers and other booklets can be found that concern with curriculum, teaching materials and methods and so on. The review of the related literature of this study and theoretical framework of this study deals with the books, theories, research studies and articles to the study which were collected and studied by the researcher. In this study the actual classroom performance and its condition has been submitted. For the paper different books by foreign writers have been read, consulted with expert frequently and regularly. Mathematical journals and articles of different researches have been consulted sufficiently.

#### **Empirical review**

Each and every research work requires the knowledge of previous background to open the targeted objectives and to validate the study. This section is an attempt to reviewed studies, articles and reports. Some of the old thesis has been reviewed considering them as a related literature and also as evidence to the present study.

Pathak (1987) conducted a research on “A study of the problems faced by the teacher of Kathmandu District in the implementation of mathematics on of mathematics curriculum for lower secondary level.” He took sixty five teachers as the sample of lower secondary level of Kathmandu District. He administered a set of questionnaire to the lower secondary mathematics teachers who has faced by problems regarding the difficulties of mathematics curriculum teaching methods and evaluation techniques. Then he conducted that the problems regarding evaluation was that most serious problems to the lower secondary level mathematics teachers.

Bom (2009) also carried out a research study on the topic” Effects of home environment in mathematics learning”. This study was based on the objectives to assess the existing learning achievements of Baadi children in mathematics of lower secondary level of Rukum District. He applied written documents and the previous research reports. Furthermore, he also used interviews, interaction, observation and focus group discussion to collect data from five students studying in different classes in lower secondary level. His study conducted that parents of students were not responsible for learning achievements of their children; He found that the home and classroom environment effect to students learning. He further found students were not discriminated by the teachers.

KC (2009) conducted a thesis “A study of problems faced by students in compulsory mathematics at secondary level.” The nature of this study was quantitative as well as qualitative. This study followed by survey design. He was selected six schools from urban area of Lamjung district randomly. Among them three were private and three were government schools. From each school, one mathematics teacher and three mathematics students of grade X selected as a sample for the study. For the data

collection, a set of class observation from and interview schedule were used. The obtained data was analyzed and interpreted with the help of weight age.

The major findings of this study were literate parents, poverty of parents, lack of encouragement for study, the gap of low achievement and high achievement students, unavailability of teaching learning materials, motivation and interest of student, lack of mathematics lab, lack of trained teacher, lack of physical facilities and sufficient budget for school. It concluded that there had been significant problems in learning geometry at secondary level.

Majhi (2012) conducted a research on a study of Ethno mathematical concept practiced by their community in Morang district. He started his research with the objectives to identify ethnographic mathematical concepts used to construct artifacts in Tharu community. He used data collection tools; observation, photographs and interview to collect primary data for his study. He studies the Tharu community of Kaseni VDC Ward No. 9 Of Morang. He found through his study that their community children used different mathematical concepts in their daily works but they were ignorant of its used in pedagogy and teaching methods and materials.

CERID (1993) conducted a study report on “Meeting basic learning need of primary school children in Nepal” which conducted that verbal problem algebra and geometry were the difficult area of learning for the students. Language of the students was poor to comprehend. The language used in the text book as well as their teaching technique almost traditional without the objective to identify the basic learning need of primary school children and unprivileged population group.

After studying overall literature, the researcher found that desired significant steps have not been made to study the learning difficulties of school level geometry.

Hence, this study was concentrated in the exploring learning difficulty in school level geometry.

### **Theoretical Literature**

Researches on geometry learning have utilized a model for teaching and learning posited by Pierre M. Van Hiele and Dina Van Hiele Geld of in the late 1950s. Pierre M. Van Hiele and his wife Dina M. Van Hiele, developed this theory out of the frustrations both they and their students experienced with the teaching and learning of geometry. The Van Hiele supported composite approach of level's and phases to teaching by defining the subject matter to be learned but at the same time defining the role of the teachers as a helper guided the student through levels of understanding of the subject matter. Van Hiele(1986) explains that when teaching geometry his students," It always seemed to as through I were speaking a different language."(P.39). Van Hiele wanted to know why students experienced difficulty in learning geometry and how bee could resolve those difficulties. In secondary school geometry involved a high level of thinking and primary school geometry involved lower levels of thinking. After observation and discussion of students' progress, van Hieles concluded that in learning geometry, the students seemed to progress through a sequence of five reasoning levels, from holistic thinking to analytical thinking to rigorous mathematical deduction. They also concluded that to progress from one level to the next, students seemed to pass through five phases and through to integration phases.

The solution van Hiele found for his students frustrations was the theory of different levels of thinking. The theory has three aspects the existence of levels, properties of levels and the movement from one level to another existence of level.

According to the theory, there are five levels of understanding in geometry. These levels are described by the van Hiele in various places in both general and behavioral terms, and are used referred to in this study.

**Level 1:** (Visualization or Recognition) Students recognize figures by their global appearance. They recognize triangles, squares, parallelograms, and so forth, but they do not explicitly identify properties of these figures (Square and rectangles seemed to be different).

**Level 2:** (Analysis) Students analyze properties of figures and learn the appropriate technical terminology for describing them, but they do not explicitly inter-relate figures or properties of figures (Rectangles have four right angles).

**Level 3:** (Abstraction) Students logically order properties of figures by short chains of deduction and understand interrelationship between figures.

**Level 4:** (Deduction) Students develop longer sequences of statements to deduce one statement from another, and also understand the significance of deduction, the role of axioms, theorems and proofs.

**Level 5:** (Rigor) Students analyze various deductive systems with a high degree of rigor, while understanding such properties of a deductive system as consistency, independence and completeness of axioms.

All the above mentioned Van Hiele levels of geometrical thinking can be summarized in the following table:-

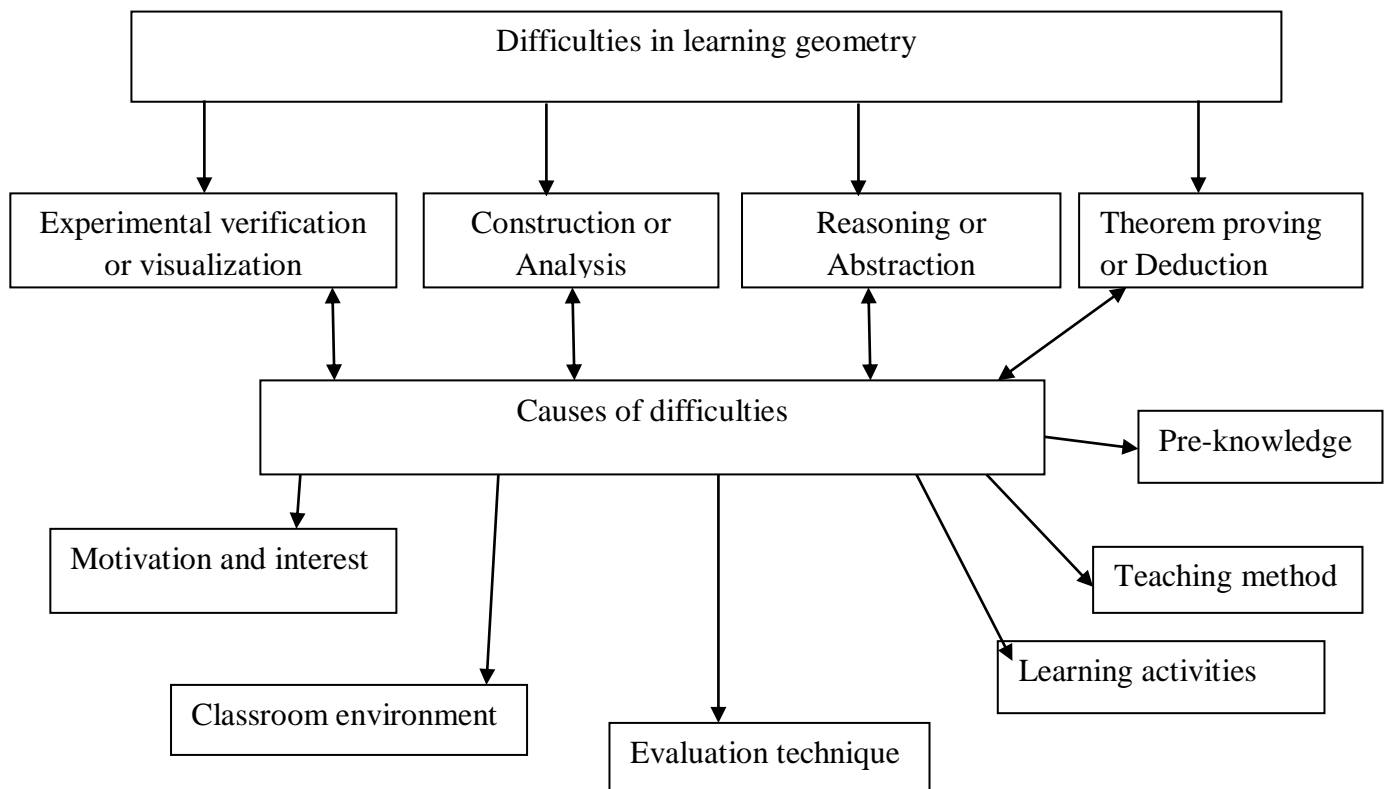
**Table No. 1: Van Hiele Levels of Geometric Thinking**

