<center>**Chapter-I**</center>

<center>**INTRODUCTION**</center>

**Background of the study**

The growth and development of geometry is seen from ancient age. Babylonian geometry is intimately related to practical menstruation. The chief feature of Babylonian geometry is its algebraic character on the essentially nontrivial algebra problems. Geometry is considered as a tool for understanding, describing and interacting with the space (with and without motion) in which we live,  perhaps the most intuitive, concrete and reality linked part of mathematics. The outstanding historical importance of geometry in the past, in particular as a prototype of an axiomatic theory, is so universally acknowledged that it deserves no further comment, Moreover, in the last century and specifically during the last decades, as Jean Dieudonne asserted at ICME IV(Berkeley,1980), Geometry "*bursting out of its traditional narrow confines has revealed its hidden powers and its extraordinary versatility and adaptability, thus becoming one of the most universal and useful tools in all parts of mathematics".(ICMI VI,1980)*

Some aspects of geometry can be stated as the science of space. Geometry, as a method for visual representations of concepts and process from other areas in mathematics and in other sciences eg: graphs and graph theory, diagrams of various kinds, vector geometry, geometry is a meeting point between mathematics as a theory and mathematics as model resource. Geometry is a way of thinking and understanding and at a higher level, as a formal theory, geometry is a paradigmatic example for teaching deductive reasoning, geometry is a tool in applications both in traditional and in innovation. The thinking about vector became many years later than the thinking about geometry, when we consider the geometrical concepts, ideas with motion or

sense; it is becoming the creation on the ideas of vector, vector, the concept of geometry on real world, is application of geometric or graphic constructions.

One of the new applications of mathematics is the concept of vectors at school level. The history of the development of vector concept started only in the middle age of 19th century in the beginning stage the American physicist Josiah Willard Gibbs (1839–1903) encountered by every student of elementary physics. A vector is graphically reared as a directed line segment or arrows and the vector are made of addition and multiplication.

According to Murray R. (1973), "In recent years vector is an essential part of mathematics background required for engineers, physicists, mathematicians and other scientists, it might very well be considered as the most rewarding language and made of through for physical science."

After the implementation of the act, optional mathematics has been included as the first optional paper in the secondary level. The National Education Commission (2049-2050). Was added important  suggestion for improvement of education, Curriculum Development Centre (CDC) reformed the curriculum of subjects of all levels, Accordingly in 2056- 2057 the new topics such as vectors, Transformations, Relation & Function and Linear programming problems were included  in the curriculum at secondary level optional mathematics paper.

The course of study of S.L.C. examination was the combination or course of study of class nine and ten, but according to the challenge and requirement of 21st century on education, Ministry of Education determined from 2063 that the question will be taken for S.L.C. examination is only from the course of study of grade ten.

Difficulties related to mathematics learning directly affect the achievement of mathematics. This is a great threat to the mathematics teacher. Some problems of

learning mathematics for student might directly be related to teachers' academic background, classroom practices, school management and leadership. Other problems of learning mathematics are concerned with the pre-knowledge of students. Similarly, difficulties on the basis of literature are attention difficulties, computational difficulties, organizational difficulties, language, connection difficulties, difficulties due to the pre-knowledge of students' and output difficulties. Generally students may feel difficulty while learning mathematics problems related to the understanding of new concepts and relations, Bhattarai (2005) showed the sources of problems in learning are relevancy of textbook in daily life, teaching learning activities, classroom management, physical facilities, evaluation techniques and inherent potentiality and circumstances of the individual learners.

Vector quantities are those which have magnitude and direction. Force, Acceleration, Velocity, and displacement etc are all examples of vectors. It is represented by directed line. In written form it is written as $\rightarrow$ sum of two vectors is a vector as well as the addition of vector does not obey arithmetic rule. Product of two vectors may be a vector or scalar.

From the above sentence, it is usually seen that those students and teacher who have been teaching- learning mathematics, are facing with number of problems to deal with. The problems which are occurring to mathematics are also the difficulties on vectors learning. The main purpose of this study is to explain some difficulties of students' in learning vector geometry at secondary level.

**Statement of the Problems**

Through my own experience of teaching at Kaligandaki higher secondary Boarding School, Baglung-6 Baglung, as well as during my practice teaching of B.Ed and learning period of my secondary level, I had faced difficulties while teaching and

learning vector geometry. Also most of the students say that, they felt vector geometry as more difficult than other topics. So I selected this problem as research. The mathematical concept is given from the basic level to secondary level but vector geometry is new concept for student in secondary level, However teacher seldom use teaching material while teaching mathematics especially on this topic. So students were less interested to learn geometry especially on vector. The present techniques of teaching would not be sufficient for them. To change the method of teaching, the difficulties of student in learning vector geometry is necessary. Students do not have pre knowledge to learn vector so there will be needed effective teaching process and method which we do not manage. Therefore there arise different difficulties in learning vector geometry. The study based on the following question.

）What are learning difficulties in vector geometry at secondary level? How do they affect students' learning?

）How can we minimize the difficulties in learning vector geometry?

**Objectives of the Study**

All research studies have their own objectives. In this sense, this current study cannot be an exception. The broad objectives of this study show the condition of students in vector geometry, how they learn vector?  The main objectives of this study were as follow.

）To explore the different kinds of difficulties in learning vector geometry at secondary level.

）To find out the way for minimizing the difficulties in learning vector geometry at secondary level.

**Significance of the Study**

Geometry is taught as an essential and important component of school level curriculum. It has been taught as compulsory subject at any level of school education program. In spite of important role of geometry in increasing creativity, most of the students dislike it and afraid of it. Similarly vector geometry is a branch of geometry which is more important to show both magnitude and direction. In the study of science and machine, we can't define how much force is used in which direction without vector and vector geometry. Though it is necessary to learn vector and vector geometry, most of the student felt difficult to learn it. Students have not clear concept about vector geometry. Still students try to solve the vector geometric theorems but they cannot organize properly with stepwise solution because of its lack of pre knowledge. As a result, most of the students lose their interest in learning vector and vector geometry at secondary level. Thus the significances of this study were as follow.

) Its findings are supportive to improve the mathematics achievement of students understanding.

) It helps to students and teachers for vector geometry teaching and learning.

) This study opens the door for the further study about the problem of vector geometry.

) It provides the appropriate information about difficulty faced by students in learning vector.

**Delimitation of the Study**

The research was case study research so it cannot be generalized to all over the students of different place of nation. It had concerned with only one school of secondary level in Baglung district. The delimitations of the study were as follows.

) This study concerned to only with Baglung district.

⟩ This study is delimited only in secondary level.

⟩ This study carried out only a government school and problems of students to learn vector geometry.

⟩ The study was completed on the basis of interview, observation forms and recorded history of schools.

⟩ This study covered only vector and vector geometry part of optional mathematics at secondary level.

**Definition of Related Terms**

**Secondary level students**

In this study students means those who are reading at secondary level and taken optional mathematics.

**Difficulties**

Difficulty means obstruction or problem in learning vector geometry at secondary level.

**Vector**

Those quantities which have magnitude and direction and satisfy the vector geometric properties are called vector quantities. It is represented by directed line.

**Vector geometry**

Any specific system of vector that operates in accordance with a specific set of assumptions is called vector geometry.

**Learning difficulties**

Learning difficulties is a general term which refers to children or students who express problem or obstacle with their learning, especially on vector geometry.

**Attention difficulties**

Attention difficulty means that, students who do not focus their mind in mathematical task or student misbehave in the class during the period of learning vector geometry.

