

Chapter-I

INTRODUCTION

Background of the Study

Among the four major areas of mathematics, geometry is one of them. Literally, the term geometry means "measurement of the earth". It is one of the most useful and important branches of mathematics. The subject of geometry is of the spatial relationship of objectives with one another (Gamer, 1981). It is the branch of mathematics concerned with the shape of individual objects. Spatial relationships among various objects, and the properties of surrounding space (Dhakal, 2013) Geometry is also considered as a tool for understanding, describing and interacting with the space is perhaps the most intuitive, concrete as well as reality linked part of mathematics. On the other hand geometry as a discipline rests on an extensive formalization process, which has been carried out for over 2000 years in increasing levels of diligor, abstraction and generality. Oxford advanced learner's' dictionary defines geometry as, "Geometry is the branch of mathematics that deals with measurement and relationships of lines, angles, surfaces and soli'" In the same way, Penguin dictionary of mathematics has defined geometry as" the branches of mathematics concerned with the properties of space and of figurers in space. Geometry is a basic skill because it is an important aid, for communication, our basic speaking and writing vocabularies are rich in many geometrical terms such as point, line, angle, parallel, perpendicular plane, circle, triangle and rectangle. This geometric terminology helps us to communicate our ideas to others in a precise form. Geometry is a part of our life and we cannot run our daily tasks without geometry. It is mainly used in real life by engineers and architects. The conception of geometry appears to

show that there are different approaches to the study of geometry. Indeed there are many approaches Euclidean (synthetic), analytic (co-ordinate) transformational, even vertical. But when the term school geometry is used, it is almost universally understood to mean Euclidean geometry. Euclid, the father of geometry established geometry as a discipline of mathematics but could not make the discipline agreeable among its stakeholders. During Seventies comprehensive school mathematics project (CSMR) of united state took place to write the status of geometry teaching. Two major conferences one in Germany in 1974 and other in Belgium in 1982 were held to address the issues of geometry teaching but not consensus finding was emerged. Basically, the early mathematics was closely related with geometry which is nowadays regarded as one of the branches of mathematics Besides this; geometry is one of the oldest intellectual pursuits of human being. Its origin can be traced to the early Babylonians and Egyptians for whom geometry was essentially and imperial science cultivated solely for its utility.

Teaching geometry is not an easy task (Upadhy, 2007). But geometry teaching has demonstrative values. It develops that power of reasoning. It provides opportunities for observation, exercising the process and deductive logic; it is also helpful in providing knowledge about space. Spatial word and abstract of life. Due to the maintain aspects, geometry among mathematicians and mathematics educationists there is a widespread agreement that teaching of geometry should start at an early age and should continue in appropriate forms throughout the whole mathematics curriculum. Rai (1979) states that teaching of geometry has several reasons for its importance. Certain causes of teaching and studying geometry are as follows:

- It brings cultural development and is key to mathematical thinking.
- It has demonstrative values and develops the power of reasoning.

- It provides opportunity for observation and exercising the process of deductive logic.
- It is also helpful in providing knowledge about space, spatial wounded and abstract of life.

Nowadays Madhyamik Siksha Pathyakram, 2064 approved by government of Nepal is implementer in secondary level. This curriculum contains six compulsory subjects and two optional. Students of secondary level must have to study mathematics as a compulsory subject and they have chance in selecting optional first paper. So they may or may not select optional mathematics. The mathematics curriculum of secondary level has been designed to give mathematical skills and knowledge for higher studies (Acharya, 2013), For this, mathematical experience of junior classes has been included and necessary subject matter for the foundation of higher studies is also included. In this curriculum Subject matter of class nine and ten has been produced sequently. Sets, Arithmetic, Menstruation, Algebra, Geometry, Trigonometry, Statistics and Probability are eight sections which have been included in compulsory mathematics. To teach these chapters of class nine and ten, total 150 periods have been allotted in secondary level mathematics curriculum and has stated four general objectives. As for geometrical portion is considered, there are four specific objectives in each class of secondary level. Along with finding out the different problems and issues in teaching geometry (Pandit, 2004). Several activities are carried out to address the geometry classroom practices from government and non-government sectors in many parts of the world. However, these mere assumptions and plans are not sufficient in answering and addressing the questions and challenges about geometry classroom practices. Hence, it seems sensible to raise some basic questions- how are the current mathematics classroom practices being

carried out from the perspective of geometry teaching? How do teachers feel, and what are their experience and perceptions regarding the geometry classroom practices? What do multi-ethnic learners think and realize about geometry classroom practices? How do diverse learners involve in classroom practices and how do the teachers address and accommodate them? What kind of instructional strategies are being used to address inclusiveness, child-friendly environment and fear-free environment? Out of these several issues, one fundamental question that encouraged me to conduct this study is: - What classroom practices are being used to promote geometry teaching within the mathematics classroom in schools across the country?

With this in mind, I have tried to explore the geometry mathematics classroom practices.

Mathematics like a language is a basic tool of communication. Daily communication involves the frequent use of mathematical concept and skills so for understanding of every discipline, mathematics is essential. Now every human discipline such as chemistry, physics, social science, economics, psychology, engineering etc. are interpreted as a mathematical model. Without having mathematical knowledge, it is very difficult to understand those disciplines. Mathematical techniques are essential tools for the development of every field of knowledge. Either, it is science and technology, social studies, like economics, management etc. need mathematics for advanced study. Thus twenty first century is said to be that of computer based information technology and it is all based on mathematics or equivalently logical thinking. The training of basics mathematics and computer is imperative for skill manpower in every field of national development.

It is already mentioned that mathematics education is necessary to every field and every person, so mathematician felt that it must be made popular to all. To make

mathematics popular different mathematical programs such as family mathematics program, ethno-mathematics, and woman mathematics has conducted. Many mathematical organizations such as ICMI (International Commission on Mathematical Instruction), IMO (International Mathematical Olympiads), and ICME (International Congress on Mathematical Education) have played vital role to make mathematics popular. The ICMI (IV) declared the policy of mathematics education “Mathematics for all” and everyday life mathematics.

In context of Nepali society, people says that mathematics is the so hard subject, only gifted students can study this subjects, the girls students can't study optional mathematics in school level etc. these are the traditional thinking and this is the example of Nepali culture towards the mathematics. Similarly, people said that mathematics subject is only for teaching occupation, it can't use in others sector. So, this is also the main difficulty in learning mathematics due to the negative thinking of people. By this discussion we can say that gender beliefs towards mathematics, approach towards the mathematical literature, religious and cultural approach to study mathematics and relevance language, learning mathematics and its future etc. are the cultural diversity in mathematics education.

In the Nepalese society, much diverse varieties of classroom are experienced. All students are not from same cultural background. They have different perspectives towards the learning mathematics. The students who have low economic condition, illiterate family, narrow conception towards mathematics, lack of equity and justice are not ready to study mathematics properly. Low passes rate and overall poor achievement also affect the school education sector. This is always blamed that school has used traditional methods of teaching, poor school environment, monolingual instruction, lack of teaching materials, dominants culture, school has not been

addressing justice, equality, freedom, peace, compassion and clarity of all students in learning. These things are challenging for all who are interested in learning mathematics. Therefore, I am motivated to select this topic for the inquiry.

Statement of the Problem

The study is concerned with the present situation in teaching geometry at public school classroom. Both, the teacher and students face several difficulties in teaching and learning geometry. Most of the students from Nepali medium public schools fail in mathematics in S.L.C. examination and higher level, too. Geometry is integral component of mathematics with containing more verbal and abstractive problems related to triangle, quadrilateral, similarity and congruence of triangle which are directly related to our daily life problems and further study. Geometry is an essential branch of mathematics in primary level up to higher level. Generally the teachers teach geometry at the last hour when it is the time for the students to build up the mind for the exam preparation. They don't understand the teacher's expectation as it is difficult to memorize the theorem. They feel it boring. The student may lack the basic knowledge of geometry which deteriorates their curiosity. Ultimately most of the students fail in mathematics due to the geometrical portion. The major cause behind leaving school and failing in this subject is due to the poor performance in mathematics. In mathematics geometry is the subject which is responsible behind failure and low performance of the students. According to the school teacher's most of the student can't even obtain the pass mark in the S.L.C. examination. They thought geometry is the boring and difficult chapter of mathematics subject. So, it is well appropriate to research about present situation and challenges of teaching geometry at public school.

Therefore, it is relevant to conduct a research on present situation in teaching geometry at public school. This research intends to answer the following research questions:

- How do students learn geometry at public school ?
- How do teachers teach geometry at public school ?

Objective of the study

The main objectives of this study were as follows:

1. To explore the present situation in teaching geometry at public schools.
2. To explore the challenges of public school's teachers and students in teaching geometry .
3. To explore the possible ways to overcome these challenges.

Significance of the Study

Mathematics is an essential part of school curriculum, So every student should study. It has been taught for all pupils as a compulsory subject at school level as well as optional subject. Teaching mathematics is a difficult and challenging because of its nature, course content, social need, student interest and exploration of new field of knowledge. The world now has become a global community. Nepalese community can't live in isolation. We have to cope our challenges and need to stand upon our reality. If we try to meet the challenges, significant changes in education need to occur. Nepal's education sector suffers from several constraints that affect its efficiency and effectiveness. The educational reforms seemed to be able to convince the public of the benefit of change and not all the efforts made so far have brought desirable change.

In Nepal, achievement of public school is not satisfied. SLC result also shows more than 50% students fail and the result of public school is worse than private school. The SLC result also indicates that maximum number of students fail in mathematics. In school level dropouts and failures are still in large number. But there is no enough study related to socio-cultural aspects of children that uncover the issues in their schooling and learning. Similarly, only the technical intervention is not sufficient to address the issues of school development as it is influenced by technical and cultural focuses. Educational Act and government policy is also practicing to improve the school's performance. But these works are not enough to meet their goals. So the research is becoming an important door to meet the expected desired.