Levels	Stages	Characteristics
Level 1	Visualization	Student recognize the figures on the basis of their physical appearance
Level 2	Analysis	Students analyze the component part of figure
Level 3	Abstraction	Students establish the inter-relationship of properties both within figures.
Level 4	Deduction	Students able to construct proofs using postulates or axioms and definition
Level 5	Rigor	Students can work in a variety of axiomatic system

In my research I am going to use van Hiele theory to find the level of students. The van Hiele levels have generally been accepted as a reasonable explanation as to how student learn geometry. Van Hiele theory, originally developed using two-dimensional geometry has been shown to apply to other areas of geometry so in school level geometry van Hiele theory is needed indeed NUWS (2007) state that, Pegg and Davey believe that the van Hiele levels are basic to improving the teaching of geometry. Therefore, it is important then, that preservers teachers have an understanding of van Hiele's model and are await of their levels of understanding of geometry. This would allow them to teach effectively the subject matter by guiding their students through the phases of each level and through the levels themselves.

## Conceptual Framework

The analytical management or design which contains the factor affecting achievement of mathematics and hindrances that difficulty faced by teachers and students in class performance of geometry portion. By the help of literature review, expert consultation and peer discussion it had been constructed by the researcher herself including school related factors to make the study specific, systematic and easy.



From the above conceptual framework, there are mainly four factors of difficulties in learning geometry.

**Experimental Verification: (Visualization)** it is practical measurement of figure by geometrical instrument to prove the theorem. Students recognize the figure on the

basis of their physical appearance. It will be helped to find out the problem in sequential idea in verification and proper use of materials.

**Construction: (Analysis)** students analyze the component part of figure. It is related to constructing geometrical shapes on the basis of given terms and conditions.

Construction related to triangle parallelogram or quadrilateral in single diagram with equal area requires complex knowledge of analysis and combination of concepts.

Students having fewer concepts of axioms, theorems and postulates mostly had the problem on construction.

**Reasoning: (Abstraction)** students establish the inter-relationship of properties both within figures. It is related to giving logic to find the measurement of given sides, angles and distinguishing the relation on figures. Theorem, postulates definitions and basic rules etc. are the main base of reasoning. Ideas and knowledge of these terms also help on theorem proving which the causes of difficulties on learning geometry.

**Theorem proving: (Deduction)** students able to construct proofs using postulates or axioms and definition. The topic has raised the difficulties on learning theorem, for the purpose it dealt with the basic concept of students related to postulates, axioms, definitions and basic facts. Also there shall be the problems in arranging the relation sequentially.

Similarly, from the above conceptual framework, there are mainly six causes of difficulties in learning geometry. The first cause of difficulties in learning geometry is pre-knowledge of students about geometry which includes base courses and geometric concept and definition used at home. Similarly the second cause is teaching methods and technique which include teaching materials, teacher perception and activities in the classroom. The third cause is drill and practices which include the

students are too much practice exercise at home. The fourth cause is evaluation technique which include the teacher evaluate by using summative, formative, diagnosis and continuous assessment system at classroom teaching.

Next, fifth cause is environment which includes home and school environment, at home environment include available materials at home, home environment for practice and school environment include physical facilities at school, relation between student and teacher, classroom interaction and inclusive environment and remedial teaching. And the sixth cause is motivation and interest which include the students are interesting, curious to learning geometry and teacher giving motivation.

Learning environment of school focuses that students and teachers make regular use of manipulate materials and technology and actively participate in discourse and conjecture, verify reasoning and share solutions. Similarly the character of student's influences their intellectual development. Basic knowledge of students is very important to understand the mathematical concepts. Teaching methods and technique play the role of bridge in learning geometry.

## **Chapter-III**

### **METHODS AND PROCEDURES**

This chapter included with research design, population of the study and sample of the study, data collection tools, data collection procedure and data analysis procedure.

#### **Research Design**

Research design is the specification of the methods and procedure. It is also a way of the research that provides the direction for the researchers to achieve the goal of the research. Research frameworks derived from research design. This study focuses on the Exploring learning difficulties in school level geometry. This research was based on mixed method design.

#### **Population of the study**

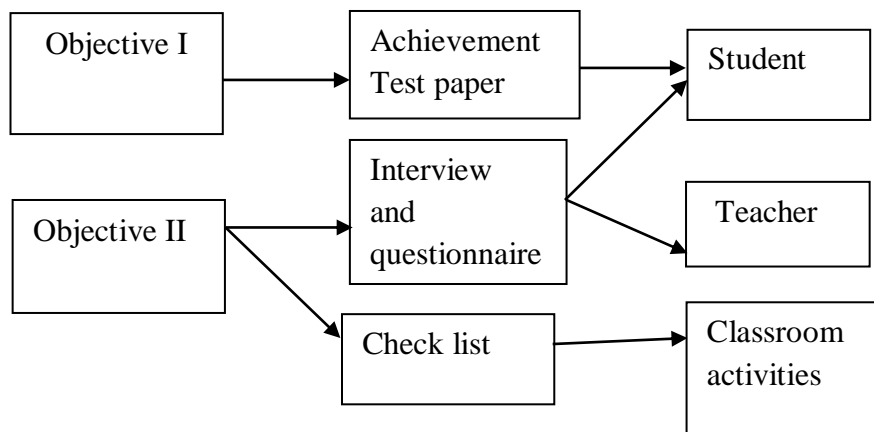
The population of this study was consisted of all the secondary level schools, mathematics teacher and students of Hetauda who currently involved in teaching and learning program directly or indirectly.

#### **Sample of the study**

The participants of this study were ten secondary levels mathematics teachers, and two hundred secondary level students. Researcher took 20/20 students of each secondary school. Altogether 210 respondents were taken as participants (sample) from the population above by simple random sampling method. The selected schools, students and teachers were situated in different VDC of this sub-metropolitan.

## Data Collection Tools

The major means of data collection was class observation form (check list), achievement test paper (included questions from four different aspects of geometry, Reasoning, Experimental Verification, Theorem Proving and Construction) for student and interview from to the teacher and questionnaire to teachers and students. Observation of schools and students also was the additional support to collect data respectively.



## Reliability and Validity of Tools

### Achievement Test

First research question find out by the achievement test paper which included the areas of VHGT methods and construction, experimental verification, reasoning and theorem proving. It deals about the difficulties in learning geometry at grade IX. The reliability of achievement test paper was determined by pilot testing. For the estimation of the validity of the class observation form, the subject experts, specialist and subject teacher were consulted to judge.

### **Interview schedule**

Second objective find out by the interview schedule from mathematics teacher, grade IX students and head teacher of school. The interview schedule was related to cause of difficulties in learning geometry at secondary level. The reliability of interview schedule was determined by pilot testing. For the validity of tool, the subject experts, specialist and educators were consulted to judge. The suggestions from the experts were incorporated

### **Questionnaire**

Second objective cannot fulfill by the interview schedule of teacher and student and class observation form. Researcher also took closed questionnaire find the difficulties only learning activities and evaluation technique from teacher and students. The reliability of questionnaire was determined by pilot testing. For the validity of tool, the subject experts, specialist and educators were consulted to judge.

### **Class Observation form (Check list)**

The reliability refers to the consistency of the results. The class observation form included the class environment, pre- knowledge of students, teaching methods and use of teaching materials in the classroom. It is determine by the pilot testing of the class observation form to the students of grade IX. For the estimation of the validity of the class observation form, the subject experts, specialist and subject teacher were consulted to judge.

### **Sources of Data**

The main source of data is primary and secondary source of data. In my research, researcher was collected by primary source of data. Researcher collecting

data was observation form, achievement test paper, questionnaire and interview by survey methods.

### **Data Collection Procedure**

To fulfill the objectives of the study, related data was gathered by different procedure such as: the researcher finding learning difficulties of student's by using achievement test paper (Appendix A) which included VHGT method and four aspects of geometry (Experimental verification, Construction, Reasoning and Theorem proving). The researcher was observed the classroom using observation form (Appendix B) for ten days in grade IX. Also the researcher did interview with mathematics teacher, students and head teacher with the help of interview schedule (Appendix C) and questionnaire was filling up by teachers and students for learning activities and evaluation technique. The researcher was listened the replied of respondents curiously and noted properly.