**Computational Weakness**

Those students who are inconsistent at computing are called computational weakness.

**Organizational difficulties**

Students have problem in organization and difficulties in multiple steps or elements of a problem are organizational difficulties.

**Language difficulties**

Language difficulties is difficulty with the vocabulary of math be confused by terminology in word problems.

## Chapter –II

## REVIEW OF THE RELEATED LITERATURE

Review of the related literature is made in order to know has already been done to determine what is to be done in the concern area to be studied. It is essential to review the related literature for introducing the problem clearly, to significant the research clearly, to select the appropriate research method, to determine the process of data collection and analysis. Also a review of the related literature is the source of the further study of the research which provides the better idea for the surveying in the whole research. I have reviewed some of the literatures which are given below.

**Empirical literature**

The empirical study of literature is an interdisciplinary field of research which includes the psychology, sociology, Philosophy, the contextual study of literature, and the history of reading literary text. The object of study of the empirical study of literature is not only the text in itself, but the roles of action within the literary system, namely, production, distribution, reception, and the processing of texts. The methods used are primarily taken from the social sciences, reception theory, cognitive science, psychology, etc. In general the steps to be taken in empirical research are the formation of a hypothesis, putting it into practice, testing, and evaluation. More concretely, for the study of reader response a wide array of techniques are used, ranging from protocol techniques and thinking aloud protocol to pre-structured techniques, such as the semantic seven point scale discourse analysis, association techniques, etc.

**Sharma (2000)** did study "A comparative study of the achievements of students of grade IX in the topic vectors of secondary school curriculum". The objective of this

study was to examine the appropriateness of vector content secondary level curriculum on the basis of content weightage perspective and re-organizational perspective, to examine the relevancy of vector contents of secondary level. This study was descriptive survey type. In addition it is qualitative and observational as well. The major findings of this study were the topic vector is appropriate to study in optional mathematics at grade IX of secondary level.

**Pangali (2012)** did study on "Difficulties in learning arithmetic at grade IX" with the objectives, to identify the difficulties in learning arithmetic of grade IX students and to find out the causes of difficulties in learning arithmetic of grade IX students. The sample of this study was only one school of Surkhet of only five students who are reading in grade IX. The main instruments of this study were observation, written test, and interview. The study was concluding that the learning environment of students is not supportive.

**Ghimire (2013)** did study on "difficulties of bote students in learning mathematics" with the objective to identify the difficulties of bote student in learning mathematics at lower secondary level and to analyze major causes of difficulties in learning mathematics. The sample of this study was two secondary school of vays municipality. Observation & interview were the main instruments of this study. The study concludes that difficulties related to cultural background, socio-economic condition, parental involvement and interaction and motivation.

**Paudel (2014)** did study on "difficulties in learning trigonometry". The main objective of this study was to find the causes of difficulties in learning trigonometry and to minimize the difficulties in learning trigonometry at secondary level. For the sample

one public school and private school was selected. Class observation and interview was used for the data collection. The study concludes that there was not sufficient material for learning trigonometry and due to the lack of interactive classroom student feels difficulties in learning trigonometry.

**Sharma (2011)** did study on "problem faced by student and teacher in teaching and learning activities on vector at secondary level". The main objective of this study was to find the problems on teacher and student in teaching learning activities on vector & to identify the pre-knowledge of students and teacher in vector as well as to determine attitude, belief and interest of student on vector. The sample of this study was only two school of urban and rural area each of them six student were selected. For the data collection observation and interview was used as a tool. The study concludes that giving lecture and using chalk and board only may not help average and below average students to understand mathematical concepts of vector in normal class. There was a lack of motivation and encouragement about vector class.

**Hanich (2001)** did study on performance across different areas of mathematical cognition in children without learning difficulties; performance of 2010 second grader in the different area of mathematical cognition was examined. Children with difficulties in mathematics performed across worse than normally achieving groups in most areas of mathematical cognition. Those with difficulties only in mathematics show an advantage over the group with difficulty in both mathematics and reading.

**Luitel (2015)** did study on "difficult area in arithmetic a case study of deaf student" with the objective to locate the difficult areas in arithmetic and to relate with their causes. This study was qualitative inquiry and information gathering process in the

form of case study. Most of the people have felt that deaf children have negative idea about mathematics but this case study concludes that they did have good vision of the mathematical concepts.

Among the above researcher had studied in different topic related to vector and others. I have tried to search as much as possible about research on vector geometry. But I found only one research about vector. He studies problem face by teacher while teaching on vector also he left the gap on learning difficulties on vector geometry. I had faced difficulties on learning vector geometry when I am in secondary level. So i select this topic as a research to find the difficulties on learning vector geometry.

**Theoretical Literature**

There are so many theories which can be used to understand the learning difficulties in mathematics. There are structural functionalist theories, learning theories, cultural language theories, learning disability theory and so on. Among them the researcher was used learning disability theory and burner constructivist theory.

**Learning disability theory**

Learning disability is a classification that includes several areas of functioning in which a person has difficulty learning in a typical manner, usually caused by an unknown factor or factors. Given the "difficulty learning in a typical manner", this does not exclude the ability to learn in a different manner. Therefore, some people can be more accurately described as having a "Learning Difference", thus avoiding any misconception of being disabled with a lack of ability to learn and possible negative stereotyping. While learning disability, learning disorder and learning difficulty are often used interchangeably, they differ in many ways. Disorder refers to significant

learning problems in an academic area. These problems, however, are not enough to warrant an official diagnosis. Learning disability on the other hand, is an official clinical diagnosis, whereby the individual meets certain criteria, as determined by a professional (psychologist, pediatrician, etc.). The difference is in degree, frequency, and intensity of reported symptoms and problems, and thus the two should not be confused.

The unknown factor is the disorder that affects the brain's ability to receive and process information. This disorder can make it problematic for a person to learn as quickly or in the same way as someone who is not affected by a learning disability. People with a learning disability have trouble performing specific types of skills or completing tasks if left to figure things out by themselves or if taught in conventional ways.

Some forms of learning disability are incurable. However, with appropriate cognitive/ academic interventions, many can be overcome. Individuals with learning disabilities can face unique challenges that are often pervasive throughout the lifespan. Depending on the type and severity of the disability, interventions and current technologies may be used to help the individual learn strategies that will foster future success. Some interventions can be quite simplistic, while others are intricate and complex. Current technologies may require student training to be effective classroom supports. Teachers, parents and schools can create plans together that tailor intervention and accommodations to aid the individuals in successfully becoming independent learners. School psychologists and other qualified professionals quite often help design the intervention and coordinate the execution of the intervention with teachers and parents. Social support may improve the learning for students with learning disabilities.

In the 1980s, NJCLD defined the term learning disability as: a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning or mathematical abilities. These disorders are intrinsic to the individual and presumed to be due to Central Nervous System Dysfunction. Even though a learning disability may occur concomitantly with other handicapping conditions (e.g. sensory impairment, intellectual disability, social and emotional disturbance) or environmental influences (e.g. cultural differences, insufficient/inappropriate instruction, psychogenic factors) it is not the direct result of those conditions or influences. It used the term to indicate a discrepancy between a child's apparent capacity to learn and his or her level of achievement Retrieve from https://en.m.wikipedia.org/wiki/learning_disability

**Bruner (1966)** A major theme in the theoretical framework of Bruner is that learning is an active process in which learners construct new ideas or concepts based upon their current/past knowledge. The learner selects and transforms information. Constructs hypothesis and makes decisions, relying on a cognitive structure to do so. Cognitive structure (i.e, schema, mental models) provides meaning and organization to experiences and allows the individual to "go beyond the information given".