This study has the following significances;

- Teaching is an art of the artist with skillful and tactful tasks so this approach is very helpful for teaching effectively.
- It is also help to the teacher, student and other common people to create better environment and awareness to provide positive attitude towards teaching geometry.
- It is helpful to be the integrated learning mathematics.
- It is helpful to make the inclusive classroom teaching.
- This study also helps to know the effect of individual difference in mathematics achievement.
- This study provides the knowledge about the relation between teachers and students.
- This study provides the different factors which effects in learning geometry. Further more, this study will also open the door to do research in the similar area of other district.

Delimitations of the Study

This study is delimited in terms of theory, which was considered as the basis of this research. I was made the case of Chitwan district only due to my constraints. The methodology was explained only from the basis of qualitative perspectives. Among all schools only one case was taken in accordance with my convenience and the study result was focused only on mathematics classroom of grade nine and ten of case school. So, the result of this study could be no more generalized. The study was following delimitations.

- This research had held in Chitwan districts only.
- The area of study was delimited to different two schools of Chitwan district
- The data was collected only from the teachers teaching at secondary level.
- The respondents was four mathematics teachers and eight students of class 10 from different public schools.
- The study was delimited to elicit (use) the present situation in teaching geometry at public schools in Chitwan district.

Operational Definition of the Key terms

Present situation: - The term present situation refers to the existing or happening practice or activities now.

Situation: - All the circumstances and things that are happening at a particular time and in particular place.

Challenges: - Facing with the difficulties and problems to carry out the actions effectively and freely.

Strategies: - The process of planning something or putting a plan into operation in a skillful way.

Public schools: - Those schools which receive the government grant for the salary of teacher and other purpose regularly.

Students: - The students who are studying at secondary level.

Teachers: - Teachers who are teaching mathematics at secondary level.

Geometry: - The science that treats of the shape and size of things, the science of properties and relation of lines and solids. Or the branch of mathematics that deals with the measurements and relationships of lines, angles, surfaces and solids.

Difficulties: - In this study difficulty is defined as the thing or situations that cause problems faced by students in learning geometry at secondary level.

Curriculum: - Mathematics curriculum which is to be implemented at present grade IX and X.

Problem: - Problems are the things which are difficult to deal with or to understand during learning mathematics. These statements which have solution are said to be problems. In this study problems in mathematics are the difficulties of mathematics students. The synonymous words for problem are brain teaser, difficulty, disagreement, dispute, trouble and question.

Physical facilities: The physical aspect of classroom is itself a physical environment of the classroom, which includes different variables such as classroom arrangement, seating patterns and materials and number of inhabitants.

Learning: Learning is the act of acquiring new or modifying and reinforcing, existing knowledge, behaviors, skills, values, or preferences and may involve synthesizing different types of information.

Achievement: In this study, student's achievement means the score obtained by the students.

Inclusive education: Inclusive education is a process of addressing and responding to diversity of needs of all learners on the classroom, in school, and on the society. Inclusive education creates suitable environment for all learners addressing multicultural differences.

Difficulty in learning mathematics: In this study, difficulty in learning mathematics belong difficulties in acquiring knowledge and skills of mathematics to the normal level expected of those because of cultural diversity.

Chapter-II

REVIEW OF RELATED LITERATURE

A literature review can be just a simple summary of the sources, but it usually has an organizational pattern and combines both summary and synthesis (Google search). It minimizes the duplication of the research. A literature review goes beyond the search for information and includes the identification and articulation of relationships between the literature and our research site. While the form of the literature review may vary with different types of studies, the main aim of literature review are:

- Provide a context for the research
- Justify the research
- Outline gaps in previous research
- Show where the research fits into the existing body of knowledge
- Enable the researcher to learn from previous theory on the subject
- Illustrate how the subject has been studied previously
- Highlight flaws in previous research
- Show that the work is adding to the understanding and knowledge of the research site
- Help refine, refocus or even change the topic
- Ensure the research hasn't been done before (or that it is not just a "replication study")

Therefore, I have collected some books, journal, articles, researches which are related to present situation and challenges of teaching geometry. By deeply study of these resources, I reviewed the related literature as follows;

Empirical Review

An empirical review in research methodology is when the writer reviews the information and theories currently available concerning the topic and the historical background of the topic. The point is to do two things. First, it is to demonstrate through understanding of the field in which s/he is conducting research. Second, it is to show that the problem being studied has not been done before or has not been done before in the way proposed by the writer.

Thakuri (2011); carried out the research on the topic “Problems faced by student in geometry at secondary level of Jajarkot district” with the aim: to identify the problems faced by student in geometry at secondary level. He closed with descriptive survey method and study site was Jajarkot district. Questionnaire was regarded as the main tool of this study which was developed by researcher himself with the help of the supervisor. The data had been collected by primary sources. From the field survey and statistical analysis of the collected data it was found that students have been facing numerous problems of geometry teaching in the classroom at secondary level. Different types of internal and external factors are affecting to arise these problems

- Problems on teacher guidance for solving problems
- Due to the lack of sufficient time, there were difficulties in checking homework
- Besides problems related to good performance of teacher, lack of guiding encouragement, motivation is equally problematic.
- Lack of time to use various method, lesson plan and appropriate examples to make clear concept of difficulties

- There arose the problems in class evaluation system
- Teaching materials have not been used because of the large number of class size
- Problems on using materials in teaching theorems and exercises
- Teacher was unknown about the current teaching methods and implication of it
- The teacher was not able to manage the students due to the small size of classroom
- There was problem on fulfillment of student's creativity and curiosity

From the above stated findings of this study, it can be concluded that:

Teaching and learning of geometry was not satisfactory in Jajarkot district. There had been significant problems in teaching learning activities, instructional materials, theorems and construction, classroom management and evaluation technique.

Nepali (2014); Carried out the research on the topic “A study on errors committed by grade 8 students in geometry learning” with objectives of the study: to identify the error committed by students in angle construction, to compare the error with respect to gender of grade 8 students in angle construction and to analyze the error made by the students according to Newman Hierarchy of error analysis in solving problem of angle construction. He closed with interpretative design. Study site was Kathmandu District. Test and interview schedule were regarded as the main tool of this study. The data had been collected by primary sources. The study showed that students committed more errors at comprehension level while solving geometrical problem at lower secondary level, which might be due to lack of understanding the language. The study also showed that students committed more errors at transformation level as well. The high percentage of transformation and comprehension errors found in study

using the Newman procedure providing unambiguous evidence of the importance of language in development of mathematical concepts. The study showed that students transformed the verbal problems into figure but some of them were not able to solve problem due to lack of mathematical structure and carelessness. The study showed that there is no significant difference between the error committed by boys and girls. Which means both boys and girls have same mathematical schema

Chaudhary (2014); Carried out the research on the topic “Difficulties faced by students in learning geometry at lower secondary level” with aims: to find the difficulties faced by students in learning geometry at lower secondary level and to analyze the difficulties faced by students in learning Geometry related with classroom management. He closed in qualitative in nature. The intended research was descriptive case study research. Study site is Bara district. The data was mainly obtained by using interview guideline and class observation. He had used the primary data collected from the field by observation and interview schedule. This case study was mainly focused upon findings the causes of difficulties faced by the lower secondary level student in learning geometry. From the interview with teacher, students and parents, and class observation, the researcher found the following difficulties which are mentioned below:

- In this study the researcher found that cause of difficulties in learning geometry are lack of basic concepts of geometrical shapes and figures, less practicing of students.
- Lack of visualization of teaching materials and traditional method created difficulties in learning geometry at lower secondary level.
- Lack of pre-requisite knowledge of geometry made obstacle to learn formal deduction level.

- In this study the researcher found that geometrical standard language related to student's vocabulary created difficulties in learning geometry.
- The researcher found that less practicing and inappropriate activities in the classroom are also cause of difficulties in learning geometry
- Lack of two way communication between teachers and students created difficulties in learning geometry.

This study concerned with difficulties faced by students in learning geometry at lower secondary level. From the above stated findings of this study, it can be concluded that learning geometry was not satisfactory in Kalaiya municipality of Bars district. Students face difficulties in learning geometry due to lack of pre-knowledge, less practices, lack of teaching materials, poor skill in sketching figure, problems of students' vocabulary and lack of coordination between students, parents and teachers. Consequently, these all factors play vital role in learning geometry.

Sharma (1997); Conducted a research on “A study of understanding of geometry ideas of Grade-8 student of Gorkha district.” With the aim to find the distribution of the students with their acquired basic skill of geometry into its different level on the basis of the achievement test and to determine the level of basic skill of geometry among the boys and girls of Grade-8. He adopted a normative survey method and selected seven schools from the 43 schools randomly. From each school a sample of 42 to 47 students were selected. He made the achievement test and administered it on the sample of the 183 students and applied t- test to conclude that level of mental development in understanding geometrical ideas advanced the percentage of students decrease with a sudden break in the level 8, the student was interpreted by the increase of the percentage of the students than the other level.

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 survey design. He 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 10 were selected as a sample for the study. For the data collection, a set of class observation form and interview schedule were used. The obtained data was analyzed and interpreted with the help of mean weight age.

The major findings of this study were illiterate parents, poverty of parents, lack of encouragement for study, the gap of low achievement and high achievement students, unavailability of teaching learning materials, 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.

Lamichane (2001); conducted a descriptive survey type research on “A study of problem faced by the secondary level mathematics teachers in teaching mathematics” in Kaski district. Eighteen school were selected randomly from each of the strata (i.e. 11 urban and 7 rural) by using the random number table. The questionnaire was filled an observation form used to collect the data. Weighted mean and t-test were used to analyze and interpret the data. The major finding of the study is the several problems proposed up in the eyes of teachers such as inadequacies of text book and teachers guide, lack of instructional material, teacher’s training, lack of supervisory help and lack of physical facilities etc, Further he concluded that the lack of motivation to learn mathematics is poor on the part of student.