### **Data Analysis Procedure**

The research was adopted on descriptive survey method. Answer sheets was separated in accordance with the solution that students made. Percentage of students solving all or the particular portions was found, analyzed separately and different conclusions were derived. Class observation was interpreted and analyzed with the help of three points Lickert scale, Statistical tool mean was used to find the mean weight age for the data obtained from class observation check list and questionnaire. The data obtained from interview was analyzed descriptively.

## **Chapter IV**

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

The researcher analyze data were collected for the study from nine (IX) secondary schools of Hetauda metro politician. The collected data were tabulated and analyzed according to the objectives of the study. The tabulated data were statistically analyzed and interpreted by using statistical tool mean weightage.

The researcher took achievement test in 200 students by making standard question to find the ground reality of students' academic level which could help to find the difficulties in learning geometry which fulfill the first objective. Interview guideline was prepared and interview schedule, and questionnaire was taken to the mathematics teacher, grade IX students and head teacher of school. The interview schedule could help to find the cause of difficulties in learning geometry at secondary level which fulfill the second objective. The researcher observed 10 different mathematics teachers which included teaching and learning of geometry portion to find whether there is problem in teaching strategy of teacher.

The researcher also observed physical facility, math lab, structure of building, relationship with guardians etc at selected schools which could effect in math learning. All these activities were done in the complete instruction and supervision of expert. The following topics are related to difficulties in learning of geometry.

#### **Difficulties in Learning Geometry**

Researcher analyzed the difficulties in learning geometry by the help of achievement test paper; researcher took the 200 students of public and private schools of grade IX at Hetauda metropolitan (Appendix E). Students, who did all these

questions, correct without any errors these students' categories excellent. Students, who did partially correct but tried all the questions these students categories good and students, who did not make even a single question complete these students categories poor. First objective fulfill by the help of achievement test paper as given below.

- Experimental Verification (Visualization)
- Construction (Analysis)
- Reasoning (Abstraction)
- Theorem Proving (Deduction)

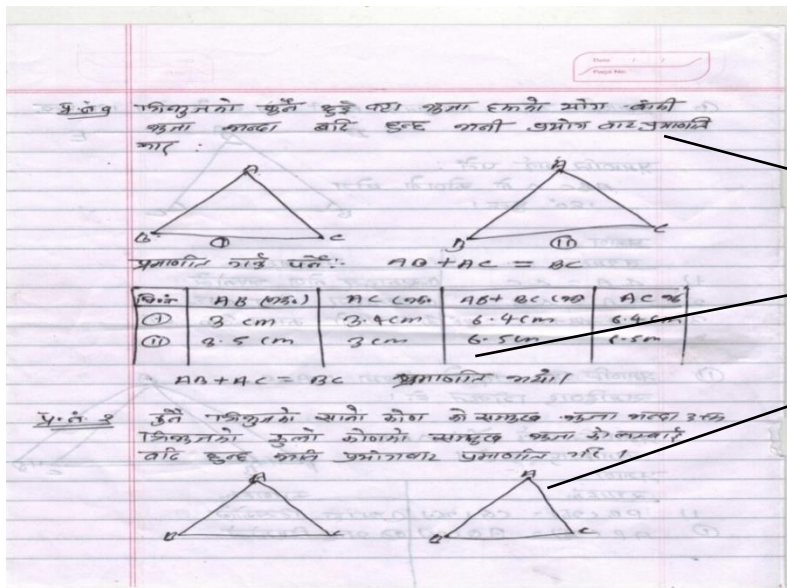
### **Experimental Verification or Visualization**

Visualization is the first step of Van Hiele models of geometric test. Some errors that students did are kept as one of the main base to analyze the difficulties in visualization. Difficulties and problems related to experimental verification were also analyzed on the basis of achievement test paper.

Experimental verification portion contained the question related to angles and sides of triangle. Students seemed to be able in calculating the angles and sides related to question having triangle. The students who could not make even a single question correct also have written the experimental verification or visualization of angles correct and measure of sides but calculation of angles and measured of sides of triangle and placement of logic is not in correct way.

Students Performance	No. of Students	Percentage of Students
Excellent	52	26%
Good	104	52%
Poor	44	22%

Three questions were kept in experimental verification portion. There were only 26% students who were excellent who did all these questions correct without any errors. Remaining 52% students were good who did partially correct but tried all the questions. Though they tried their best the rest 22% poor students who did not make even a single question complete. The paper below is one of the representatives of 22% students who made the experimental verification portion.



Result did not show in table.

Students were confused with given statement.

Students did not give conclusion.

Students could not start in proving theorem.

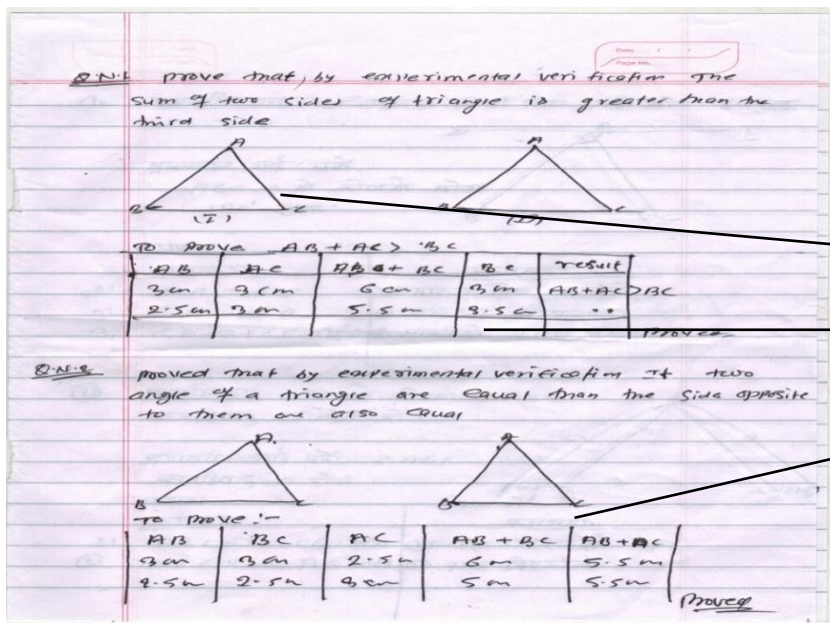


Fig. no. is not in the table.

Experiment is correct but not complete.

Students were wrong experiment.

Fig: I

Some of the students seemed to have very poor idea even to measure angles and sides of triangles and distinguish the figure on the basis of triangle. In some of the cases students seemed to write opposite experiment or own way. Some students also seemed to be confused in the given statement. Some students could not start in proving theorem. Students also did not complete the verification and did not give conclusion.

### **Construction or Analysis**

Analysis (construction) is the second step of Van Hiele models of geometric test. Some errors that students did are kept as one of the main base to analyze the difficulties in construction. Difficulties and problems related to construction were also analyzed on the basis of achievement test paper.

Students Performance	No. of Students	Percentage of Students
Excellent	43	21.5%
Good	118	59%
Poor	39	19.5%

Three questions were kept in construction portion. All the questions of construction were completely done by excellent 21.5% students with significant reason. The remaining 59% good students made it partially correct left 19.5% poor students did completely wrong. While observing their answer sheet the researcher noticed that most of students have very less concept even to construct square, triangle and parallelogram. The students who did it partially correct were seemed to have fewer concepts a sequence of construction and figure combination. Though they could not make the construction completely correct the students lying in 59% have shown

their good concept while constructing the figures. The paper below is one of the representatives of 19.5% students who made the construction portion.