As far as instruction in concerned, the instructor should try and encourage students to discover principles by themselves. The instructor and student should engage in an active dialogue ( i.e., Socratic learning). The task of the instructor is to translate information to be learned into a format appropriate to the leaner's current state of understanding. Curriculum should be organized in spiral manners so that the student continually builds upon what they have already learned.

Bruner (1966) states that a theory of instruction should address four major aspects: (1) predisposition towards learning, (2) the ways in which a body of knowledge can be structured so that it can be most readily grasped by the learner, (3) the most effective sequences in which to present material, (4) the nature of pacing of rewards and punishments. Good methods for structuring knowledge should result in simplifying, generating new propositions, and increasing the manipulation of information.

In this more recent work, Bruner (1986, 1990, 1996) has expanded his theoretical framework to encompass the social and cultural aspects of learning as well as the practice of law. ( retrieve from http://carbon.cudenver.edu/~mrydeer/itc data/constructivism.html. )

Bruner describes the general learning process in the following manner. First the child finds in his manipulation of the materials regularities that correspond with intuitive regularities it has already come to understand. According to Bruner the child finds some sort of match between what it is doing in the outside world and some models or templates that it has already grasped intellectually. For Bruner it is seldom something outside the learner that is discovered. Instead, the discovery involves an internal reorganization of previously known ideas in order to establish a better fit between those ideas and regularities of an encounter to which the learner has had to accommodate.

**Dr. Levine (2002)** did a study on "All kinds of minds" with the attention difficulties of students. Those who had attention difficulties tend to have disruptive behaviors that could not be described as being of psychiatric nature. The behaviors were not age appropriate, so an older person may misbehave in similar way to much younger peer. Students were distracted during vector tasks. Individuals have difficulty focusing

their attention to completed a specific task lose their place while working on a vector problem. Some research shows that students with hyperactive impulsive attention symptoms tend to have more behavioral problems, while those with the inattentive types had a higher risk of depression or anxiety disorders. Students were appearing mentally fatigued when doing vector. Many factors contribute to attention defect disorder, including neurological factors such as the control of impulses and concentration as well as genetic, inherited and environmental factors. Attention abilities help children maintain a steady focus on the details of mathematics. For example, children must be able to distinguish between a minus and plus sign sometimes on the same problem.

For the attention difficulties in vector to teach children how to self monitor. During a task, show children how to stop and assess how well they are progressing. For example, tell them "every 10 minutes you will need to stop and check your answer". Teach children to ask themselves questions such as "How is it going?" and, "Do I need to make changes?" Does my answer make sense?" and "Does my answer match my estimate?" help children maintain mental energy. Allow them to take frequent breaks while completing vector assignments. Suggest that they get up and walk around during these breaks. Teach self –checking strategies. Students have change to a different color pen when they had finished their work, becoming a "test checker" instead of a "test taker". This will help them notice their errors. For students who continue to make attention errors in calculation, despite instruction and practice with self-checking, permit the use of calculator for checking. Provide with model with work through the mathematical problem with the child verbalizing or demonstrating each step. Especially with homework, assist the child by doing the first problem together.

Identify the topic of interest to children for explore mathematical or arithmetical concepts in relation to motivating topics, such as building a skateboard ramp, tracking a satellite's orbit around the earth, discovering how the pyramids were built, or saving money in an interest –bearing account. Ask students to help you identify topics for mathematical or vector problems. Have children found on one step at a time. For example, provide mathematical activities in which children identify only (1) what the question was asking them to find,(2) which information was necessary to answer the question, and (3) which operation should be used in solving the problem. Attention abilities help children maintain a steady focus on the details of mathematics. For example, children must be able to distinguish between a minus and plus sign sometimes on the same page, or even the same problem. In addition student must be able to discriminate between the important information and the unnecessary information in word problems. Attention also plays an important role by allowing children to monitor their efforts; for instance, to slow down and pace themselves while doing math, if needed.

**Louden (2000)** did a study on "signs of vector geometric difficulties" with different learning difficulties in vector which are output difficulties that becomes students are unable to recall basic math facts, procedures, rules or formulas. Students' also forget what he or she is doing in the middle of a math problem. Organizational difficulties that become students have difficulties sequencing multiple steps. Students are distracted during math task. Learners whose skills are below expectation for their age and ability may be identified by presents or caregivers, centre and schools as having

learning difficulties. There is wide range of characteristics which may impact on learning in a variety of ways.

**Westwood (2000) and Carnellor (2004)** highlight the importance of educators using a judicious blend of constructivist and explicit teaching with ample guided practice/scaffolding toward independence. Where does this leave one-to-one instruction and drill activities that have long been the mainstay of many mathematics remediation programs? Before any practice is undertaken, a secure understanding of underpinning concepts, where new learning sis linked to previous learning, must be assured. If not, it may become a cycle of practice and forget, practice and forget. How often has one heard said, "I taught him/her and it's already forgotten'? A response might be "How do you know he/she understood it in the first place?" Sherman, Richardson and Yard (2005) believe that students with learning difficulties are given tedious and boring activities to develop the basics. They go on to remind educators that it is critical that the same content not be taught year after year, in almost the same manner of delivery. Students who did not "get it" the first time are not likely to "get it" the next several times it is taught in the usual manner. This may be where technology can provide a different way to develop conceptual understanding (More about this later). It has also been suggested that doing more of the same low level tasks not only narrows the curriculum but that it does not enable a student to show what they truly know and can do. Instead of watering down, educators must program-up and have ambitious but achievable goals.

**Conceptual Understanding of the Study**

This study tried to find out the difficulty in learning vector at secondary level students from the already described different empirical and theoretical literature, the following conceptual framework has purposed to identify the difficulties and to find out how to minimize difficulties in learning vector geometry at secondary level. According to WBGH 2002 educational foundation, written by Dr. Levine. The following were the difficulties in learning vector at secondary level.

**Attention Difficulties**

Those who have attention difficulties tend to have disruptive behaviours. The behaviours are not age appropriate, so an older person may misbehave in similar way to much younger peer. Students are distracted during vector tasks. They are discussing about out of things when vector learning. Individuals have difficulty focusing their attention to complete a specific task. Also they lose their place while working on a vector problem. Students were appearing mentally fatigue when doing vector exercise. Attention abilities help children maintain a steady focus on the details of mathematics.

**Computational Difficulties**

Many students, despite a good understanding of mathematical concepts, are inconsistent at computing. They make errors because they misread signs or carry numbers incorrectly, or may not write numerals clearly enough or in the correct column. These students often struggle, especially in primary school, where basic computation and "right answers" are stressed. Often they end up in remedial classes, even though they might have a high level of potential for higher-level mathematical thinking.

**Connection Difficulties**

Some students have difficulty making meaningful connections within and across mathematical experiences. For instance, a student may not readily comprehend the relation between numbers and the quantities they represent. If this kind of connection is not made, math skills may not be anchored in any meaningful or relevant manner. This makes them harder to recall and apply in new situations.

**Output Difficulties**

A student with problems in output may be unable to recall basic math facts, procedures, rules, or formulas be very slow to retrieve facts or pursue procedures have difficulties maintaining precision during mathematical work have difficulties with handwriting that slow down written work or make it hard to read later have difficulty remembering previously encountered patterns forget what he or she is doing in the middle of a math problem.

**Organizational Difficulties**

A student with problems in organization may have difficulties sequencing multiple steps become entangled in multiple steps or elements of a problem lose appreciation of the final goal and over emphasize individual elements of a problem not be able to identify salient aspects of a mathematical situation, particularly in word problems or other problem solving situations where some information is not relevant be unable to appreciate the appropriateness or reasonableness of solutions generated.