Bhattarai (2005); made a study entitled “The problem faced by the mathematics student in existing curriculum.” this study being descriptive in nature. Twelve schools from urban in Ilam district were selected by simple random sampling method as well, From each school, one teacher and four students were chosen respectively. The main tool of the study was questionnaire. The questionnaire was developed into three point likert scale. The collected data were analyzed by calculating percentage. The major findings of this study are concluded that learning mathematics in secondary level is disturbed by so many factors such as lack of teacher’s involvement in classroom planning, lack of referential and instructional facilities and aids, student’s weak background in the subject matter and so on.

Gyawaly (2009); conducted a research on “the study of effectiveness of van Heile approach in teaching geometry at secondary level.” The objectives of this study is to explore the effectiveness of van Heile approach in teaching geometry and reducing the gender differences in achievement in geometry. For this study 40 students were selected as sample involving in control and experimental groups 20/20 students in each group. This study was experimental quantitative research. In this study the researcher found the mean achievement of the students taught by van Heile’s approach. Using t-test, the research concluded that van Heile;s approach more effective than the conventional method in geometry at secondary level.

Attreya (2006); concluded a research entitled “A study of problem faced by mathematics teachers to maintain positive discipline in secondary level classroom.” He used both qualitative and quantitative measures to collect data. He took seven schools from three different districts, three from Gulmi; two from Kavre and two from Kathmandu. The findings of the study show that different problem creators are responsible such as problems due to classroom management, administration, school

environment, student's activities, Curriculum, methods of teaching and social and economic status were the main indicators to create problems. Not only that disciplinary problems due to crowd, lack of furniture, un managed seat planning, irregularity, lack of trained teachers, gap between students-teachers-parents are also some problem create factors.

Bhatt (2014); conducted a research on "Students difficulties in learning geometry." The objective of this study was to determine van Heile's level of geometric thinking of grade-8 students and to identify the causes of difficulties in learning geometry. The study was qualitative and quantitative in nature. In this study the researcher selected two secondary schools as the sample purposively from Baitadi district. Six students from each school were selected for interview on the basis of the weak written response. He had analyzed and interpreted the data on the following headings: level of geometry contents according to van Heile's. Theory, student's response about content and teaching pedagogy on geometry, difficulties on teaching learning strategies, difficulties on student's participation and area of difficulties and their sources. After analysis and interpretation of different data, he found that weak students in geometry were van Heile's understanding visualization level and analysis level. The cause of students difficulties in learning geometry were traditional teaching method, negligence of teacher, lack of teaching materials.

Filling the Gap

Overall review of related literature, geometry teaching is the major point in learning mathematics. Due to the different things of teaching geometry is affected. Difference languages, school environment, home and school culture, different learning strategies, teacher's professional skills and knowledge are the factors which affects in learning mathematics. From the above review of literature, what are the

current difficulties faced by the secondary level students in learning Geometry? why does student face difficulties in learning geometry at secondary level ? what sort of error do students commit in solving problem of angle construction? Does gender has any effect in committing errors? what are the current problems faced by the secondary mathematics students in learning geometry? Do the problems faced by the mathematics students in rural area school differ from urban area school? But there was no such research to explore the present situation in teaching geometry at public schools. There is a gap that the challenges of teaching geometry at public school's teachers and students. So, through this research I am going to identify the present situations in teaching geometry at public school.

Theoretical Review

In this section some approaches and theories are discussed, which are needed to support for findings of the study. Even though no consensus prevails among the learning theorists, psychologists and educators on how children learn and on the most effective methods for promoting learning, a careful study of learning models and theories is very important in order to develop learners understanding of phenomenon on holistic perspectives. The teachers need to understand theories on how children learn and how to apply these theories to instruction. The van Hiele model is very important for development and learning of geometry in students.

van Hiel'e Theory Learning Geometry

The van-Hiele's theory (1986) is a learning model that describes the geometric thinking of students through as they move from a holistic perception of geometric spheres to a refund understanding of geometric proof.

Pierre M. van-Hiele's 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. van-hiele (1986) explains when teaching his students geometry "It always seemed as though I were speaking a different language". van-Hiele wanted to know why students experienced difficulty in learning geometry and how he so could remedy those difficulties. The solutions van-Hiele found for his students that frustration was the theory of different levels of thinking. The following are the van-Hiele levels that are used and referred to in this study.

Level 0 (Basic level): Visualization

Students recognize figures as total entities (triangle, square) but do not recognize properties of these figures (right angles in a square).

Level 1: Analysis

Students analyze component part of the figure (opposite angle of parallelograms are congruent) but interrelationship between figures and properties can not be explained.

Level 2: Informal deduction

Students can establish interrelationship of properties within figures (In a quadrilateral, opposite sides being parallel necessities opposite angles being congruent) and among figures (a square is a rectangle because it has all the properties of a rectangle) informal proofs can be followed but students do not see how the logical order could be altered not do they see how to construct a proof starting from different or unfamiliar premises.

Level 3: Deduction

At this level the significance of deduction as a way of establishing geometric theory within axiom system is understood. The interrelationship and role of undefined terms, axioms, definitions, theorems and formal proof is seen.

Level 4: Rigor

This level of geometric thinking most often applies to college level geometry classes, where students are formal logic to compare abstract system often without concrete model. Students reason formally about mathematical system. The product of their reasoning is establishment, elaboration and comparison of axiomatic systems.

All the above mentioned van Hiele levels of geometrical thinking can be summarized in the following table.

Table No. 1
van Hiele's Levels of Geometric Thinking

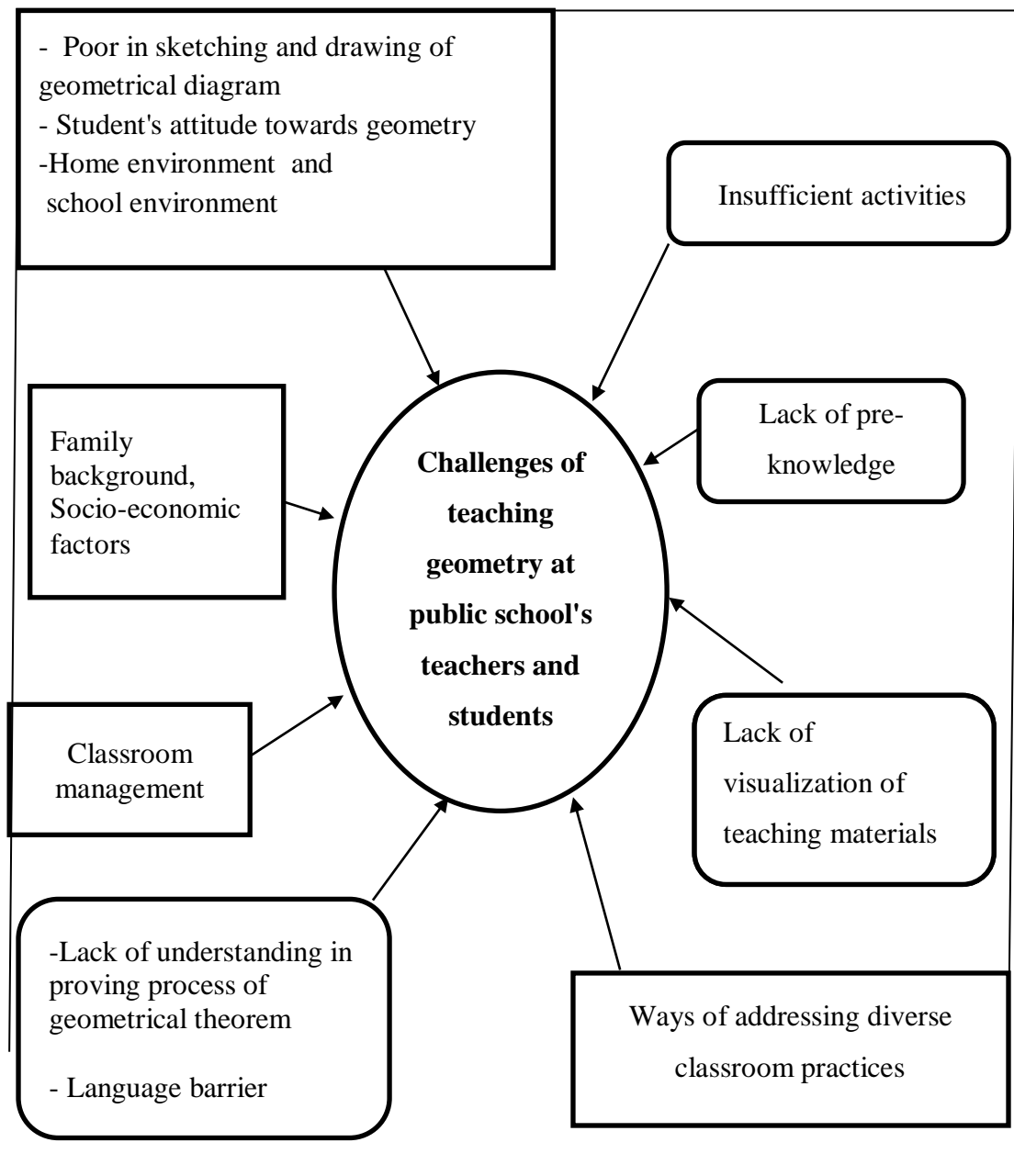
Levels	Stages	Characteristic
Level 0	Visualization	Students recognize the figures on the basis of their physical appearance
Level 1	Analysis	Students analyze the component part of figures
Level 2	Information	Students establish the interrelationship of properties both within figures.
Level 3	Deduction	Student able to construct proofs using postulates or axioms and definition
Level 4	Rigor	Students can work in a variety of axiomatic system

Conceptual Framework of the Study:

From the above discussed point of view related to literature, present situation in teaching geometry may depend upon different variables. These variables affecting students learning process in geometry are improper understanding about geometrical figures and shape by the students, poor in sketching and drawing of geometrical figures and shapes, lack of understanding geometrical figures and shapes, lack of understanding to prove theorems of geometry, student's attitude towards geometry, classroom management, home environment, school environment etc. Similarly, variables related to home environment consists of lack of proper understanding of geometrical theorems by students, educational condition of students, study hour of children at home, lack of student friendly environment, unavailability of proper teaching materials in geometry.