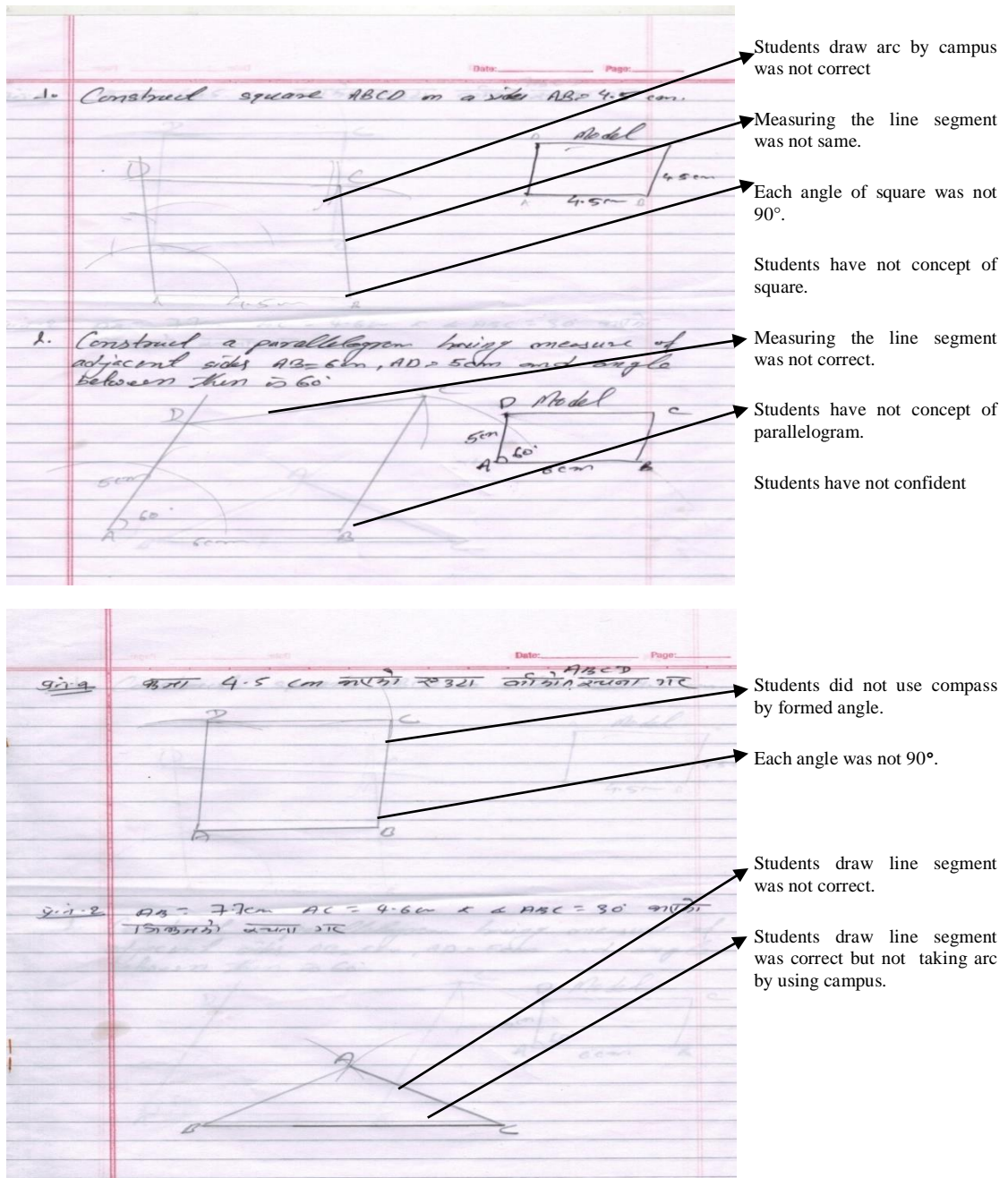


Fig: II

Some of the students seemed to have very poor idea even to construct angles by compass and measure of sides. Students did not take arc by compass in suitable place for required figures. Students seemed to have not concept of required construction.

Some students also seemed to be confused in the given construction. Students also did not complete the construction and conclusion.

### **Reasoning or Abstraction**

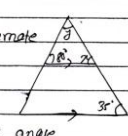
Abstraction is the third step of Van Hiele models of geometric test. Some errors that students did are kept as one of the main base to analyze the difficulties in reasoning portion. Difficulties and problems related to reasoning were also analyzed on the basis of achievement test paper.

Students Performance	No. of Students	Percentage of Students
Excellent	62	31%
Good	90	45%
Poor	48	24%

Five questions were kept in the reasoning portion. There were 31% excellent students who did all these questions correct without any errors. Remaining 45% good students, who did partially correct but tried all the questions. Poor students who tried their best the rest 24% didn't make even a single question complete. The paper below is one of the representative 24% students who made the reasoning portion.

Q.1 From  $\Delta$

$\angle y = 48^\circ$  (being alternate angle)

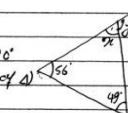


Now  $\angle x = 95^\circ$  (being corresponding angle)

Here  $\angle x = 95^\circ$  and  $\angle y = 80^\circ \parallel$

Q.2 From  $\Delta$

$\angle x + \angle y + \angle z = 180^\circ$   
(Sum of angle of  $\Delta$ )

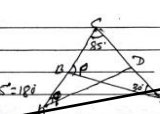


or  $\angle x + 105^\circ = 180^\circ$   
or  $\angle x = 180^\circ - 105^\circ$   
 $\therefore \angle x = 75^\circ$

Now  $\angle x + \angle y = 180^\circ$  (From straight angle)  
or  $75^\circ + \angle y = 180^\circ$   
or  $\angle y = 180^\circ - 75^\circ$   
 $\therefore \angle y = 105^\circ$

Q.3 From  $\Delta$

$\angle q + \angle 30^\circ + \angle 65^\circ = 180^\circ$

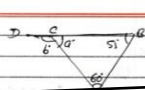


or  $\angle q + 115^\circ = 180^\circ$   
or  $\angle q = 180^\circ - 115^\circ$   
 $\therefore \angle q = 65^\circ$

Now  $\angle p = \angle q$   
 $\therefore \angle p = 65^\circ$

Q.4

Here,

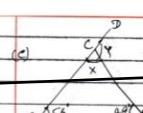


$\angle a = 60^\circ$  (यहाँ बाह्य कोण का आधार को कोण माना हुआ है)

Now  $\angle a + \angle b = 180^\circ$  (सिध्दांत से या बिना कोण कायेंगे)

or  $60^\circ + \angle b = 180^\circ$   
or  $\angle b = 180^\circ - 60^\circ$   
 $\therefore \angle b = 120^\circ \parallel$

(c)



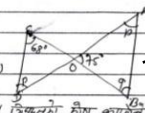
Here

$56^\circ + 49^\circ + x = 180^\circ$  (सिध्दांत से कोण कायेंगे)

or  $105^\circ + x = 180^\circ$   
or  $x = 180^\circ - 105^\circ$   
 $\therefore x = 75^\circ \parallel$

Now  $y =$

Here  $\angle q = \angle 66^\circ$  (समतल कोण कायेंगे)



Now  $\angle p + \angle q + \angle r = 180^\circ$  (सिध्दांत से कोण कायेंगे)

or  $\angle p + 66^\circ + 75^\circ = 180^\circ$   
or  $\angle p + 149^\circ = 180^\circ$   
or  $\angle p = 180^\circ - 149^\circ$   
 $\therefore \angle p = 31^\circ \parallel$

Students have poor concept of angle.

Students did not give reasons.

Student did not give conclusion.

Students did not distinguish the triangle.

Student have poor concept of alternate angle.

Students did not complete the problem.

Fig: III

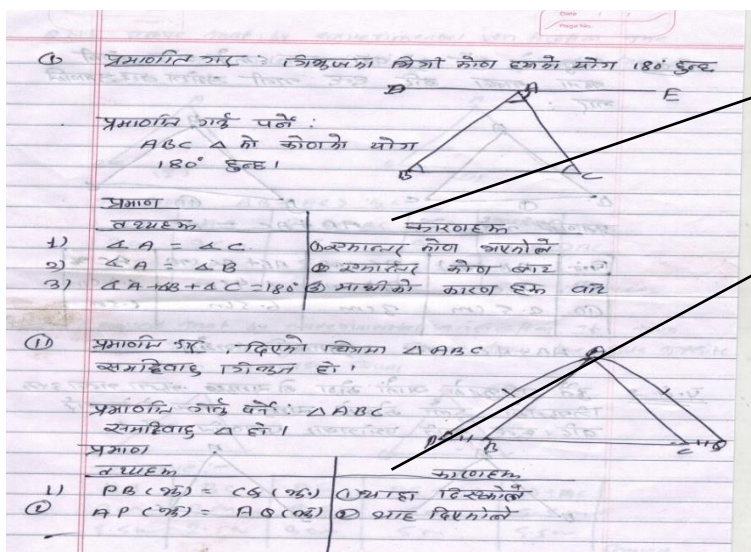
In the reasoning part, some of the students seemed to have few concepts of triangle and its interior and exterior angles. Students were also poor knowledge of the angle base on the parallel line. Students were not identifying the triangle and they have not concept of its characteristics. Some students did solve the given question but without reason.

## Theorem proving or Deduction

Deduction is the third step of Van Hiele models of geometric test. Some errors that students did are kept as one of the main base to analyze the difficulties in theorem proving. Difficulties and problems related to theorem proving were also analyzed on the basis of achievement test paper. Researcher analyzes the student's performance by the help of given table:

Students Performance	No. of Students	Percentage of Students
Excellent	58	29%
Good	106	53%
Poor	36	18%

Four questions were kept in theorem proving portion. There were 29% students are excellent who did all these questions correct without any errors. Remaining 53% students are good who did partially correct but tried all the questions. Poor students they tried their best the rest 18% didn't make even a single question complete. The paper below is one of the representative 18% students who made the theorem proving portion.



Students have not good knowledge of angle and did not give correct reasons.

Students did not start the answer and incomplete the proving theorem.