**Language Difficulties**

A student with language problems in math may have difficulty with the vocabulary of math be confused by language in word problems, not know when irrelevant

information is included or when information is given out of sequence. Most of the
students have following difficulty in vector

) have trouble learning or recalling abstract terms

) have difficulty understanding directions

) have difficulty explaining and communicating about math, including asking and
answering question.

) Have difficulty reading texts to direct their own learning.

To fulfill the objective of the study researcher mentioned the following model
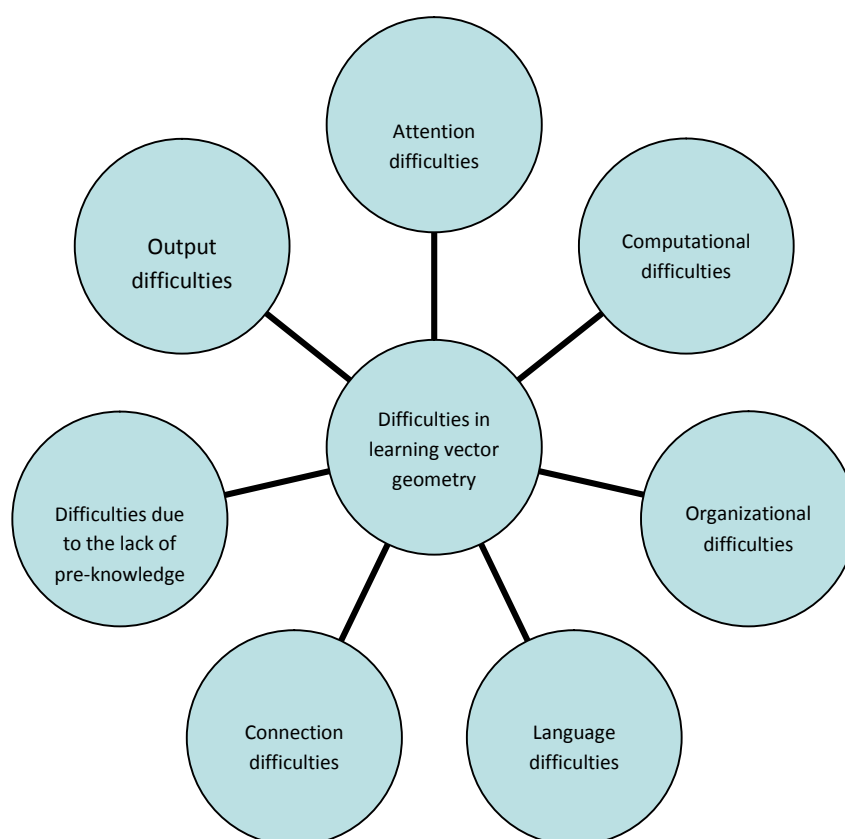


Source: 2002 WBGH, Educational Foundation, from the story of Nathan V, Lauren Sarah Lee written by
Dr. Levine.

## Chapter - III

## METHODS AND PROCEDURES

Methods refer to technique and procedure used in the process of data gathering. It is to venture generalizations from the success of particular techniques, suggesting new applications and to unfold the specific bearing of logical and metaphysical principle on concrete problems, suggesting new formulations (kalpan, 1973). This chapter deals with the design, site selection, selection of respondent, tools and procedure of the study which is carried out to achieve the objective and get the answer of statement of the problems.

### Design of the Study

This study was based on case study related to difficulties of secondary level in learning vector geometry. A qualitative descriptive study is one in which information is collected without changing the environment (i.e., nothing is manipulated). It was a descriptive because it aimed to describe the events or situation addressing the learning difficulties of the student and teachers. Case study research is more than simply conducting research on a single individual or situation. This approach has the potential to deal with simple through complex situations. It enables the researcher to answer "how" and "why" type questions, while taking into consideration how a phenomenon is influenced by the context within which it is situated. For the novice research a case study is an excellent opportunity to gain tremendous insight into a case. It enables the researcher to gather data from a variety of sources and converge to the data to illuminate the case.

This study is based on qualitative descriptive research with case study especially concerned with exploring meanings and the way, how to people understand about difficulties in learning vector geometry? Since the design of the research based on

descriptive qualitative on which meaning derived from the total picture, logic and reasoning of why it was like that, how linking with theories & proposition. This study view on the reality the interaction in difficulties on vector geometry learning in case school with students' and teachers.

**Site Selection**

This study did in a public school situated in Baglung-6 Mulpani Baglung which was Mulpani higher secondary school, Mulpani Baglung. Researcher had been reading at that school from 2051-2060 as well as doing teaching practice at that school while he was in B.Ed level. Also the researcher had taken tuition class of class 10 at that school for two years .Therefore researcher is familiar with the educational and physical environment of the school. The result of Mathematics was poor than other subject at secondary level. However, the school could not improve the poor result of mathematics yet. So, for finding main difficulties in learning mathematics or vector geometry researcher selected this school. The school was selected in purposive manner.

**Selection of Respondents**

The respondents of this research were students; mathematics teacher and head teacher of the selected school. They were selected purposively. From the secondary level of that school, seven students were selected as the respondents for the interview. The criteria of selecting students will be different ethnic/caste, gender, talent and weak student  c family status about education. Those students are said to be talent who score high in test exam and weak those who score below the average.

**Tools**

This study was qualitative descriptive research so that the researcher collected data only by the primary sources and analyzed with the help of literatures. In this study the following tools were used.

**In-depth interview**

Interview is two directional interactions between interviewer and interviewee. In this research, researcher used in-depth interview guidelines with respondents on semi structure form. The researcher took the interview to achieve the objectives. The interview guidelines was designed on the basis of attention difficulties, computational difficulties, organizational difficulties, language difficulties, connection difficulties, output difficulties and difficulties due to the lack of pre-knowledge of student etc. The researcher took interview with students, mathematics teacher and also Head teacher. Researcher constructed three semi structural interview guidelines separately for students, mathematics teacher and head teacher.

The Appendix 4 was used for head teacher to find out physical facilities, learning environment, policy of school and parental involvement in schools. Researcher took the interview two times with head teacher on the basis of semi structural guidelines tools (Appendix 4). Second form used for mathematics teacher to find out difficulties on vector learning and teaching, teaching strategies, use of teaching materials while vector teaching effect of organizational difficulties in learning vector, effect of language in learning vector.  Similarly researcher had taken two times interview with the mathematics teacher on the basis of Appendix 3. Third form used for student to find out difficulties on vector learning, student attitude, interest on vector, difficulties while using formulas, difficulties with the vocabulary of vector, confused by language in theorem, difficulties in sequencing of multiple steps, speed of hand writing mentally fatigued or not in class room, pre knowledge to learn vector. Researcher had taken two times (two different days for each student) interview with selected students by using appendix 2. At the time of interview the researcher noted the opinion of respondent carefully by using paper as well as recorded the opinion on mobile.

### Observation

As a data gathering device direct observation makes an important contribution to descriptive research. Researcher taught two different theorems in his research duration for exploring the difficulties. The observation of the study was taken on the basis of difficulties and observational note. Researcher had taken four days class observation during the vector geometry class by using appendix 1. At that time researcher could watch, listen, interact, and record the essential data during the teaching period.

### Test

Test is a kind of assessment which was taken as paper pencil test with student. It is widely used to evaluate the student standards. It helps to examine the knowledge of students acquired from the certain content. Test was a set of question which makes by researcher purposively from the related content of vector geometry. Questions were selected purposively to examine the knowledge of students and to explore the difficulties on vector. After making the set of questions, the researcher administered it with the grade X students. After checking, the researcher took discuss and explore the difficulties with them.