The conceptual framework devised through the literature studies facilitated to attain research objectives, get the answer of the research questions and carry out the research work as a whole smoothly (Acharya, 2015). Analyzing various literatures in relation to inclusive classroom practices, and the relevant theory, I have developed a conceptual framework for the study, which is given below:

Figure No. 1



Source :- Chaudhary 2014

The conceptual framework, which I mentioned in above table no.2, is the important part of this study. I have applied the qualitative research design and case study approach for carrying out this study. van Hiele theory has used to interpret the data. There are many factors which effects on learning geometry. Familie's background plays the key role in children's learning achievement.

Chapter-III

METHODS AND PROCEDURES

This chapter presents the research method of study which determines how the research becomes complete and systematic. This study is concerned with the present situation in teaching geometry. The major procedures followed in this study were as follows.

Design of the study

Sample and sampling

Study site

Data collection tools / Instruments

Quality Standard

Data collection procedure

Data Analysis and Interpretation

Design of Study

The conducted study was essentially qualitative in nature with case study approach. Qualitative research was used for this study because it helped me to find out related information regarding the present situation in teaching geometry at public schools. It was the research design that had to be carried out in small scale.

Qualitative design was widely employed in school and educational researches.

Investigations through small scale studies carried out by single researcher the purpose of qualitative research was generally to obtain a snapshot of condition.

In nutshell, qualitative research is conducted to eliminate important educational issues and data are collected from schools. Then those answers which are given by the sample are collected from teachers and students. Then those answers which are given

by sample are though that whole group has given same type of information. It means, I generalized the result obtained from sample to the whole teachers and students.

Sample and sampling

Purposive sampling procedure was used to select the population for the study. Adopting this procedure, four secondary level mathematics teachers and eight students of class-X of public schools of Chitwan district were selected as sample.

Study Site

Shree Bhandara secondary school and Shree Buddha Santi secondary school of Mathematics teachers teaching at secondary level and the students of class-X of public schools of Chitwan district were the study public school.

Data Collection Tools/ Instruments

Creswell (2007) visualize data collection as a series of interrelated activities aimed at gathering good information to answer emerging research questions. An important step in the process is to find people or place to study and to gain access to and establish rapport with participants, so that they will provide good data. Data collection is the important part of the study. On the basis of the data, we can study and analyze every aspect of the study. Research tools are the basic instruments to gather data, to seek possible solutions for observed problems (Wikipedia). In order to the mentioned research questions, the tools of the study were the observation and interview, it needs close involvement of researcher with the person/objects/site/activity, which is relevant to the aims of study. The researcher has to observe the behavior and work closely with respondents in a natural setting as much as possible in order to collect essential data.

Data collection is the most important part of the study. Every aspect of the study can be analyzed and studied because of data. The data was mainly obtained by using interview guideline and class observation.

Interview Guideline

Interview is a two-way interaction between researcher and researched as in the form of interviewer and interviewee in which interviewer creates situations that can attract the attention of respondents for a enough period of time in asking questions and answering the questions which interviewee puts his/her understanding and meaning (Wikipedia). Kerlinger (1986; as cited in Adhikari, 2006) describes interview as face-to-face interpersonal role situation in which one person, the interviewer, asks a person being interview, the respondent and questions designed to obtain answers pertinent to the purpose of the research problem. In interview, also known as unstructured interview could be regarded as informal interview. It was used to discover the in-depth understanding of people in the context under the study (Bailey, 1982; as cited in Adhikari, 2006). It can be done in a day to day conversational way in which interviewer does not know whether s/he had been interviewing or not. This interview helped to create a friendly situation that opens up a free feeling environment for both researcher and respondent.

In this study all, the required information was not possible to gather through the observation and documents. To go in-depth of the information interview were much more helpful. So, I carried out open ended interview to clear his/her difficulty regarding learning geometry. Since some questions had raised according to the situation available. I took in interview of all eight key students using unstructured questionnaires. After the interview of the key students, I also took interview of four

mathematics teachers. I used this tools as required to the key students and their mathematics teacher.

It is one of the most important tools of qualitative research. I had developed interview schedules in semi structured form including relationship between teachers and students , less participation of students in learning geometry, classroom management, challenges in learning geometry content, lack of home as well as class practice, difficulties on classroom practice, questioning system of mathematics class, views of the teachers towards teaching geometry, the performance of students in geometry, views about challenges faced by students in learning geometry, causes of lower achievement of the students in geometry, facilities provided to the student in learning geometry, classroom management, personal feelings, interaction with teachers, students and participation in learning. I took interview with students, and subject teacher to collect primary data.

Observation

Observing in a setting is a special skill that requires addressing issues such as the potential deception of the people being interviewed, impression management, and the potential marginality of the researcher in a strange setting (Hammersley and Atkinson, 1995; as cited in Creswell, 2007). Observation is a kind of tools that helps to seek knowledge through the use with sense i.e. eyes, nose, tongue, and skin. It has great importance not only in research work but also in our daily lives. (K.C, 2000; as cited in Adhikari, 2007) writes that direct observation has the advantages of putting researchers into first hand contact with reality. In this study, observation was used to capture the physical setting that is the physical environment of school and classroom, the human setting that is the organizations of students in the classroom and interaction setting that is the participation as well as interaction of teachers with students and vice

versa. Observation guideline was developed with reference to research objectives. The teachers were pre-informed about the purpose of observation and their permission was taken before entering into the classroom. My role during the observation was that of non-participant observer noting down the things as it occurred and making notes of the things that were noticed. Observation helped me in collecting detail information about respondents, their everyday practices and capture actual experiences of the participants.

Since, the Nepalese classroom constituted by different challenges forces because students from different background have their own lived reality and in the classroom, they are not simply conform norms and values of the school. To get required information regarding mathematical concepts, I observed school overall as well as key respondents individually and collectively during their work at school, classroom, playing with peers, interacting with teachers and friends, school behavior, culture, and participation. I became a friends of students and I always helped them to do their classwork and exercise. Students also felt easier with me by my behavior with them, which helped me to know their attitude. I also observed teachers collaboration and discussion in subject matter, participation of students in classroom activities as well as extracurricular activities in terms of gender, caste, religion etc., teachers' behavior towards students in teaching learning process, and teaching learning strategies of teachers and students. Participating in a naturally occurred setting, whether either classroom or school, I get a great opportunity to see, feel, test, hear and interact with the informants very closely through the senses that can produce necessarily data. It needs an in-intensive, close, and continuous visit to the school, class that helped me to be accepted normally by the students and teachers in the setting.

I observed grade - X with observation tools and took participation and non participation role when observing classroom teaching and learning activities of the class. I observed that activities of all students participating in geometry class and their interaction with each other and teachers. The observation form included main activities of the students, ways of questioning and answering, area of interest in learning geometry, teacher's behavior towards the students, interaction with teacher and friends, classroom management, motivation provided for self learning, class work, teacher's performance, student's achievement and total educational management.

In my study, research reports/dissertations (as stated in reference), various journals and articles helped me identifying the guideline for observation and components for interview as well as arriving at the research objectives.

Quality Standard

After completing the construction of the research tools, it is necessary to maintain quality standard. For quality standard, I used interview and class observation in the field. For quality standard, I followed the following ways:

Credibility

This concept replaces the ideas of internal validity, by which researchers seek to establish confidence in the truth of their finding. To maintain credibility of my research I tried to spend as much as time for observation and interview with different mathematics teachers and students. After getting information I wrote notes, I asked similar types of questions to others teachers students and tried to find real practices from those information.

Transferability

Transferability replaces the concept of external validity. This criterion refers to the applicability of finding in one context (where the research is done) to other contexts or setting (where the interpretations might be transferred). To maintain transferability I had explained mathematical practices found in different community students briefly. I had tried to capture most of scenario by using thick description of observation, interview and my meaning making.

Dependability

This concept replaces the idea of reliability. This is the third standard for judging qualitative standards and refers to stability or consistency of the inquiry processes used over time. To maintain it I had presented the logic used for selecting people and events to observe, interview and include in the study. I would try to maintain credibility and transferability to ensure dependability standard.

Conformability

A fourth standard is conformability, which refers to the quality of the results produced by an inquiry in terms of how well they are supported by informants who are involved in the study and by events that are independent of the inquiry. This is sometimes referred to as the audit trail (a record of how decisions were made throughout the study). I am also the part of students, so, to maintain conformability before concluding information I reviewed those information myself several times and sometimes I conform those information to my other students/friends before concluding information as well.

Collection Procedure

At first I went to the selected school to collect information and discuss with mathematics teachers. The school records were studied such as mark ledgers of students, classroom management, register, teachers profile, physical facilities and other documents. On the basis of the observation form the students of grade-X were observed for-15 days. I recorded the behaviors and activities of the teacher and students during teaching learning activities. Mathematics teachers and students were interviewed. All the answers were noted during the course of interview.

Data collection refers to gathering information from vivid sources through the application of multiple data gathering methods to attain the objectives of the research under consideration (Niure, 2014). For this study, the data and information was collected using tools as observation and interview and so on in order to collect information the respondents. To collect the primary and secondary data, class observation were done regularly during teaching learning activities. I observed, listening, interaction and recorded the essential data from the information on the basis of observation from classroom behavior, interest, and needs in geometry learning.

With the help of interview schedule. The interview was taken with key students and mathematics teachers. The interaction with the respondents was carefully listened and recorded properly. Related documents also reviewed and analyzed on the basis of need. The data from interviews consists of direct questions to people about their experiences, opinions, feelings and knowledge. The data from observations consists of detailed description of people's activities, behavior, actions and the full range of interpersonal interactions and organizational processes that of observational process, human experiences.

Data Analysis and Interpretation

Data analysis in qualitative research consists of preparing and organizing the data for analysis, then reducing the data into themes through a process of coding and condensing the codes and finally representing the data in figures, tables or a discussion (Creswell, 2007). In this study, the data collected through above mentioned tools from different respondents and sources were processed in different steps. First, the data from interview in the tape recorder was translated in English. The writing and reading of transcripts allowed me to generate common codes, patterns and themes as well as the issue that have been anticipated. The text data, the sentences and paragraphs from transcripts of different respondents were then coded with specific term or concept that it reflected. Further, this coded sentences and paragraphs that expressed similar meaning were segmented into common categories. Finally, after revising those categories, smaller specific themes in line with the research questions were generated.