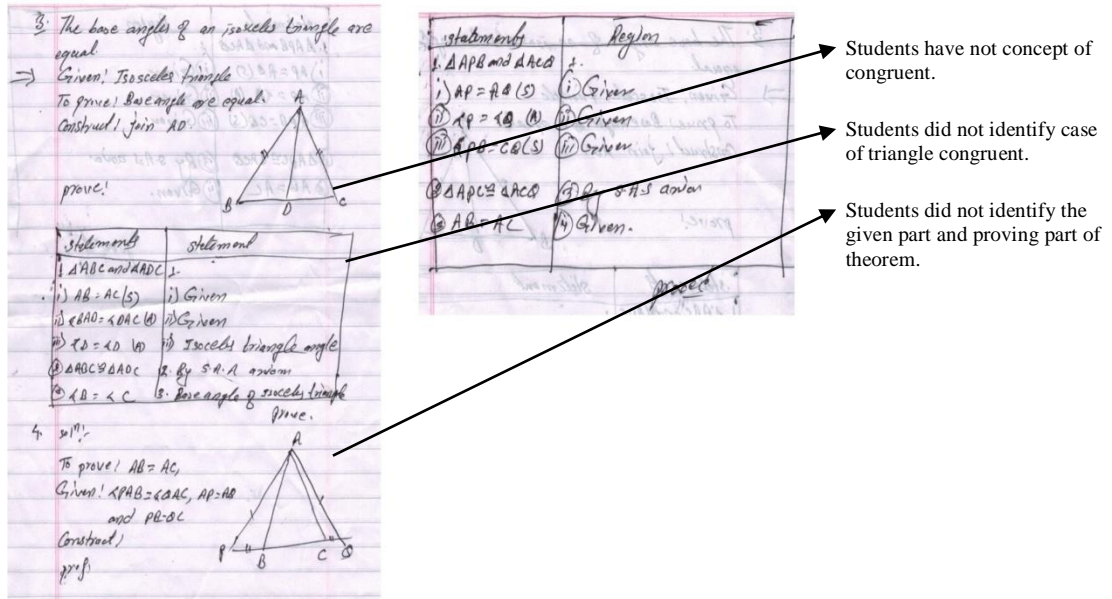


Fig: IV

Some of the students seemed to have very poor idea even to proving theorem and angle of triangles and distinguish the figure on the basis of angle formed. In some of the cases students seemed to write wrong reason or own way to proving theorems. Some students also seemed to be confused in the given statement of theorem. Some students could not start in proving theorem. Students also did not complete the theorem and conclusion.

Thus, researcher finds out the difficulties in learning geometry by the help of achievement test paper. The achievement of students in geometry is not satisfactory. The average achievement is poor in each and every portion of geometry as through the achievement test. Researcher concluded that the teaching and learning of geometrical theorems and problems are not easy task at all. It is abstract and challenging task because of it is related to figures (2D, 3D), angles, lines and uses to axioms and postulates. Construction is also appears as a great problems because of less skill of students in manipulating the instruments. Many students faced difficulties in proof of geometry problem solving.

The Van Hiele noticed the difficulties that their students have in learning geometry. His theory explains why many students encounter difficulties in their geometry course especially with formal proof. Van Hiele believed that writing and that many students need to have more experiences in thinking at lower level before learning formal geometric concepts.

Furthermore the complex concept and structure of reasoning and experimental verification can decline the curiosity of learners. Furthermore the complex concept and structure of geometrical proofs were the main reason to harass students.

### **Causes of difficulties in learning geometry**

Causes of difficulties in learning geometry were second objective in my research. To explore the causes of difficulty in learning geometry I used the observation form and interview schedule for teacher and students. Through observation and interview I have caught different lived experiences of students and teachers. The data obtained from observation and interview was explained on the following topics.

- a. Teaching Method
- b. Classroom environment.
- c. Learning activities.
- d. Evaluation technique.
- e. Motivation and interest
- f. Pre-knowledge.

Mean weightage greater than 2.1 ( $>2.1$ ) was considered to be a good for positive and mean weightage less than 2.1 ( $<2.1$ ) was considered to be a negative statement and analyzed it.

### **Difficulties related to Classroom Environment and Teaching Method.**

Before instruction begins, it is important to create an effective classroom atmosphere in which learners feels safe and motivated to collaborate, cooperate, and engage in the pursuit of mathematical understanding. Research from the learning sciences indicates that successful learning happens when students are immersed in environments that are learner-centered, knowledge-centered and assessment-centered.

In this environment teachers are able to:

- Attend to students' preconceptions and begin instruction with what student think and know.
- Organize mathematical knowledge around core concepts.
- Focus on what is to be taught and what mastery looks like.
- Provide daily opportunities to make students' thinking and learning visible as a guide for teacher and student in learning and instruction.

(Washington, DC: The National Academies Press, 2005) p.13.

For the understanding causes of difficulties in learning geometry and teacher activities in the classroom I observed ten different geometry classes in different school by the help of classroom observation form which is developed in three points of Licart scale. Researcher evaluated classroom cleanliness, arrangement of classroom, punctuality. Researcher also evaluated use relevant teaching methods, aids, materials and techniques and technology in their teaching and learning of geometry. In terms of the classroom management the researcher had evaluated the following aspects; attends to course interaction, demonstrates leadership ability; maintain discipline and control, summarization of lesson and assignment were

evaluated as conclusion portion. Mean weightage derived from ten different classes are shown in the table below:

**Table 4.1. Difficulties Related to Classroom Management and Teaching Method**

S.N.	Observed Item	Always	Sometimes	Never	Mean weightage
	<b>• Physical facility</b>				
1.	Classroom cleanliness	6	4	0	2.6
2.	Arrangement of classroom	2	4	4	1.8
3.	Punctuality	4	4	2	2.2
	<b>• Teaching methods</b>				
4.	Uses relevant teaching methods, aids, materials, techniques and technology	0	3	7	1.3
5.	Uses examples that are simple, clear, precise and appropriate	3	7	0	2.3
	<b>• Management</b>				
6.	Use time wisely	2	4	4	1.8
7.	Attends to course interaction	1	7	2	1.9
8.	Demonstrates leadership ability	6	4	0	2.6
9.	Maintains discipline and control	4	6	0	2.4

The above mean weightage of statements 1.8, 1.9, 1.3, have the mean weightage less than 2.1 and hence there were problems in arrangement of classroom, uses relevant teaching materials, technique and technology, teacher did not managing time wisely, teacher did not effectively attends to course interaction and the main

problems in used of relevant teaching methods. The low average obtained in the statements 1.3, 1.8, and 1.9 indicate that there is very less availability and use of relevant teaching methods, aids, materials, technique and technology. From the observation form I found that the number of students was large and teacher could not control the classroom. Teacher could not manage the classroom to conductive to geometry learning in most of the sample schools of this area.

Punctuality, meet class at schedule time, establishes classroom environment conductive to learning, uses examples that are simple, clear, precise and appropriate are average in comparison to others.

Most of the teachers agreed that we were facing various learning problems such as large number of students, different learning capacities of students in the classroom. Besides these problems, teacher was again argued that we did hard labors to provide quality education but student were not interested for their study.

*"Teacher does not use materials except geometry box and daily used materials at mathematics class." (Student A)*

*"At any cost we should finished book at the fixed time otherwise we should have to defense with the administration. Comparatively mathematics curriculum is very large so we con not taught by students level at that time and school does not provide sufficient materials to effective teaching." (teacher A)*

The above view of teacher and students suggested that there are many problems on teaching and learning of geometry. Students say that teacher doesn't use materials in their teaching and we couldn't understand geometrical figure. So we cannot solve the problems and theorems. Teachers said that due to administrative pressure and large mathematics curriculum we cannot taught by students'

background. Schools were not provided the teaching materials so we are faced by many difficulties in learning geometry.

Also the teacher's carelessness and lack of supervision by administration has played vital role in the difficulties in learning of geometry. It also seems that the book preferred is not by the teacher's choice. They have to select much larger books with high weightage to show themselves standard in comparison to others which pressure to teacher finished his course. The reason behind this was found that math teachers in some school were part timer and seemed to be very busy and disturbed that means they couldn't create constructive and wonderful class.

### **Difficulties related to learning activities**

Learning is positive change in behavior. Learning activities done inside a classroom for gaining and sharing of knowledge based in fixed curriculum. Learning activities is the main body of educational plan. Learning activity is synonym for a self-contained. In education system, learning is the positive change in behavior. Teacher described curriculum with students and students are gain new knowledge and change in behavior.