### Standards of Tools

For reliability and validity of the tools researcher made guidelines tools for observation, and in depth interview using different theories and literature. Guidelines question are organized in simple to complex form. Also subject expert, specialist and supervisor helped to check the reliability and validity of tools and necessary one. By the regular help of supervisor, the questions are removed and added if necessary. The researcher tried to understand by collecting different kinds of information from different perspectives from different sources and with under different tools. In this study researcher used the triangulation theory where the data were obtained from the

classroom observation, interview with the students, mathematics teacher and head teacher.

**Data Collection Procedure**

The researcher went to concerned school with tools to collect the qualitative data. Researcher took class observation of vector teaching at secondary level attending behaviorally with students and teacher. In that period researcher observed carefully and recorded each and every notable activities of students and teacher in the observation form. Similarly, researcher took interview with head teacher, Mathematics teacher and students with the help of interview guidelines respectively. The researcher listened carefully the opinion of respondent and noted properly.

By observing surrounding environment of school, condition of mathematics lab, other facilities of school and interview with head teacher as well as document analysis of school, learning environment, student participation, organizational, attention difficulties, connection, language and output difficulties were analyzed.

**Data Analysis Procedure**

Data interpretation is the systematic process of presenting and showing its effect. The analysis of data is important thing while we are preparing research report. In this study primary data presented and analyze. The collected data from primary source by interview, and observation were analyzed and interpreted by using descriptive method.

This was case study, which is qualitative in nature so that the researcher collected data only by the primary sources and analyzed with the help different theory. To find out the difficulties in learning on vector, all information were collected from primary sources and matched with information from reviewed document. The collected raw data were presented in systematic manner in tabular forms and are analyzed by applying different logical ways as well as with the help of conceptual framework, to

achieve the research objectives. For this purpose the collected sets of data (from observation, in depth interview and test) were coded on the basis of respondents and types of difficulties. Different difficulties on vector learning were categorized by the themes of observed form and the difficulties found from semi structure interview guidelines. Then the data from the observation were analyzed by cross match approach with the data from the in depth interview. As well as data from the interview were analyzed by triangulation approach.  At last the main themes were analyzed with the help of of learning disability theories, Bruner's constructivist theories and Dr. Levine all kinds of mind.

## Chapter – IV

## ANALYSIS AND INTERPRETATION OF DATA

This was a descriptive qualitative research related to the difficulties in learning vector geometry at secondary level students of Baglung district. Only one school was chosen for this study purposively, which was Shree Mulpani Higher Secondary School Mulpani Baglung. The objectives of this study were to find the difficulties in learning vector geometry at secondary level and to find the way for minimizing difficulties in learning vector geometry at secondary level. In-depth interview and observation were used for the data collection as a main tool. The main respondents of this study were all student of secondary level (only seven student were taken for interview) who takes optional mathematics, Mathematics teacher and head teacher of selected school.

This chapter includes the analysis and interpretation of the information obtained from the field of the study. The data collected from field are not in proper manner, so first they are coded and separated according to theme of information. The data were presented in terms of following difficulties (which are also given in conceptual framework) organizational difficulties, language difficulties, connection difficulties, attention difficulties, computational difficulties, output difficulties and difficulties due to the lack of pre-knowledge. Mention data were collected through interview and observation. Researcher took interview with the student, mathematics teacher, and head teacher with the help of interview guidelines tools respectively. Also researcher had done class observation with the help of class observation form to observe the activities of student and teacher at the teaching vector and vector geometry. At that period researcher observed carefully and recorded each and every notable activity of students

and teacher. The data were analysed and interpreted by the information taken from, math teacher's interview, student's interview, head teacher's interview and classroom observation. These data were analysed by analytical method.

This chapter presents the result of analysis done together with their interpretation. The collected data were analysed and interpreted on the headings; organizational difficulties, language difficulties, connection difficulties, attention difficulties, computational difficulties, output difficulties and difficulties due to the lack of pre-knowledge.

**Attention Difficulties**

Attention difficulties mean that students who are not focusing their mind in vector geometry class or students' misbehave in the class. Also according to Levine (1993), those who have attention difficulties tend to have disruptive behaviours. The behaviours are not age appropriate, so an older person may misbehave in similar way to much younger peer. Students are distracted during vector tasks. They are discussing about out of things when vector learning. Individuals have difficulty focusing their attention to complete a specific task; lose their place while working on a vector problem. Students were appearing mentally fatigue when doing vector exercise. In attention difficulties researcher tried to show that the some aspects of students such as distraction during vector tasks, discussing about out of things, and appear mentally fatigued when doing vector geometric theorem.

The researcher asked the question with mathematics teachers, head teachers and students "What are the causes of feeling difficulty in vector geometry? How is attention effect in learning vector geometry? Then they said respectively:

*"Some of the students are frequently absent and don't complete homework. They also make noise in the vector geometry class. I tell them not to make noise in the class if you do not understand ask me. Still they are not focused to learn vector geometry so that there is difficulty in learning vector geometry for the students".* *(Mathematics* teacher's view)

From the above mathematics teacher's view shows that, the main problem is irregularity of student. But social constructivism is a new method of teaching mathematics which believes that the knowledge is constructed by the active involvement of children. Also he did not have appropriate technique and method to make the students attention for learning vector geometry in the classroom. In this class teacher says that 'not to make noise if you do not understand ask me' which was not sufficient for convincing them.

*"Some of the students are not disciplined. They create noise at school and in the classroom. They are not interested in learning mathematics too so that students are becoming poor by their own activities. There is difficulty in learning mathematics because of the students own learning behaviours and characteristics".* (Head teacher's view)

From the above head teacher's view we can conclude that, school did not have any new techniques and policy for changing the behaviours of students as well as paying attention that directly affect the students learning.

Similarly, from the class observation (episode 1 to 3) researcher found that students were not careful about learning vector geometry. They were not doing the homework and also did not do the class work. They were not attentive towards topic in the class. Some students were looking outside of the class. They were discussing about

out of topic in class. Also students were seen mentally fatigued to learn vector geometry. Also some of the students were not interested in learning because they were weak and hesitated from teacher and other friends.

> *"Some of the students feel proud themselves and said that nobody can tackle with them. They have not proper attention towards topic".* *(Mathematics teacher's view)*

By the above mentions, and view of students, mathematics teachers and head teachers as well as class observation indicates that student were not curious and aware for learning vector geometry. Students were talking out of the context at the time of learning vector. According to Levinen (1993), those who had attention difficulties tends to have disruptive behaviours that could not be described as being of psychiatric nature. Individuals have difficulty focusing their attention to complete a specific task. There is a gap between learner and teacher to make his/her class attentive which directly affects the students learning on vector. Lack of appropriate method, using present techniques, and using materials are the main issues of students' attention in class (Carnellor, 2004). Also the researcher asked to the students and teachers, what should we do? Show that such difficulties are to be minimized. Then they told

> *"We have to makes class room interaction between student and student, teacher and student about the concerns topic according to desire of students'. For minimizing difficulties punishment, reward and reinforcement are used in class room."* (Mathematics teacher's view)

> *"Teachers are qualified and they teach well but the students' gained poor result and difficulty. So it would be better to send them for training about how should they taught about new concept in the class." (*Head teacher's view)

*"Teachers' should teach differently than usual manner by using technology as far as possible".* (Students view)

From above mentions view, it can conclude that, teachers have to teach differently by using technology. So that their mind is not being divert about out of things (NCTM, 2006). Also the teachers made classroom interaction between student and student, teacher and student. According to desire of students', teachers have to create learning environment in the class room. For better learning punishment, reward and reinforcement are also used in classroom if necessary. The feeling of head teacher's towards teachers' is positive. But the question is that why students' are in difficulty or gained poor result in exam then other subject instead of qualified teachers and good environment of school. So for minimizing difficulty, he wanted to send them for training So that their teaching process is best.