For the purpose of analysis, the themes were analyzed for answering the research questions. The important passages and paraphrases with same meaning were brought together and summarized to support the argument whereas less relevant passages with same meaning were skipped for the ease of analysis. Interview and class observation were adopted to maintain the validity and reliability of the results of the study. Mainly the three sources of the information were triangulated in classroom observation, teaching learning styles of mathematics, and interview with mathematics teacher and key students in addition with field notes. Then after, with the help of theories the analyzed texts were interpreted and summarized. Thus, analysis of the passages and statements from the specific themes were done and theories were used to interpret the meaning, values, experiences, opinions and behavior of respondents from the analyzed themes and answer the research questions.

Chapter-IV

ANALYSIS AND INTERPRETATION

This chapter deals on the sorting out and establishing connection of the different concepts and theme. The word ‘analysis’ means breaking of a whole into meaningful parts/components (Sharma, 2011). In qualitative research, long interview text, observation notes, documents, photographs etc. are the data and a systematic arrangement and categorization is the first phase of analysis. Different methods are used to make the analysis and interpretation understandable. During the study, I conducted different observation and interview. Direct observation was done every day in classroom. Taken with 8 key students and 4 mathematics teachers.

The method used in this study was basically interpretive because this study analyzes and describes the Present situation in teaching geometry at public schools. My objectives of this study were to explore the present situation in teaching geometry at public schools, to explore the challenges of teaching geometry at public school’s teachers and students and to explore the possible ways to overcome these challenges. To achieve these objectives, this chapter is divided in three sections. The first section discusses about the present situation in teaching geometry at public schools. The second section explains the challenges of teaching geometry at public school's teachers and students. The third section discusses about possible ways to overcome those challenges.

Section I: Present Situation in Teaching Geometry at Public School

At primary and lower secondary level, geometry is taught and learned by experiencing, observing and measuring where as at secondary level, it is taught and learned experimentally and theoretically. At school level in the process of teaching

and learning geometry is not taught as easily as arithmetic and algebra. The students studying at secondary level feel difficulty in learning geometry as well as the teachers face challenges to teach the geometrical concepts.

In the context of Nepal, teaching and learning geometry has not got enough space because the objectives determined by CDC are not fulfilled. The teachers also teach the geometry by using lecture method. Similarly, they teach the geometry after completion of other units. It is found that the teachers use the rote learning methods and they give less importance to theorems and even ignore some of the geometrical portions. CDC allocates geometry at the beginning of the lesson at primary and lower secondary level where as at the secondary level it is allocated at the end. Therefore, teaching and learning of geometry can not be complete and learning outcomes are not achieved.

In the interview of teachers, I had asked a question, *what is the present situation of teaching geometry at public school?* In this issue teacher T₁ who teach Bhandara secondary school Chitawan replied that,

"In the government school, all most all teachers use traditional method and teacher centered method. In the school level (1-10) of Nepal, geometry learning is not effective. The teachers teach the students being active himself but they don't make the students participate in different activities. They don't teach the geometrical figures from the sequential order. such as concrete, semi-concrete and symbol. These methods can not make the concept clear and learning also does not become permanent. It is found that problem solving method, discovering method, etc are not used while solving geometrical problems related to their figure and properties and in our context this kind of

practical and relevant methods are less used or not used, Merely lecture method is perforated."

From the information of my participant T₁ I found that the present situation of geometry teaching was traditional teacher center method. In classroom teaching process teacher was active but the students were passive. It is better to use problem - solving and constructivist approach to teach geometry. In this regard, Vygotsky (1987) claims that learning mathematics through collaboration of activities and participation of learners.

After taking the interview I observed the class of grade ten of Shree Bhandara secondary school , Rapti-06, Bhandara, Chitawan. This was my first classroom observation

It was the day of May 15, 2017 the teacher and I entered the class ten all the students stood up and said good morning sir the teacher replied good morning class and sat down. The period of observation was third. The teacher started to teach the lesson area of triangle and quadrilateral. He stated the theorem in the board: A diagonal of a parallelogram divides it into two triangles of equal area. Then he draw the figure and proves that theorem one way. All the students copy it.



From the classroom observation, I found that the teacher teaches the geometry by using traditional teacher centered pedagogy. As whole class the teacher was very active but the students were passive listener. In addition, in the class observation, I have seen that, the mathematics teacher mostly used lecture method. He gives less chance for students in classroom, teacher doing problem on whiteboard and students

are copying on their copy. However, sometimes they told the students to do themselves. But, this is not enough for effective classroom teaching.

In the classroom observation I have never seen that teacher used teaching materials in teaching mathematics. Therefore, I asked the teacher *why you do not use teaching materials in teaching mathematics*. In this question teacher, T₁ said that,

“Materials is the basic needs in teaching mathematics at school level but we don't have sufficient materials. We have few materials but that are not useable. Our class is occupied by diverse students, they have different home environment. If I teach them, by using student friendly materials, they will be clear on content but I am unable to do this because we have lack of sufficient resources. I always want to use that material which is available with us”

From the above information of my teacher participant T₁ I found that, insufficient teaching materials suffer mostly government schools, which is most important for teacher and students. In addition, teacher believed that teaching material is very important for gaining the concept of mathematical knowledge but practically he was unable to use in classroom teaching because lack of resources. In this perspective Acharya (2015) argued that use of teaching materials, students understand the subject matter quickly and accurately.

In the interview of other teacher, I had asked a question, *what is the present situation of teaching geometry at public school?* In this issue Teacher T₂ said that,

“In our country the government has emphasized in free education. But they have not focused in teaching materials, different guidelines, classroom conditions (size, situation, furniture etc) which have

negative impact in the geometry teaching and learning process too. There is no supervision in teaching. So, teachers cannot provide full satisfaction to the students in geometry classes. As a result students are at very back situation in geometry than other branches of mathematics."

From the above opinion of my participant, I found that more students and teachers feel that geometry is difficult rather than other branches of mathematics. Teachers can not satisfy the students to teach geometry. There are many reasons to create this situation. such as traditional teaching learning methods is one of the main causes for this. The teacher use, lecture method in teaching mathematics, which is not relevant for students. The Students learn best when they are active rather than passive learners.

I also asked same question for other teacher T₃ he replied that,

"At present in the government school, teaching geometry is in very poor condition but teachers and students consider the geometry as the work of burden. The geometry is ignored to teach in some schools. The teacher teach the geometry without the use of teaching material where it is required the must. The facts show that less care is given to the geometry from the lower classes."

From this information, I found that, present situation in teaching geometry is very poor condition and teaching -learning geometry is burden subject. Moreover, some school geometry part is left to teach in the lower classes. The teacher does not use teaching materials to teach geometry which is very essential.

In this matter teacher, T₃ said that

“I always want to give more opportunity for the students to do problem on whiteboard, but by this process I won’t finish course in time so it makes the problem for me. However, I am giving chance sometimes but most of the time I used lecture method which is unjustie for students and lecture method can not give equity in classroom teaching in diverse situation”.

From the above information I found that teacher want to give opportunity to the students but he believes that by applying this process the time is not sufficient for providing all the students because of large number of students. They feel easy to teach by using lecturer methods, but it is unjustic for students. The traditional methods cannot give equity in classroom. The classroom occupies with diverse students need multicultural classroom teaching. For this, teacher needs to understand the different views of different students who come from different cultural groups. If possible teacher needs to teach mathematics by connecting daily life of students.

In the interview of other teacher, T₄ who teaches at shree Buddhashanti secondary school, I had asked a question, *what is the present situation of teaching geometry at public school?* In this issue teacher T₄ said that,

"Teaching geometry is one of the core problems in public school. Students feel irritation, in comparison to other chapter. It is abstract chapter for students."

In the above interview of the teacher, I found that present situation in teaching geometry, students feel irritation because the geometry is abstract chapter for students.

After taking interview of the teachers, again I observed the grade ten students class.



It was the day of may16,2016, I observed grade- 10 in the 3rd Period of Shree Bhandara secondary school , Rapti-06, Bhandara, Chitawan. It was my second class observation. The teaching chapter was area of triangle and quadrilateral. He taught the theorem- Parallelograms on the same base and between the same parallels are equal in area. He proved the theorem by writing all statement and reasons in the whiteboard. Students were silent they copied all the things whatever the teacher wrote in the board.

From the above classroom observation, I found that the way of teaching of teacher was one way traffic method. The teaching method was not creative, the role of teachers were active and role of students were passive. It was against the Vygotsky's social constructivism which emphasis that knowledge can be constructed by active participation.

From classroom observation, I observed the student's responses above, students either correctly wrote the name of the geometry object but could not draw it properly.

In the interview of teacher T₁, I had asked another question, *How do students learn geometry at public school classroom?* In this issue, teacher T₁ replied that,

"In public school students learn geomentry from reciting method. They don't want to take the conceptually. They cannot generalize the meaning and use of geometry in behaviour. So they have only the theoretical concept of geometry."

From the above interview of teacher, I found that, the student could learn geometry by reciting method. Without generalizing the concept the teacher taught the geometry theoretically but did not teach the geometry practically. In this regard, van Hiele (1986) claims that teach geometry by applying five level of geometry thinking.

I also asked this question for other teacher T₂, he replied that,

"In the government school, the students learn geometry practically rather than theoretically. The students learn the geometry by touching, seeing and creating different constructions rather than theoretical facts. They can't memorize the geometrical facts but they enjoy doing different constructions and solving problems. This types of practice cannot see in the classroom teaching."

From the above view of teacher, I found that it is not better to the memorize the fact that without understanding. The students enjoy doing different construction and solving problems. In this sense, van Hiele (1986) argued that students can establish interrelationship of properties within figure.