For the understanding causes of difficulties in learning geometry and teacher activities in the classroom I observed ten different geometry classes in different school by the help of classroom observation form which is developed in three points of Licart scale. The researcher had evaluated the subject matter content: Shows good command and knowledge of subject matter and demonstrates breadth and depth of mastery. In terms of class performance the researcher had evaluated the following aspects: teacher organizes subject matter, through state clear objectives and meet class at scheduled time. Researcher also evaluated: holds interest of students, provide

feedback, encourages participation, interacts with students, eye contact with students, teacher uses clear voice, strong projection and proper enunciation. Researcher also evaluated teacher summarize the lesson and assignment were evaluated as conclusion portion. Mean weightage derived from ten different classes are shown in the table below:

**Table 4.2. Difficulties Related to Learning Activities**

S.N.	Observed Item	Always	Sometimes	Never	Mean weightage
	<b>• Subject matter content</b>				
1	Shows good command and knowledge of subject matter	5	4	1	2.4
2	Demonstrates breadth and depth of mastery	2	4	4	1.8
	<b>• Organization</b>				
3	Organizes subject matter	2	4	2	1.8
4	Through state clear objectives	4	6	0	2.4
5	Meet class at scheduled time	3	5	2	2.1
	<b>• Rapport</b>				
6	Holds interest of students	2	5	3	1.9
7	Provide feedback	2	5	3	1.9
8	Encourages participation	3	4	3	2
9	Interacts with students	2	6	2	2
10	Show enthusiasm	4	5	1	2.3
11	Uses examples that are simple, clear, precise and appropriate	3	7	0	2.3

•	<b>Presentation</b>				
12	Establishes classroom environment conducive to learning	5	4	1	2.4
13	Maintain eye contact	3	5	2	2.1
14	Uses clear voice, strong projection and proper enunciation	5	4	1	2.3
•	<b>Assist students with academic problems</b>	3	6	1	2.2
•	<b>Personal</b>				
15	Evidences self confidence	7	3	0	2.7
16	Maintains professional comportment and appearance, personality	7	3	0	2.7
•	<b>Assignment</b>	6	4	0	2.6

The above mean weightage of statements 1.8, 1.9, and 2 have the mean weightage less than 2.1 and hence there were problems in classroom teaching, teacher have not teach deeply, teacher not effectively organized subject matter, students were not interest in their learning, teacher did not effectively attends to course interaction and the main problems in evaluation technique. The low average obtained in the statements 1.8, and 1.9 indicate that there is very less availability and teacher have not always demonstrates breadth and depth of subject matter content, teacher's classes were not interesting, sometimes teacher provides feedback and sometimes teacher attends to course interaction in most of the sample schools of this area.

Shows good command and knowledge of subject matter, through state clear objectives, meet class at schedule time, encourage participation, interact with students show enthusiasm, uses examples that are simple, clear, precise and appropriate, establishes classroom environment conducive to learning, maintain eye contact, uses clear voice, strong projection and proper enunciation, maintains discipline and control, assist students with academic problems are average in comparison to others. In case of assignment most of the school gave much more assignment. Which is not excellent job but it is not too bad so it can be considered that there is average quality of assignment. In case of teacher self-confidence and maintain professional comportment and appearance, personality is always better so there is good mean weightage students were not treated democratically. They were forcefully kept in rule and discipline and compelled to read and acquire the complex geometric concept.

Interaction with teachers and students difficult due to learning activities in the classroom were as follows:

- It was very difficult to prepare and implemented the lesson plan.
- More emphasis should be given to finish the course rather than students' learning.
- To motivate students towards learning mathematics was very difficult.
- Class control and students motivation was difficult task for the teacher.

Weakness of the students and teachers faced difficult in teaching further leads to slow speed teaching. The different category students and their negligence towards mathematics created in learning.

To counter the difficulties related to learning the researcher analyzed the responses of sample teachers and students ask in closed questionnaire. By finding the mean weightage of responses of teachers and students and analyzed.

**Table 4.3 Teacher Responses and Difficulties Related to Learning Activities.**

S.N.	Statements	SA	A	DA	Mean Weightage
1.	I always used teaching, materials and technology.	1	5	4	1.7
2.	I always give examples that are simple, clear and appropriate.	4	5	1	2.3
3.	I always give the feedback after completion the lesson.	2	5	3	1.9
4.	I taught different kinds of practice book that are related to text book.	5	3	2	2.3
5.	I always give the basic concept of previous chapter of geometry.	4	6	0	2.4
6.	I always give the previous concept of lower class.	4	5	1	2.3

Inspection of the table reveals that the teacher responses are different.

Researcher asks question related to learning activities. These responses explain by mean weightage. The very less mean weightage in the statement 1 and 3 obtained in the table above indicated that the there was very enormous problems in the learning activities. Some teachers not use teaching materials in the teaching learning activities. Some teachers not provided feedback for learning activities, some teacher give feedback if necessary.

*“I am not using any fixed teaching method for geometry teaching, but my aim is to how children receive the knowledge and pass the examination.” (Teacher A)*

*“There is large number of students in the classroom, teaching time is short, to finished the course on time but that is impossible with student centered teaching method.”(Teacher B)*

By the above response researcher says that teaching methods was the main causes of difficulties to teacher and students. So students feel that geometry is difficult as well as mathematics. Statement 2, 4, 5 and 6 obtained in the table above indicated that the good weightage mean that means teacher gives related example, connected with lower class subject matter, teacher gives the previous concept of lower class, teacher used practices book related with core subject.

The researcher analyzed the difficulties related to learning, the books were also of large volume with lots of examples and exercises so were not fit enough to complete in the estimated teaching period.

**Table 4.4 Student Responses and Difficulties Related to Learning Activities.**

S.N.	Statements	SA	A	DA	Mean Weightage
1.	Teacher uses teaching, materials and technology in teaching period.	0	4	6	1.4
2.	Teachers give examples that are simple, clear and appropriate.	2	7	1	2.1
3.	Teachers always give the feedback.	2	3	5	1.7
4.	Teachers use different kinds of practice book that are related to text book.	5	2	3	2.2
5.	Teachers give the basic concept of previous chapter of geometry.	2	6	2	2
6.	Teacher gives the previous concept of lower class.	2	5	3	1.9

Show that the above table. Researcher asks question related to learning activities. These responses explain by mean weightage. The very less mean weightage in the statement 1, 3, and 6 obtained in the table above indicated that the there was main problems in the teaching methods and materials and feedback. Some teachers not use teaching materials in the teaching learning activities. Some teachers not provided feedback for learning activities. Teacher not connected with previous concept of lower classes and horizontally and vertically subject matter.

*“Teacher always emphasis on bookish is knowledge and not give many examples for concept in mathematics class room.”(Student A)*

*“Teacher always focuses on their own teaching methods and they also choose the lesson according to their choice. He does not use teaching materials and not in friendly behavior.” (Student B)*

By the above response researcher says that teaching methods was the main causes of difficulties to teacher and students. So students feel that geometry is difficult as well as mathematics students were say that teacher not give the previous concept of geometry and not connecting the horizontally and vertically sequences. Statement 2, 4 and 5 obtained in the table above indicated that the good weightage mean that means teacher gives related example but not give clear concept and sometimes connected with lower class subject matter, teacher used practices book related with core subject and focus on parrot learning.

Researcher found that the triangulation of classroom observation form, teachers response view and students response view; learning activities is the main causes of difficult to learning geometry because teacher’s careless to teaching geometry, especially teacher could not use effective teaching methods and materials, lack of supervision, administrative pressure and lack of students interest.

### **Difficulties related to Evaluation techniques**

We find out the difficulties and problems on evaluation technique in learning geometry and analyzed it. The primary responsibility of teacher is to using about the maximum degree of students achievement in learning. Evaluative techniques devices such as examination of various type, unit test, monthly test, terminal test, practical were the various technique followed by the schools. For this purpose I selected ten teachers and ten students, one-one teacher and one-one students from ten each schools and asked some questions responses are given.

Mean weightage related to evaluation techniques obtained from teacher's responses are as given below.

**Table 4.5 Teacher Responses and Difficulties Related to Evaluation Technique**

S.N	Statements	Responses			Mean Weightage
		Always	Sometimes	Never	
1.	I focused on result oriented exam at teaching time.	7	3	0	2.7
2.	After the completion lesson I always took unit test.	5	4	1	2.4
3.	I always took monthly test.	4	4	2	2.2
4.	Practical evaluation is in practice.	0	6	4	1.6
5.	I ask question in the teaching time.	5	5	0	2.5

The highest mean weightage 2.7 signifies that conducted examinations are not formative. Result is announced only by the help of written examination. Specially private and public schools are focus on result oriented exam. So students feel that mathematics is difficult and hard. Mean weightage 2.4, 2.2 and 2.5 gives good average this shows that unit test and monthly test focuses on parrot learning. Practical work, terminal exam and open book tests were better constructive and motivating which emoted most of the students to take part in learning effectively.