**Computational Difficulties**

A computational difficulty means that, despite of good understanding of mathematical concepts, students are inconsistent at computing. They make errors because they misread sign or carry numbers incorrectly or may not write numerals clearly enough or in the correct side of triangle.

Teaching methods, materials & evaluation technique promoted by teachers are the main ways for teaching meaningfully and learning vector and vector geometry. Teachers is the main agent of instructional strategies, his teaching technique method and using materials are playing vital role for clarifying the concept of vector and vector geometry. Evaluation is the process to measure achievement, quality and behaviour of the students. According to behaviourist continuous evaluation system with feedback, reward and reinforcement helps to change behaviour of student to reduce computational difficulties. The researcher raised the question with mathematics teachers "which

method do you apply to teach vector geometry? How they react with this method"?
Then he said

>*"I am not using any fixed method for vector teaching but my aim is how the students gain knowledge, I go in that way. I initialize vector by discussion method with students. Our teaching is child centred".*

>(Mathematics teacher's view)

There is a contradiction on teacher's view and class observation. From class observation (episode 2) it was seen that there is lack of participatory approach of both student and teacher in class room because teacher took the problem himself and solved the solution himself without involvement of student. He taught about angle between two vectors and magnitude of vectors but he did not give any homework. He did not discuss about that problem. So we can say there is lack of learning management. There is lack of diagnostic test and oral test which directly affected students learning. But teacher told "We use child centred method".

>*"Teacher does not use materials except geometry box and graph board at teaching, teacher sometime takes class test but he did not give any feedback after it. He does not clarify any problem, he said it is hard to understand but it is important in higher level so you have to read deeply".* (Student's view)

The above view of students shows that the computational difficulties on vector and vector geometry learning are lack of using teaching materials, lack of learning management in class room, lack of explanation of terms such as parallel of vectors, law of vector addition, angle between two vectors and multiplied by scalar quantity. Also lacks of feedback, suggestion and discussion have the difficulties on vector learning. But teacher told that it is important in higher level so you have to read deeply.

Researcher took a class test which makes computational difficulty for the students in vector geometry. Where question was Proved by vector method If a position vector of A is $\vec{a}$ , B is $\vec{b}$ and m is midpoint of AB then the position vector of M is $\vec{m} = \frac{1}{2}(\vec{a} + \vec{b}$ )
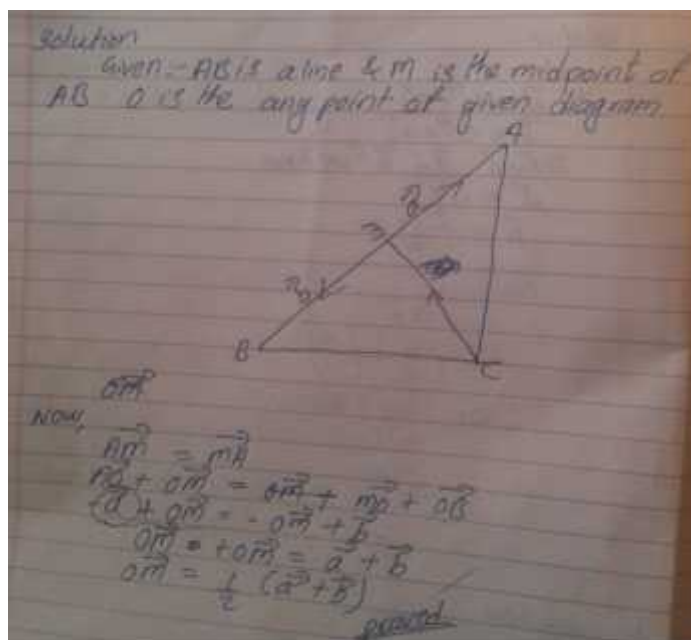


The above example was one of the class test question which was solved by one boy of grade 10. From this example we analysed that the students had so many computational difficulties despite a good understanding of vector concepts, he inconsistent at computing. He makes errors because he did not write numerals in the correct side of triangle. He wrote first $\overrightarrow{AM} = \overrightarrow{MA}$ which was wrong also he wrote $\vec{a}$ and $\vec{b}$ on the side AM and MB which was also wrong. In spite of starting wrong process he was followed correct from second step. He was entangled to write $\overrightarrow{OA} = a$ and $\overrightarrow{OB} = \vec{b}$ and $\overrightarrow{AM} = \overrightarrow{-MB}$.

From the above we conclude that, despite a good understanding of vector concept, students are inconsistent at computing. Those students often struggle, especially in primary level where basic computation and right answers are stressed. Often they end up in remedial classes, even though they might have a high level of potential for higher-level mathematical thinking. (westwood, 2000)

Also the researcher raised the question with teachers and students' "How could we minimize the computational difficulties in vector geometry? They told that

*"We have to provide opportunity to work alone and together, for this heterogeneous group are made on the basis of need"*

*(*Mathematics teacher's view)

*"Teachers should use proper materials. He had to leave to say it is hard to understand. Also he had to clarify any theorem step by step and give feedback after checking homework, class work and class test".* *(*Students view)

From this view we can conclude that we could minimize the computational difficulties by providing opportunity to do practice alone and also in group, for this we have to made heterogeneous group instead of homogeneous group. Firstly teacher should be left to say that it is hard to understand and hard topics. Also teachers should be provided feedback after checking his work. According to westwood, 2000, ( p.13) state that provide opportunities to work alone and together, Learning mathematical concepts and skills is more than receiving it like a gift from an educator. While an educator can introduce new learning and lead students toward understanding, there is much benefit in moving beyond a whole class approach by using paired and group work. Problem solving can promote discussion between peers as they share strategies and justify processes and answers. It is a way of talking and moving into understanding.

**Organizational Difficulties**

We discussed about some difficulties faced by students in vector geometry learning. Among them organizational difficulty was one of the main difficulty area in learning vector geometry. An organizational difficulty means that the student's weak aspects of making sequential order of solution, steps mismatch for making final solution of any problems. Also it can be seen particularly in word problem or other problem

solving situations. In organizational difficulties, the students randomly wrote steps of the problems. In organizational difficulties in vector and vector geometry class students show the following activities. They are; difficulties in sequencing multiple steps, unable to manage the time, inability to identify major aspects of a mathematical situation particularly in word problems where some information is not relevant etc. Researcher asked with the students "which terms or procedure especially confuses for you, So that your learning is affected?" And how are mathematical terms dealt by your teacher? How do you feel? Then they said

> *"Vector geometry is difficult for us because in mathematics, the theorems which have to be proved by vector method aren't organized easily. So, we feel very difficult and confused".* (Student's view)

From the above student's view we conclude that the theorems which are easily proved in compulsory mathematics but vectorically are not organized easily. They have good understanding about geometry. But they have lack of concept of vector geometry. So they felt difficulty in learning vector geometry.

> *"Mainly the topic 'direction' is confusing for us. When we use same magnitude for different questions, then our result is wrong". When we enter wrong sign then our result is also wrong".* (Student's view)

Above quoted view of student, they are mainly confused in direction. To solve the vector problem, we mainly focused on direction but lack of concept of vector and its rules they are unable to organize easily. Not knowing about that length is negative in vector they take same sign in different direction, so the result was also wrong.