I also asked same question for other teacher T₃, he replied that,

"The students in the classroom have different ability but the teaching ways of the teacher is same as all level of the student . Students had to engage into different works at home so they could not give more time in learning geometry. Lack of geometrical lab in schools, they couldn't learn by doing. "

From the view of my teacher participant, I found that, the student couldn't easily learn geometry due to not use of appropriate teaching method the lack of time to practice, lack of geometrical lab. The good way to teach geometry by applying

constructivist. In this line Vygotsky (1987) explains that knowledge can be constructed by learners themselves through active involvement of the subject matter.

I also asked same question for other teacher T₄, he replied that,

"There are many students in the classroom. There is limited time period. Within the limited time period we have to conclude and finish our assigned course. So, we can't provide more time for practicing of drawing geometrical shapes in the classroom."

From the above view of my teacher participant, I found that, the students can't learn geometry in proper ways because there are many students in the classroom so it is not possible in participating all the students in classroom teaching.

Next day I had a plan for class observation of grade ten students of Shree Bhandara secondary school, Rapti-06, Bhandara, Chitawan. It was my 3rd observation class.

The teacher taught the theorem: The area of a triangle is equal to half of the area of a parallelogram on the same base and between the same parallels. The teacher wrote this statement in the board and proved it. The classroom was pin-drop silent.



From the above classroom observation, it was concluded that the teaching approach of geometry was deductive rather than inductive. I concluded that students feel difficulties in learning geometry due to lack of understanding and proving process of geometric theorem.

In the interview of teacher, I had asked next question, "How do teachers teach geometry at public school classroom?," In this issue, teacher T₁ replied that,

"The teachers at public school teach geometry by inductive method which is suitable strategy also. But there are many factors such as physical condition, environmental condition, community, the lack of training in teachers have affected the teaching learning process of geometry classes."

From the interview of my participant T₁, I found that, the selection of method and lesson, the teacher always dominated the students but the modern view of learning emphasized more collaborative and co-operative method for teaching and learning geometry and students indicated that the mathematics teacher in the classroom did not try to conduct extra mathematics activities such as did not give many examples and did not try to manage extra mathematical activities.

Again I also asked this question for other teacher T₂ said that,

"In the government school, the teachers teach the geometry more theoretically. As a result the students learn the geometry a bit less and teaching can't be more effective and fruitful without using teaching material or learning may be more difficult as well."

From the analysis of the above data I found that the teacher was not confident about the topic which was being taught in the class. He did not follow the simple rule of learning. He was in confusion of applying the learning rules of van Hiele and piages. The teacher teach geometry theoretically rather than practically.

I also asked same question for other teacher T₃ he replied that,

"Only lecture method is used to teach geometry. All benches makes difficult to make group discussion. Students are not encouraged for this creativity. More emphasis is given to finish the course rather than student's learning achievement. Daily lesson plan was not used by

teachers he couldn't complete the course in the time. Most of the teachers use lecture method. Lack of using geometrical material in teaching. Classroom arrangement is not proper setting for teaching geometry."

I also asked same question for other **Teacher T4** (secondary level mathematics teacher) said that,

"Students learn geometry in deductive way. Teachers write some axioms and students learn that not by experiment but just by rote learning. Teachers teach geometry in lecture method."

From the above information, I concluded that lecture method is used to teach geometry. The teacher does not encourage the students for this creativity. The more emphasis is given to finish the course rather than student's learning. Daily lesson plan was not used by teachers he couldn't complete the course in the time.

Again, it was the term of class observation of class ten students of Shree Buddha Santi Secondary School, Rapti-2, Gadaili, Chitawan. It was my fourth classroom observation. The observation date was May 24, 2016.

It was the second period; the subject teacher and me entered the class all the students greeted us. The subject teacher replied to sit down. The subject teacher started to prove the theorem related to the circle. Theorem was equal chords of a circle form equal arcs in the circle. The teacher took the textbook from the students and wrote the statement of the theorem Then he also wrote facts one side and reasons in the other side of the board. He proved that theorem thoroughly without discussion the students.

From the classroom observation, I concluded that teacher used the lecture method to prove the theorem without use of any teaching materials. In addition I

concluded that students must visualize the teaching materials for easy learning of geometry to solve the problems as well as prove the geometry theorem.

Next day, the day was 25 May 2016, I planed the class observation of grade 10 in Shree Buddha Santi Secondary School, Rapti-2, Gadyauli, Chitawan. This was my 5th class observation. The observation time was 2nd period.

The mathematics teacher and I entered the class, all the students stood up and said good morning sir. The teacher replied good morning class and sit down. The teacher talked about the geometry on the topic similarity of triangle. First the teacher wanted to teach definition of similarity of triangle and said two triangles are similar if the corresponding sides of triangles have equal in ratio. The teacher talked about similarity of triangle with related figure Then he explains about the conditions for similarity.

From the above classroom observation I found that the classroom teaching of geometry was focused on student centered methods. His teaching styles is descriptive the subject matter, not iterative and critical

Again it was day of 27 May, 2016 , I planed the class observation of Shree Buddha Santi Secondary School, Rapti-2, Gadyauli, Chitwan, to find the existing teaching- learning situation of geometry. The observation class was grade 10.

In the second period the mathematics teacher entered the class to teach geometry. Students and teacher bade their greeting. The teacher started to teach geometry on the topic the congruence triangle. The teacher described the concept of congruence by comparing two triangles He explained two triangle are congruence if their sides and angle and area also equal. After

describing the subject matter the teacher asked some questions to the students his teaching was focused on descriptive not iterative and critical.

From the above classroom observation I concluded that the classroom teaching of geometry was focused on teacher centered, not student centered. The teacher described the subject matter in detail. His teaching was not focusing on collaborative and cooperative. It is better to teach geometry to their students constructive way, in which the students learn geometry by active participation and the role of teacher is facilitator.

Section II : Challenges of Teaching Geometry at Public School's Teachers

To find the challenges faced by teachers to teach geometry I took interview with four mathematics teachers in teaching geometry in secondary level. For this I had asked the question, What are the challenges of the teachers and the students teaching geometry at public school? In this issue, teacher T₁ replied that,

"Lack of trained and qualified teachers, inadequate teacher in proportion to the number of students, irresponsibility of the guardian to their children, poor economic condition of guardian, most teachers involve in politics no provision of regular supervision and monitoring by the authorities, no provision of reward and punishment to the teachers, negligence of the teachers to apply the acquired knowledge and experiences in the real classroom".

I also asked same question for other teacher T₂ said that,

"Challenges of teachers and students of teaching geometry in public school are unavailability of teaching materials, unable to use teaching material and absence of ICT use in mathematics."

From the above information of teacher T₁ and T₂ I found that the challenges of teaching geometry are lack of trained and qualified teacher, economic crisis in school, poor economic condition of gradian, teacher involve in politics, unavailability of teaching materials lack of use of ICT while teaching geometry.

I also asked this question for other teachers T₃ and T₄ they replied the same opinion such as,

"The teacher himself gets confused in teaching geometry. Teaching material is less or no use in teaching geometry. The teacher himself is less proficient in geometrical concept.

From the information of both teachers, I found that, the main challenge to teach geometry is teacher himself not confidential to teach geometry part of the mathematics. In this regard van-Hiele suggests to learn geometry for a student, they should learn level wise. If students don't know the base level (0) and they jump directly into the next level (2) then they can't recognize the figures properly and they can't understand the solution process that is related to geometrical shapes. That is why, it is very difficult and students face challenges in learning geometry.

Challenges Faced by Students in Learning Geometry

To find the challenges faced by students in learning geometry, I had taken the interview with 8 students of grade ten of two schools of my sample schools. In the interview of students, I had asked question, *What are the challenges of the students to learn geometry ?* In this issue, student S₁ replied that,

"If there is no geometry then I can pass every grade easily. I feel that geometry portion is difficult I have not clear ideas about the geometry. So, I

don't understand theorems of geometry properly. I forget whatever I learn and read in the class.

In the same issue my other student participant S₂ said that from the above information of the student S₁ I found the subject geometry is very difficult. He found that geometry portion does not have clear ideas and does not communicate properly with students. They never focus upon two ways of communication only learn formulae and learn the sets of problem solving. She forgets formula quickly as she learns. Therefore, the students feel difficulty in learning geometry.

In the same question the student S₂ replied,

"While teaching mathematics, our teacher uses a standard mathematics language in the classroom. Therefore, I can't learn geometrical problems. Furthermore, in our school there are no facilities of visualization of teaching materials, no facilities of extra activities conducted to promote the knowledge about mathematics." In this issue my other student participant S₃ claims that,

"The main problem for learning geometry is due to lack of communication and the language barrier. Teaching methods adopted by teachers are not supportive and sufficient for learning mathematics. There is no teaching materials to use and parents do not support to learn. As a result, I am very poor in understanding of theorems and its proving system".

From the above view of the students I concluded that there is lack of two way communication between students and teachers due to the language. So students feel difficulty in learning geometry because teacher doesn't communicate properly with

students and he has not sufficient materials for learning mathematics and also he has not parental support because his parents are illiterate.

I also raised same issue for other Students S₄ and S₅. In this regards S₄ said that,

There was lack of two ways communication between them, use of lecture methods in teaching, lack of visual materials are the main causes of difficulties in learning geometry. So that I feel geometry as more difficult subject. I could not understand the theorems and its proving system as well as process of learning geometrical concepts. Due to these difficulties, I left practicing more about this subject. As a result, I could not learn geometry because I had not sufficient time for practice, discussion with teacher and students, not clear vision and understanding about the context”

In the same issue student S₅ said that,

“I feel very difficulties in drawing of geometrical diagrams. Because I have no basic concepts of geometrical shapes and also can't categorize the geometrical shape. So I have no ideas how to draw the figures of geometry. So I create anxiety to learn geometry.”