All these evaluations were done in successive planning but the result whatever comes was not taken seriously that is poor students were not helped well. Therefore

the researcher concluded that one of the significant problems behind the learning difficulty of geometry is narrow and congested evaluation system of schools.

**Table 4.6 Student Responses and Difficulties Related to Evaluation Technique**

S.N	Statements	Responses			Mean Weightage
		Always	Sometimes	Never	
1.	Teacher focused on result oriented exam.	7	2	1	2.6
2.	After the completion lesson teacher takes unit test.	2	5	3	1.9
3.	Teacher takes monthly test.	3	3	4	1.9
4.	Practical evaluation is in practice.	0	4	6	1.4
5.	Teacher ask question in the teaching time.	2	6	2	1.8

The highest mean weightage 2.6 indicates that the most students are in favor in result oriented exam in evaluation technique. By the above, Researcher analyzed these table the mean weightage 1.9, 1.4 and 1.8 indicates the students near to problems and difficulties. Students agreed about the unit test, monthly test, terminal exam, problems in exam of geometry and given priority in learning geometry.

From the view of the students claimed that there is not a connection between the classroom evaluation and final examination of the students. It indicates that the

poor students could also pass the final examination by cheating and defective promoted policy.

### **Motivation and Interest**

Motivation and interest focuses on encourage to learning participation. In this research, researcher found that students interest in learning geometry. It is generally agreed that students' ability is dissimilar in learning math due to various background such as; maturity, family background, socio-economic status, age, gender and intelligence level. Poor motivation and failure to provide insights related to meaning and method of content into students in mathematics learning is the main problem of teacher.

*“First of all I go to the home and practice English subject and other but math is hard so I haven't interest to practice math subject only do homework.” (Student A)*

*“Our parents forced us in household work. They said you must complete household work then go to the school. So I cannot manage time to practice mathematics.”(Student B)*

*“I learned geometry from grade VIII but it was too much difficult to solve simple problem and difficult to say that I could not able to simple question answer till now means class IX.”*

*(Student C)*

From the above view of students, most of the parents were uneducated and they focused their children for doing works at home. There was few time for doing homework only but most of the time, they were busy to cook food, care small baby and extra work. So there was not good environment for practice of mathematics.

Many students indicate that they could not able to memory already learned matter of geometry. So they had to face great difficulties to learn geometry.

The above view of students indicates that basic knowledge of students played most important role in the learning new concept of geometric thinking. It could be seen that the most of the students faced problem in learning geometry. Due to the poor knowledge and base knowledge of students in geometry; teacher has also faced problem to teach geometry. The main serious problem of students is to the bad feeling towards geometry.

It concluded that the student's basis knowledge plays a most important role to achieve good knowledge in geometry. The main causes behind the difficulties in learning geometry were poor knowledge, motivation and interest of students in geometry. They get opportunity to learn the basic concept of geometry only from grade IX. Most students have faced problem about simple basic concept and bad feeling towards geometry.

## Chapter V

### SUMMARY, FINDING CONCLUSION AND RECOMMENDATIONS

This chapter deals with the summary, major finding, conclusion and recommendations.

#### Summary and finding

The main purpose of the study was to identify the exploring learning difficulties in school level geometry. The specific objectives of the study were to:

- To explore the difficulties in learning geometry.
- To analyze the causes of difficulty in learning geometry.

For the convenience of the study the difficulties were categorized into different themes; difficulties related to teaching method, difficulties related to classroom environment, difficulties related to learning activities, difficulties related to evaluation technique.

The study was entirely survey type. The population of this study consisted entire mathematics students and teacher of government and private schools of Hetauda Sub-Metropolitan city. The researcher developed the class observation form, achievement test paper and interview schedule under the strong guidance of supervisor. The class observation form, achievement test paper, interview schedule were the major tools of this study. The responses were collected from teachers and students which selected by using simple random sampling methods. Some of the collected data (from class observation and interview) were quantified on the basis of Three Point Likert Scale and analyzed on the basis of mean score. Students' achievement obtained from test paper and responses of teachers and students were

analyzed on the basis of different themes determined earlier in the conceptual understanding.

From the field survey and statistical analysis of collected data it was found that the students and teachers have been facing lots of problems and difficulties in teaching and learning of geometry at secondary level classes. Different types of internal and external forces play role to continue the problems and to increasing difficulties in learning geometry. On the basis of analysis and interpretation of data the findings are stated below:

### **Difficulties due to Experimental Verification, Construction, Reasoning and Theorem Proving**

- Students were wrong experiment and confused with given statement. So students feel difficulties on experimental verification.
- Most of the students have no knowledge of angle and did not give correct reason.
- Difficulties faced on using geometrical instrument in teaching construction.
- There were difficulties faced on the theoretical and practical concept of proving theorem.
- Problem on using teaching materials in teaching theorems and exercise.
- Students were not interested and did not practice on exercise.

### **Difficulties due to Classroom Environment and Teaching Method**

- The main difficulties on teaching, teacher did not effectively attend to course interaction and did not use relevant teaching methods.
- There was a difficulty on solving parallel questions related to exercise due to the large volume of book and short teaching period. So teacher cannot manage time.
- There was problem related to sound management and effective use of instructional materials.
- In three sample schools math period was at seventh bell whereas students feel boring and very less on learning math curiously.
- In case of government school, there was problem in home work checking; teacher just looks through the copy of poor students and does not check in details.
- In case of private schools (boarding schools), there was problem on child centered instruction because the course was to be finished before mansir and revised it.
- Due to the weakness of perfect entering behavior most of the students were not satisfied with the logics given by teachers while proving theorem.

### **Difficulties due to Learning Activities**

- Lack of time to use various methods, lesson plan and appropriate examples to make clear concept of its difficulties.
- Difficulties on use of effective teaching methods and technique in learning geometry.

- Misconception of students to mathematics as hard subject has become a problem students are found not be laborious. Hence, there also great problems from students site.
- Problems on individual differences in learning geometry.
- Beside problem related to good performance of teacher, lack of content knowledge, lack of guiding encouragement, motivation and interest etc are equally problematic.

### **Difficulties due to Evaluation Technique**

- Difficulties on daily homework correction because of large class size and over work load of teacher.
- Difficulties on take unit test, monthly test and another test of mathematics classes because students number is large and any cost, course was finished at fixed time.
- There was problems on fulfillment of students creativity and curiously.
- There was problem on evaluation system due to low achiever students in classroom activities.

### **Difficulties due to Motivation and Interest**

- The serious problem of students was to the bad feeling towards geometry.
- Most of the parents were uneducated and they focused their children for doing works at home. So that student did not practice mathematics at home.
- Lower classes teacher couldn't finish the geometry lesson. So that the student have poor concept of geometry at grade IX. So they feel difficult to learning geometry.

## Conclusion

The above major findings of this study show that students faced difficulties in learning geometry. On the basis of findings, the researcher concluded that there are problems on experimental verification, construction, reasoning and theorem proving. Students faced difficulties in solving geometrical problem due to wrong experiment, poor concept of square, parallelogram, angle and students didn't distinguish the triangle. Also student didn't identify the given part and proving part of the theorem. Students haven't confidence so they feel difficulties in learning geometry.

There were not sufficient teaching materials and relevant teaching methods. There were crowded classroom environment, teacher cannot motivate students and student didn't show interest. So there was no inclusive environment, remedial teaching methods and lack of interactive classroom for learning geometry so that students feel difficult in learning geometry. There was lack of teacher's responsive behavior with students, so student couldn't able to ask question to the teacher because of feeling fear with the teacher. Some of the teacher had not clear concept about the lesson of geometry so it created more confusion and difficulties in learning geometry.

Finally, researcher concluded that the teacher evaluated the achievement of students by checking class work and home work only. Class work checking, homework correction, interaction with student, role play, motivation, feedback and active participation in mathematics classroom is the key points to promote instructional strengths.

### **Recommendation for Educational Implication**

Recommendations have made to improve the learning situation happening the student's difficulties in learning geometry. The researcher talked with the teachers, principals and students of the private and government schools and also took the suggestion of supervisor for the correct and behavioral solution of the above difficulties. The researcher also read previous research documents which included practical effort and suggested to apply various techniques to achieve the goal despite the difficulties and problems stated above. The following recommendations are presented in the basis of above aspect.

- The teacher should teach geometry by applying the previous concept.
- Books must be with parallel and sequential examples and exercise also with error free as far as practicable.
- The teacher should use student centered method for teaching geometry and his role as a facilitator. He should encourage the students and give motivation for the study. He should use continuous assessment system.
- Teacher should use new technology and new teaching methods and materials in learning geometry and it's improve for avoiding misconception of students.
- CDC should provide perfect training advance instructional materials related to content.
- This study will help to identification the causes of student's difficulties in learning geometry in figure.
- Project works should be given to the students in different geometric topic.