When researcher observed the class then he got some organizational difficulties of students in vector geometry. In vector geometric theorem student were not sequencing in multiple steps. They were mismatching some aspect. Also students were

unable to identify the major aspect of geometric portion where some information is not

relevant. They could not distract between relevant and irrelevant terms. Vector

geometric content was hardly be finished within the limited time and last of the

session.( cited from Sharma, D. 2011, p, 34) so the students were not organize in their

many aspect of learning. Researcher took a class tests which makes an organizational

difficulty for the students in vector geometry. The question was, the angle of

circumference of semi circle is right angle. Prove by vector method.
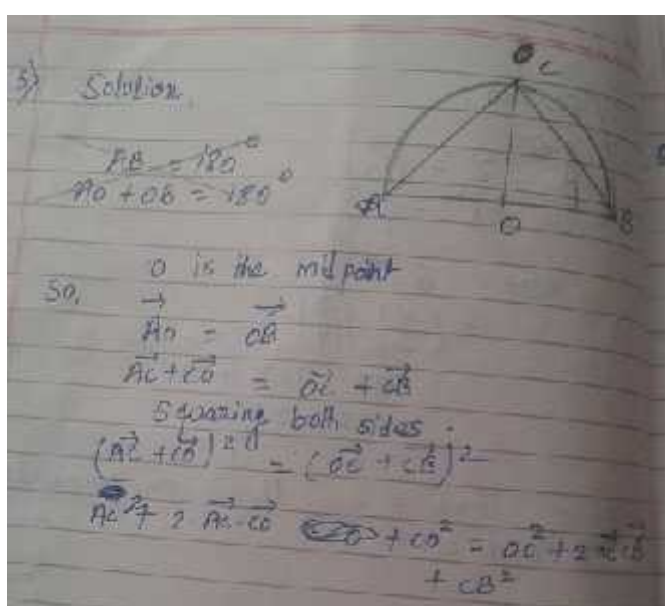


The above example was one of the class test question which was solved by one

boy students of grade 10. From this example we can analysed that the students had so

many organizational problems. In above example, it was seen that there is lack of

sequencing in multiple steps. It shows the loss of appreciation of final goal and over

emphasis of individual elements. Students could not identify major aspects of this

problem, they have not organized proper procedure or they do not know how to get right

angle on circumference of semi-circle. Also it could show particularly in word problems

because they had not computed exact answer of this problem. It shows lack of many

steps. Also from observation and literature in the limited time span students have many

difficulties in learning vector geometry. Students, who did not manage the time, were not sequencing the multiple steps of the problems, and who wouldn't compute the accurate procedure. They were organizational difficulties in learning vector geometry. (Lowden, 2000)

Also the researcher raised the question with teachers "How could we minimize the organizational difficulties in vector geometry? They told that

*"Teachers should focus on the topic 'direction' and they used continuous assessment system by providing regular feedback and reward if necessary".* (Students view)

*"Problem solving method and theorem proved method with divergent question should be taken in practice".* (Mathematics teachers view)

By the above mentions, we conclude that school administration should be taken continuous assessment system for the judgement. Also teachers should provide reward if students' are doing correct if not they always provide feedback. Teachers also took problem solving method in practice. So that, students' are able to follow steps of problem solving method. Also in using of problem solving with divergent questions the Booker, Bond, Sparrow and Swan (2004, p 44) state that problem solving is a task or situation for which there is no immediate or obvious solution. Along with other writers they question whether what educators provide as problems are little more than algorithms with words around them. Authentic problems must pose a challenge that encourages strategic thinking and are a vehicle for development of concepts and skills (Westwood 2000, Sherman, Richardson and Yard 2005). It is also important to remember that there is more than one way to be right and there is more than one way to be wrong! A student's sense of satisfaction at having developed a successful process for

solving a problem must be warmly acknowledged rather than discounted as not being 'the preferred way' .

**Language Difficulties**

A language difficulty means that students were confused about terminology, difficulties with verbal explanations and weak verbal skills for monitoring the steps of complex calculation of the vector geometry. Most of the students have following difficulty in vector geometry which are found by researcher were; trouble learning or recalling abstract terms, difficulty understanding directions, difficulty explaining and communicating about math, including asking and answering questions, difficulty reading texts to direct their own learning, difficulty remembering assigned values or definitions in specific problems, etc.

Researcher raised the question with the students "How is language of theorem effect in your learning? The terminology and vocabulary are harmful in learning vector geometry? What is your opinion towards it?" then their answer is as follow.

*"The teacher does not give us clear idea about vectors terminology and they teach us without clarifying these term, concepts, and procedures. So, that we have incomplete knowledge about vector rules. So, we can't connect the axioms and postulates of mathematics to vector geometric rules. As a result we can't deal with the questions of vector geometry and can't be focused to the questions. These are the difficult point for us."* (Student's view)

The above student's views shows that teachers does not use child centre method, he always uses only lecture method and he did not focus about terminology of vector, its concept and procedure which makes the vector geometry learning  difficult. So that students have anxiety on vector geometry as a result they are not focused to learn vector geometry at home and class. According to westwood (2000) and carnellor (2004) says

that, before any practice is undertaken, a secure understanding of underpinning concepts, where new learning is linked to previous learning, must be assured. If not, it may become a cycle of practice and forget, practice and forget. Students who did not "get it" the first time are not likely to "get it" the next several times it is taught in the usual manner. This may be where technology can provide a different way to develop conceptual understanding.

> *"In mathematics it has more difficult terms, such as vocabulary terms of vector geometry, also its notations are difficult to understand for students. Also, in word problems they are not able to change language into mathematical expression. They are unable to make figure. If students don't understand those difficult terms they would not learn vector geometry easily. For our students, there are many difficulties to teach. Also, vector geometry is one of the difficult topic because its vocabulary terms, language is not learnt too easily, it is new concept and new topic. So the language problem is one of the greatest difficulties in learning vector geometry". (*Mathematics teacher's view)

From the above views we conclude that the students feel a great difficulty to understand the vector geometric problems. They don't understand the sense of the problem or what is given and what has to be found by which procedure. Vector geometry learning was most difficult for students and also for teacher because of its technical words and terms. Students have difficulty while learning vector geometry due to the lack of clear concept on verbal problems, unable to generalize the learned concept due to the fast forgetting and cycle of practice and forgetting. (Cited from, Luitel, 2014, mathematics forum volume II). During observation, most of the students have confused to change language into own word expression and making figure according to problem and assigned value according to direction. It was also found that students had

mathematical and geometric vocabulary problems and they don't know how to find correct solution by using vector method. Also they always forget that how could we show right angle by using vector method.

From the class observation (episode 1, 2, 3) while teaching researcher himself and taking class observation with mathematics teachers at that period found that students did not complete the homework and class work. Researcher asked "why didn't you do Q. NO 8 and 9 at home?" but student said that they do not understood difficult terms of vector geometry or what sense of the question has. Also they did not understand the verbal problem and terminology of vector geometry. Researcher gave the one question for class work such as; the line joining the middle point of sides of quadrilateral taken in order is parallelogram, prove by vector method. In this question most of the students could not change this into figure. Also some of the students were noising. Researcher asked "why are you noising"? Student said "Sir we don't understand this question. We have confusion in how to express this into figure. Also we don't have any idea to apply correct procedure because of its terminology." It shows that most of the students were unable to solve the verbal problem or vector geometric theorem. These are the difficulties in learning vector geometry.