From the above view of my students participants S₄ and S₅ I found that lack of communication of students and teacher is difficult to learn geometry. So the students feel difficulty in learning geometry. Feeling uneasy to draw the different figures of geometry occurs mathematics anxiety. In this issue van-Hiele (1986) suggests that geometrical diagrams also remain in shapes and figures. They remain in form of rectangle, triangle, diagram, etc, knowing these figures and shapes level-0 are really very important for sketching diagrams. Many students face challenges in drawing figures (level-1). Students must recognize the figures of geometrical shapes

and know the properties and components. Otherwise they can't draw the figures properly, language barrier is a critical factor in the movement through the van-Hiele's level. In stressing the importance of language, van-Hiele notes that many failures in the teaching geometry result from language barrier. Geometry is deprived in terms of their vocabulary, some use of non-standard language and other use standard language, although sometimes imprecisely.

I also asked same question for other student S_6 said that,

"I am feeling that geometry is the hardest subject because of my pre-knowledge and teacher does not care us he used to forward lesson according to talent students only."

In this issue student S_7 kept his view,

"I feel geometry as an interesting to learn in the previous time. But some time later if teacher does not give clear concept in proving and verifying the geometry theorems. Then I feel lazy. Our teacher does not check our homework daily and he also neglects our creativity and curiosity. Teacher does not review the previous subject matter which are needed to know the geometrical ideas, So day by day I feel that geometry is a hard subject."

From the above information of students S_6 and S_7 it was found that geometry becomes hard subject because of no connection about pre- knowledge of geometry and the teacher neglects the creativity of students and also become difficult due to not giving clear concept about proving the theorem.

I also asked same issue for other student S_8 and said that,

Teachers do not use the visual materials, only daily used materials. So, we can't understand geometrical concepts, properties, and principles. When

teacher teaches us in the classroom, he doesn't give us the visual teaching materials related to topics. Therefore, I feel difficulty in solving the exercise problems. In addition, I feel difficulties in geometry because I don't understand the statement of the theorem. So, I have no any idea how to prove the geometrical theorem".

From the information of my student participant S₈ I found that due to the unuse of visual manipulative material, the student cannot have clear concept and he cannot understand statement of the problems of the theorem. In this regard, van-Hiele-**Level-2** suggests geometry taught in the secondary school should be informal. Such informal geometrical activities should be exploratory and hands-on in order to provide children with the opportunity to investigate. In learning geometry, two way communication is very important. So the teacher should involve all students in learning mathematics. According to van-Hiele, many students feel difficulty at this level. In Level-3 of van-Hiele (1986), explains that many students face challenges at this level. At this level, students seek logical basis to test there is informal knowledge about geometric objects. They also think in abstract stage about geometric properties. This level applied to lower and high school geometry where students begin to construct formal proof and supply reasons for each step of the proof.

Section: III Possible Ways to Overcome the Challenges.

To overcome the challenges of geometry teaching, I had taken the interview of 2 teachers of my two sample schools. Then from the opinion of the participant, I made the theme as follows:

Applying Collaborative Teaching –Learning Approach

The collaborative-learning style incorporated into the fabric of the school helps students to be resilient by aiding them with identifying their resources and testing their theories to see. Other things to consider are the need to create an effective classroom geography, focus on the process, build accountability, let students teach one another, and encourage students to be in tune with one another. Students quickly realize that they are able to solve problems as a group that they would not be able to solve as individuals.

In math classes, the students sit face-to-face in groups of four tables to collaborate.

Collaborative learning is grounded in constructivist theory. Knowledge is discovered by students and transformed into concepts students can relate to, reconstructed and expanded through new learning experiences. In this issue my teacher participant T₁ shared his view

“To overcome the challenges of teaching –learning process of geometry we apply collaborative approach. In applying this process teacher and students communicate to each other. Then they become clear about the subject matter.”

From the above information of teacher T₁ I found that collaborative approach is one way to overcome the challenges of geometry teaching – learning process. In this method students and teacher discuss to each other and make the subject matter clear. In this sense, Vygotsky claims learning mathematics through collaboration, their society and culture.

Avoiding Rote Memorization

While learning, rote memorization is still in practice in Nepalese mathematics classroom. The Western classrooms have turned away from this method of learning. This changing approach has much to do with cultural beliefs regarding how students learn best and what each culture values in its students. In my concern for way to overcome the challenge, my informant mathematics teacher T_2 expressed his view as,

Only the rote learning without understanding the subject matter, destroyed the student critical thinking. It destroyed the creativity of the learners. So the primary concern of the teacher is to enhance the students creativity and enjoy to learn the subject matter. Teachers are now incorporating more problem-solving and investigation activities to replace the traditional skill and drill exercises that were previously used in our schools. Then ultimately it overcome the challenges the teaching-learning.

From the above view of my informant, it was found that without understanding the subject matter, the only rote memorization is meaningless to learn mathematics. Therefore, the primary concern of the teacher is to acquire the content through understanding the subject matter. In this case the student-centered, modern, Western classroom, to be a positive experience in which students should enjoy a pleasurable learning experience. In this regards, Yetkin (2006) claims that students were given opportunities to experience success by engaging with the tasks and activities through multiple representations during collaborative as well as individual learning activities then ultimately reduce the challenges of teaching learning process.

Providing Reinforcement in the Classroom

Encouraging the student is one of the effective process to make teaching learning mathematics more interesting and help to overcome the challenges of teachers and students. In this issue, my teacher participant T₁ said that,

“I always thank the students when they do the given task. For this I managed a plan to reward the students if they do better so that gradually reduce the mathematics anxiety and address the challenges of mathematics teachers and students in mathematics teaching and learning.”

From the above interview of my informant of mathematics teacher I came to know that teacher provided reinforcement when the students do better than students become happy and gradually reduce mathematics anxiety. In this regard, van-Hiele (1986) suggests that motivation is the key component for learning which makes classroom more interacting and encouraging. Teacher should become a facilitator in the classroom and should contribute wildly for the development of the students. The friendly behavior of the students in learning always enhance the learning of the students. Hence, the modern concept of learning believes that positive reinforcement is more effective than negative reinforcement.

Integrate Culturally Relevant Content and Pedagogy in the Curriculum

Integrating culturally relevant content into mathematics curriculum is very challenging for teachers. Banks (2005; as cited in Acharya, 215) explains integration of multicultural content to mean the use of examples, metaphors, and perspectives from different cultural frames when examining concepts. Doing culturally responsive teaching involves integrating culturally relevant content into the mathematics curriculum. The research identified specific ways to integrate multicultural or

culturally relevant content. These include: using word problems that are culturally familiar, integrating social issues relevant to the students' community, and evaluating instructional materials and resources for hidden curriculum and bias. In this perspective mathematics teacher shared his views as;

“My long experience as a teacher that teacher need to be familiar with students. We need to be like a friend with students in teaching learning activities, and we have to share our cultural perspective, also we need to know students' cultural and social background. When we prepare the mathematics curriculum incorporating the contents related to students' culture Then students can solve their problem easily. For this, teacher needs to provide several examples relevant to culture and social norms. If we teach by collecting different content relevant to students' culture and social values Then the teaching learning activities will be effective. By collecting and connecting with culturally relevant content and issues we get succeed. That creates the suitable environment for teaching learning”.

This view provides that, teacher is not only the teacher s/he is also the friend and family of students. So teachers need to teach by connecting students' family background, linguistic background, social activities, job opportunities of parents, leadership positions, sports and businesses in their community.

Banks (2004; as cited in Acharya, 2015) also argue that more opportunities exist for the integration of ethnic and cultural content in other subject than in mathematics. While teaching mathematics, there are students from varieties of cultural groups. Therefore, while giving the examples, they must link with their culture. In this way it is easy to learn mathematics, there are also opportunities to integrate the mathematics and science curriculum with ethnic and cultural contents. In this sense

Acharya (2015) argues that teaching learning mathematics is to be linked with the culture of students, associating it with the real life situation, mitigating the existing dilemma of making culture unfriendly curriculum and promoting multiculturalism as well as culture friendly assessment is to be the other important aspects to make mathematics education culturally relevant.

Chapter- V

FINDINGS, CONCLUSIONS AND IMPLICATIONS

This chapter concludes my study, which I had drawn from chapter I to chapter IV. Besides finding and conclusion, it has some educational implications for further studies.

Findings

From the analysis and interpretation of data the following were major finding of the study.

Findings Related to Present Situation of Teaching Geometry

- The teaching- learning situation of geometry in Chitwan was teacher centered pedagogy. The way of teaching of teacher was one way traffic method. The teaching method was not creative the role of teachers was active and role of students were passive.
- The teaching approach of geometry was deductive rather than inductive.
- The students studying at secondary level feel difficulty in learning geometry as well as the teachers face challenges to teach the geometrical concepts.
- The problem solving method, discovering method, constructivist approaches were not used while solving geometrical problems related to their figure and properties.
- The teachers were theoretically concious to use instructional materials but practically they were unable in actual classroom teaching.
- The students learn geometry practically rather than theoretically.
- The teachers teach geometry theoretically rather than practically.

Findings Related with Challenges of Teaching Geometry

- The teacher himself is less confident to teach geometry part rather than other branch of mathematics. That is why, students face challenges in learning geometry.
- Lack of two-way communication between students and teachers due to the language and appropriate pedagogy created the problems in learning geometry.
- Not sufficient materials and not use for teaching- learning process of geometry.
- Feeling uneasy to draw the different figures of geometry occurs mathematics anxiety and students feel geometry is a hard subject. Teacher neglects the creativity of students and also become difficult due to not giving clear concept about proving the theorem.
- Due to the not use of visual manipulative material in teaching process of geometry.

Findings Related to Overcome the Challenges

- Applying collaborative teaching –learning approach
- Avoiding rote memorization
- Providing reinforcement in the classroom
- Integrating culturally relevant content and pedagogy in the curriculum

Conclusions

This study was concerned with present situation in teaching geometry at public school. From the above findings of this study, it can be concluded that learning geometry was not satisfactory in Bhandara municipality of Chitwan district. Teachers and students face challenges in learning geometry due to not use of appropriate

teaching- learning pedagogy, less understanding of geometrical concepts and teachers teach geometry theoretically rather than practically. Similarly, to overcome these challenges by applying collaborative teaching –learning approach, avoiding rote memorization, providing reinforcement in the classroom, integrating culturally relevant content and pedagogy in the curriculum. Then geometry teaching- learning situations become interesting and meaningful.