- Parents should give sufficient time for the study of their children at home. They should provide sufficient materials like practice books, copies and geometrics box for their children.

### **Recommendation for the further Study**

This present study may not be completed for all situations further researchers can apply the different tools and methods related to the some problems. For this researcher has presented the following recommendations for further studies:

- Similar study should be carried out with a large sample and various schools of different parts of Nepal.
- These types of studies should be conducted different levels and different subject in class.
- The similar study should be done in other district in Nepal.

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## APPENDIX A

### Achievement test paper

Name:

Date:

Subject:

Class:

Class Roll. NO:

The achievement test with the student was taken on the following questions:-

#### Experimental verification

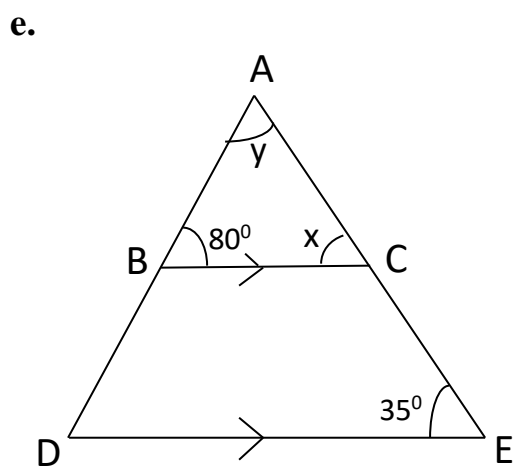
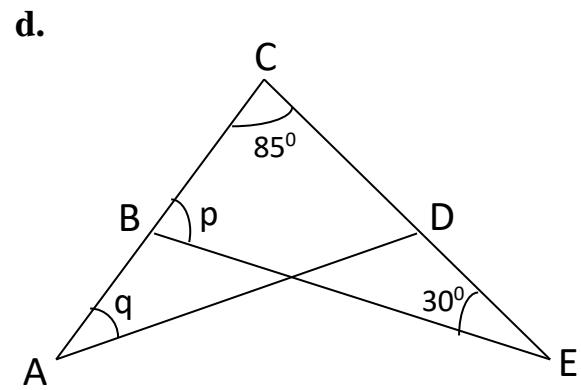
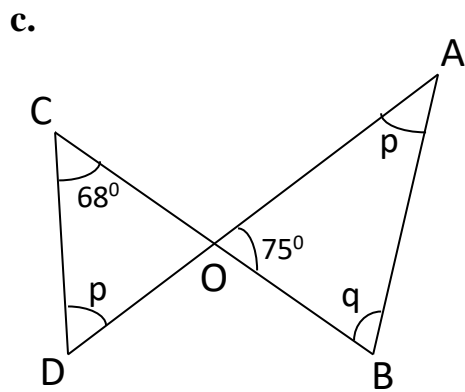
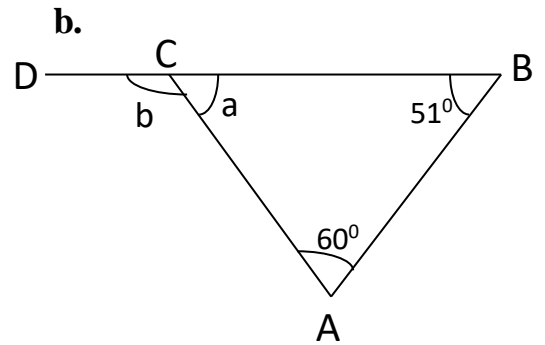
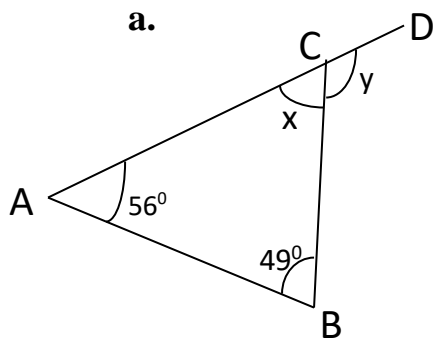
1. The sum of two sides of triangle is greater than the third side.
2. The side opposite to the greater angle of a triangle is greater than the opposite to the smaller angle.
3. If two angle of a triangle are equal than the side opposite to them are also equal.

#### Construction

1. Construct square ABCD on a side  $AB = 4.5\text{cm}$ .
2. Construct triangle ABC having  $AB = 7.7\text{cm}$  ,  $AC = 4.6\text{cm}$  and  $\angle ABC = 30^\circ$
3. Construct a parallelogram having measure of adjacent sides  $AB = 6\text{cm}$ ,  $AD = 5\text{cm}$  and angle between them is  $60^\circ$

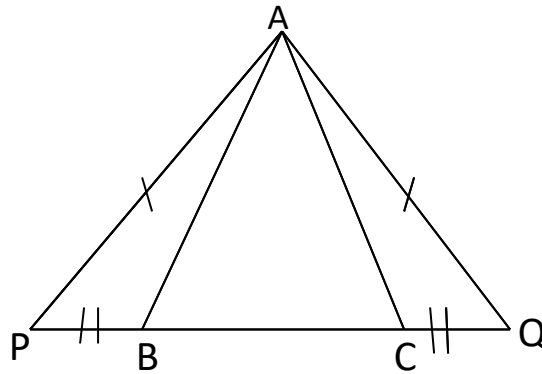
## Reasoning

Find the value of unknown angles.



## Theorem Proving

1. The sum of three angles of a triangle is  $180^\circ$ .
2. The exterior angle of a triangle is equal to the sum of the two opposite interior angle.
3. The base angles of an isosceles triangle are equal.
4. From the given figure, If  $\angle PAB = \angle QAC$ ,  $AP = AQ$  and  $PB = QC$ , then  $\triangle ABC$  is isosceles triangle.



## APPENDIX B

CLASS OBSERVATION FORM

Date:

Name of the Teacher:

Subject:

Name of the School:

Time:

Class:

Lesson:

S.N.	Observed Item	Always	Sometimes	Never	Mean weightage
•	<b>Physical facility</b>				
1	Classroom cleanliness				
2	Arrangement of classroom				
3	Punctuality				
•	<b>Subject matter content</b>				
4	Shows good command and knowledge of subject matter				
5	Demonstrates breadth and depth of mastery				
•	<b>Organization</b>				
6	Organizes subject matter				
7	Through state clear objectives				
8	Meet class at scheduled time				
•	<b>Rapport</b>				
9	Holds interest of students				
10	Provide feedback				

11	Encourages participation				
12	Interacts with students				
13	Show enthusiasm				
•	<b>Teaching methods</b>				
14	Uses relevant teaching methods, aids, materials, techniques and technology				
15	Uses examples that are simple, clear, precise and appropriate				
•	<b>Presentation</b>				
16	Establishes classroom environment conducive to learning				
17	Maintain eye contact				
18	Uses clear voice, strong projection and proper enunciation				
•	<b>Management</b>				
19	Use time wisely				
20	Attends to course interaction				
21	Demonstrates leadership ability				
22	Maintains discipline and control				
•	<b>Assist students with academic problems</b>				

•	<b>Personal</b>				
23	Evidences self confidence				
24	Maintains professional comportment and appearance, personality				
•	<b>Assignment</b>				

## APPENDIX C

### Interview Schedule with Teacher

Name:

Address:

Qualification:

Age:

Gender:

The interview with the subject teacher was taken on the basis of following boundaries:-

1. Classroom management: Physical facilities, School environment, Black board, Number of students, Time manage.
2. Teaching method: Motivation for students, Relative question, Learning environment, Assessment system, Feedback, Pre- knowledge of student.
3. Instructional material: Use of materials effectiveness.
4. Cause of low achievement
5. School environment for learning

## APPENDIX D

### Interview Schedule with Student

Name:

Address:

Class:

Age:

Gender:

The interview with the student was taken on the basis of following boundaries:-

1. Physical facilities, School environment, Home environment, math lab, Library, Time manage.
2. Learning Activities: Motivation and interest of Student, Relative question, Learning environment, Assessment system, Feedback, Pre- knowledge of Student, drill and Practice.
3. Cause of low achievement

## APPENDIX E

### Name of the sample school, number of teachers and students

S.N.	Name of the school	Name of mathematics teacher	No. of sample students
1	G.S. Niketan	Ragini Barma	20
2	Hetauda Academy	Suman Jung Thapa	20
3	Red Rose S.E. School	Gopal Ghimire	20
4	Bal Jagriti S.E. School	Binod Subedi	20
5	Tasir E.S. school	Harka Bd. Karki	20
6	Bhanu H.S.S.	Dipendra Adhikari	20
7	Bhutandevi H.S.S.	Ram Thapa	20
8	Chandika H.S.S.	Laxman Sanjel	20
9	Krishana Ma.Vi.	Milan Dulal	20
10	Amar Ma.Vi.	Pratima Bidari	20
	Total		200