Educational Implications of the Study

This study has the following implications:

- This research is helpful for professional development of mathematics teachers that way it is helpful for teachers.
- It is equally helpful for students, researchers, institutions, educationists and policy makers to improve their field.
- To enhance co-operative teaching- learning in mathematics at school.
- It is helpful to promote the student centered approach in classroom.
- To develop the friendly relation between school teachers and students.
- To enhance equality and equity in mathematics classroom.
- It is helpful to develop inclusive mathematics classroom.
- It is helpful to improve my professional field.

REFERENCE

- Acharya, B. R. (2017). *Diversity in mathematics education*. Kathmandu: Pinnacle Publication.
- Acharya, B. R. (2013). *Studies in mathematics education*. Kathmandu: Dikshant publication.
- Acharya, B. R. (2015). *The study on inclusive mathematics Classroom practices in schools of Arghakhanchi district*. Journal of mathematics education forum: I (37), p 36-37.
- Acharya, B. R. (2015). *Foundation of mathematics education*. Kathmandu: Dikshant Prakashan.
- Attreya, R. P. (2006). *A study of problem faced by mathematics teachers to maintain positive discipline in secondary level classroom*. An unpublished Master's Thesis, Department of Mathematics Education, T. U., Kirtipur.
- Bist, R. K. (2009). *A study on problems faced by secondary school mathematics teacher in teaching Mathematics*. An unpublished Thesis, Central Department of Mathematics Education, T.U.
- Bhatta, D. (2014). *Students difficulties in learning geometry*. An unpublished Master's Thesis, Department of Mathematics Education, T. U., Kirtipur.
- Bhattarai, T. (2005). *A study of problems faced by the mathematics Students in existing Curriculum*. An unpublished Master's Thesis, Department of Mathematics Education, T. U., Kirtipur.

- Chaudhary, S. (2014). *Difficulties faced by students in learning geometry at Lower secondary level*. An unpublished master thesis, Central department of education, T.U., Kirtipur.
- Denzin, N. K., & Lincoln, Y. S. (Eds.) (1994.) *Handbook of qualitative research*. Thousand Oaks, CA: Sage.
- CERID, (1998). *I study on secondary education in Nepal*. Kathmandu; CERID.
Google search
- Gyawali, S. (2009). *Effectiveness of van Heile's approach in geometry at secondary level*. An unpublished Master's Thesis, Department of Mathematics Education, T. U., Kirtipur.
- Gradler, M. (2009). *Learning and instruction theory into practice*. New Jersey, NJ: Pearson.
- JER, (Vol. 4, No. 1, 2014). *Journal of Education and Research*. A Publication of Kathmandu University, School of Education.
- JME, (Alpha-Bita). (2067). *Journal of mathematics Education*. A published of Mathematics Education Student Society.
- KC, N. (2009). *A study of problems faced by students in compulsory mathematics at secondary level*. An unpublished Master's Thesis, Department of Mathematics Education, T. U., Kirtipur.
- Lamichane, H. (2001). *A study of problems faced by the secondary level mathematics teachers in teaching mathematics*. An unpublished Master's Thesis, Department of Mathematics Education, T. U., Kirtipur.

- Limbu, D. P. (2007). *A study of problem faced by students in geometry at secondary level*. An unpublished Master's Thesis, Department of Mathematics Education, T. U., Kirtipur.
- MEF, (Vol. 2, Issue no. 36, 2014). *Mathematics Education Forum*. A Publication of Council For Mathematics Education, Kathmandu, Nepal.
- MEF, (Vol. 1, Issue no. 37, 2015). *Mathematics Education Forum*. A Publication of Council For Mathematics Education, Kathmandu, Nepal.
- MEF, (Issue 2, 2072). *Mathematics Education Forum*. A Publication of Council For Mathematics Education, Chitwan Branch, Nepal.
- Nepali, S. (2014). *A study on errors committed by grade VII students in geometry learning*. An unpublished master's thesis, Central department of education, T.U., Kirtipur.
- Pandit, R. P. (2004). *Teaching mathematics*. (four ed.). Kathmandu: Ananta Prakashan.
- Sharma, L. N. (1997). *A study of understanding of geometric ideas of grade-8 students of gorkha District*. An unpublished Master's Thesis, Department of Mathematics Education, T. U., Kirtipur.
- Sharma, L.N. (2011). *Qualitative research*. Kathmandu, Nepal: paluwa prakashan Pvt. Ltd.
- S. C. (2014). *Difficul Ties Faced By Stydents in Learning Geometry at Lower Secondary Level*. An unpublished Mastter Thesis, Department of Mathematics Education, T. U., Kirtipur.

- Sapkota, P. P. (2008). *Problems faced by students in Mathematics Learning and its impact in the examination*. An unpublished Master's Thesis, Department of Mathematics Education T. U.
- Thakuri, P.B.(2011). *Problems face by students in geometry at secondary level of Jajarkot District*. An unpublished master's thesis, Central department of education, T.U., Kirtipur.
- Tsay, M., & Barady, M. (2010). A case study of cooperative learning and communication pedagogy: Does working in teams make a difference? *Journal of the Scholarship of Teaching and Learning*, 10(2), 78-89.
- Upadhyay, H. P. (2064 BS). *New trend in mathematics* (second ed.). Kathmandu: Vidyarthi Prakashan .
- Upadhyay, H. P. (2064 BS). *Teaching mathematics* (second ed.). Kathmandu: Ratna Pustak Bhabdar.
- Upadhyay, H. P., Pradhan, J. B., & Dhakal, B. P. (2067). *Trends in mathematics education*. Kathmandu: Balbalika Education Publication Pvt. Ltd.
- UNESCO (1992). *The Educational Administrator and instructional materials*.
- Vygotsky, L. S. (1987). Thinking and speech. In R. W. Rieber and A.S. Carton (Eds.), *The collected works of L.S. Vygotsky, Volume 1: Problems of general psychology* (pp. 39-285). New York: Plenum Press.
- van-Hiele, P. M. (1986). *Survey and Insight*. Orlando, Florida: Academic press.
- Weimer, M. (2002). *Learner-centered teaching: Five key challenges to practice*. San Francisco, CA: Jossey-Bass.

- Yetkin, I. E. (2006). The role of classroom context in student self-regulated learning: An exploratory case Study in a sixth-grade mathematics classroom. Unpublished dissertation of Degree of Doctor of Philosophy in Education. The Ohio State University.
- Yin, R. K. (2009). *Case study research design and methods: Applied social research method series* (4th ed.) Thousand Oaks, CA: Sage.
- Zainal, Z. (2007). Case study as a research method. *Jurnal Kemanusiaan*, 9, 1-6.

APPENDIX-A

Interview Format for Teacher

Name: Qualification:

Age: Sex:

Teaching experience: Training:

School's Name:

Location: Rural/Urban

Nature: Government/ Private

Research Question: (For Teacher)

- i How do students learn geometry at public school?
- ii How do teachers teach geometry at public school?
- iii. What is the present situation in teaching geometry at public schools?
- iv. What are the challenges of the teachers and the students teaching geometry at public school? .
- v. What are the possible ways to overcome these challenges?

APPENDIX-B

Interview Format for Student

Name:

Age: Sex:

Father's name:

Qualification: Occupation:

Mother's name:

Qualification: Occupation:

School's name:

Location: Rural/urban Nature: Government/Private

Time to reach school: Grade :.....

Research Question: (For Students)

- i How do students learn geometry at public school ?
- ii How do teachers teach geometry at public school ?
- iii. What is the present situation in teaching geometry at public schools ?
- iv. What are the challenges of the teachers and the students teaching geometry at public school ?
- v. What are the possible ways to overcome these challenges ?

Appendix –C

Class Observation Guidelines

Name of the teacher: Class observed by:

Grade: Period: Subject:

Title:

School:

Date: Time:

The class observation guidelines

Basis of class observation
Classroom management
Use of teaching material in the class room
Teaching method
Discussion with students/ class work
Teacher's activities
Student participation
Difficulties in learning related to geometry topics
Language barrier
Motivation towards geometry

Appendix-D

Guidelines for Interview with compulsory Mathematics Students

Name: Age: Sex:

Father's name: Qualification: Occupation:

Mother's name: Qualification: Occupation:

School's name:

Location: Rural/urban

Nature: Government/Private

Time to reach school:

The researcher took an interview with the compulsory mathematics students on the basis of following topics:

S. N.	Interview basis	Very good	Good	Need to be improved
1.	Teacher's behavior towards students			
2.	Relationship between teacher and students			
3.	Use of visual aids			
4.	Opportunity to study at home			
5.	Teacher's response with them			
6.	Questioning system of mathematics class			
7.	Concepts of figures of geometry			
8.	Drawing figures of geometrical shapes			
9.	Measurement of angles arcs			
10.	Use of language			
11.	Interaction with teachers			
12.	Educational environment of classroom management			
13.	Teaching learning activities			
14.	Opportunity of group works provided by the teacher in classroom			

Appendix-E

Guidelines for Interview with Compulsory Mathematics Teacher

Name:Qualification:

Age: Sex:

Teaching experience: Training:

School's Name:

Location: Rural/Urban

Nature: Government/ Private

The researcher took an interview with the compulsory mathematics teachers on the basis of following topics:

S.N.	Interview basis	Very good	Good	Need to be improved
1.	School facilities			
2.	Participation of students in mathematics class			
3.	Use of lesson plan			
4.	Two ways communication			
5.	Relationship between teachers and students			
6.	Extra class of mathematics			
7.	Problems in learning geometry			
8.	Teaching strategies that adopted to teach geometry			
9.	Preparation of materials in geometry teaching			
10.	Home environment			
11.	Classroom management			
12.	Teaching learning activities			
13.	Instructional materials: (Effectiveness, time, use etc)			
14.	Use of ICT and visual teaching materials			
15.	School environment of learning			