It could be concluded that the language difficulties in learning vector geometry were; students had difficulty with the vocabulary of math, student were confused by language in word problems or theorem of vector geometry. They did not know when irrelevant information was included or when information was given out of the sequence. They had trouble learning or recalling abstract terms and geometric terms for translating it. Also students had difficulty with understanding to direction. They were unable to change the problem into figure and applying vector rule. Students had difficulty remembering assigned values or definitions in specific problems. According to Levinen

(1993), to avoid the language problem in vector geometry, teacher should be encouraged students to put problems into their own words and to make figure according to question. Teach children to read for meaning when trying to identify the operation to use for solving vector geometric problem. Also teacher should encourage the students to be clear about each and every terminology of vector geometry with their properties.

Also the researcher raised the question with teachers and students that how could we minimize such kind of difficulties in vector geometry? They told that

> *"We have to conform about students understanding of mathematical language. We should be conformed that students' are translating between their own intuitive and concrete understanding of the real world and the language used to describe and quantify for mathematical purpose for school."* (Mathematics teachers view)

> *"Teachers have to encouraged and clarify each and every vocabulary terms and terminology with their property by showing concrete materials or figure."* (Students view)

Above mention shows that, teachers should be conformed whether students' are translating the terms into their own word or own concrete understanding. If not they have to clarify each and every terms with their property. Westwood (2000, p18) believes that one of the main problems encountered by students…is translating between their own intuitive and concrete understanding of the real world and the language used to describe and quantify for mathematical purposes for school. Educators must build upon a student's level of language, check for understanding and not assume that nods and smiles are indicating comprehension.

**Connection Difficulty**

Students have difficulty making connection within and across mathematical experiences. For instance, a student may not readily comprehend the relation between magnitude and direction they represent. This kind of connection was not able to made, student's math skills may not be anchored in any meaningful or relevant manner. This makes them harder to recall and apply in new situations.

Researcher raised the question with the student and teachers "To prove the vector geometric theorem is it necessary to add or move rules and formula from their direction? If so how do they feel while doing so? Then their answer is as follow.

*"While proving out of the theorem of vector geometry we need to connect and organize axioms and postulates properly. But problem is here that, they feel that it is Borden for them. As a result there is difficulty in vector teaching too."* (Mathematics teacher's view)

The above quoted view of mathematics teachers, we conclude that there were connection difficulties due to the lack of axioms and postulates about geometry. Many students feel difficult to understand geometry. But in vector geometric theorems, it is necessary to understand, moving and connecting it into vector algebra rule. This creates the difficulty in students learning. Also students' feel that it is Borden as a result there is a difficulty.

*"Yes it is obviously necessary sir. But we have great confusion while doing addition and connection between rules to rules. Theorems which are being proved in one problem can be or can't be connected to another theorem directly; this is main confusing topic for us".*

(Student's view)

The above quoted view of students show that there were lacks of clear concept about vector geometry. Also there were seen lack of maturity, practice and skills about vector geometry with the students. These causes are related with the teachers too, because they are raised by the teaching technique, methods, using materials and teachers understanding about vector geometry. Also these kinds of difficulty are seen due to the lack of inclusive environment and remedial teaching in the classroom. This makes the students learning rote and difficult.

From the class observation (episode 1 to 3) students were not careful about learning mathematics. They were not doing the homework and also did not engage for doing class work. They have little knowledge about geometry but they are not able to connect their knowledge according to question. They are entangled with using or not using theorem which are being already proved in another theorem. They are unable to write midpoint formula and section formula correctly. So they are unable to solve the problem Prove that the position vector of the centroid of a triangle is one third the sum of the position vectors of its vertices. Also they don't know that median divides the centroid into the ratio  2: 1 so they are not able to solve it.

Teaching method plays vital role for the transfer of knowledge from the teacher to the students and student's knowledge towards the question. It is like the bridge for proving vector geometric theorems. Teaching techniques included the teacher's preparation, teacher's activities in the classroom etc. Teaching is an art. Teacher's preparation also plays vital role for learning process of student. If the teacher is fully prepared about the lesson and he has clear concept about the topic, then the students learn easily without any confusion. The trained teacher teaches in the classroom by

lesson plan. It helps in the learning process of students. (Cited from, poudel, 2014, p. 36)

Also the researcher raised the question with teachers and students that how could we minimize such kind of difficulties in vector geometry? They told

*"I am planning to take unit test regularly by selecting such kind of theorems which are connecting to prove another theorem. So that they are not confuses to apply rules to rules and theorem into theorem."*

(Mathematics teachers view)

*"We should connect games and puzzle during the teaching period of vector geometry. So that students' thinking have positive and interesting towards vector geometry."*   (Mathematics teachers view)

From these quoted view of teachers we conclude that it would be better to take unit test by selecting problems which are also used directly in another theorem. Also the teacher should want to connect games and puzzle concerns to topics so that students' are being interested to learn vector geometric theorem. Historically, games have been used as a reward when the real work has been finished (early). Booker (2000) reminds us that games can be powerful teaching and learning tools to develop conceptual understandings. It is engagement with interesting and fun activities that can keep a young person practicing a skill well beyond what they might tolerate if asked to do (another) worksheet.

### Difficulties Due to the Lack of Previous Knowledge of Student

The knowledge and skill of mathematics is the regular ongoing process. In this process the previous knowledge and skill are the source of improving current mathematics. In this sense, mathematics is to be taught by applying the former skill and

knowledge. The concept (knowledge and understanding) that are helped to learn the new topic is pre-knowledge. Students should have the well concept of co-ordinates geometry, Trigonometry and geometry etc. as a pre-knowledge for vector learning.

> *"We studied vector in class nine where we studied magnitude, direction of vector, simple addition and subtraction of vectors. Also we know trigonometric ratio and distance between two points and internal division and external division in co-ordinates".*
>
> (Student's View)

> *"Basic knowledge of students is most required not only for vectors unit also for other units. In vector geometry, we have to find column vector, direction of vector and angle between two vectors by using cosine angle but the topic trigonometry is latter the vector topic. So I think sequence of units of optional mathematics should be re-constructed".*                    (Mathematics Teacher's View)

From the above quoted view of students and teacher we conclude that basic knowledge of student is most required not for only in vectors but also in other units. So that pre-knowledge of students played most important role in the learning of new concept. Basic concept of one topic is co-relational with vector geometric topic. Also, basic concept of trigonometry, co-ordinates geometry, axioms and postulates are mainly used to learn vector geometry. But lack of pre-knowledge and general concept about geometry, student have many difficulties to learn vector geometry. The sequence of units of O.P.T. math should be rearranged. Because trigonometry is needed for learning vector but it is put on after the vector.

The researcher asked the question with student " Geometric axiom and postulates are mostly required to learn vector so do you have any idea about that? If yes/ no why?" then their answer is as follow.

*"Most of the previous academic years, teacher taught geometry at the last session of the year. Due to the final examination and lack of understanding concept teacher finished the geometric part quickly without clarifying its concept. So we are compelled for rote learning. And so, we have little concept about geometry".* (Student's View)

From the above student's view we conclude that students have little geometric concept due to the teacher's negligence in teaching geometry. Teacher's does not use present techniques, methods and materials. But showing the final examination they finished the geometric part quickly without clarifying them. By the activity of teachers students' are compelled for rote learning which creates the bad feelings towards geometry.

Also the researcher took the question with mathematics teacher" How students feel about geometric part? How do you feel to teach them about vector geometry? Then the teacher said

*"Generally most of the students feel geometric portion of any topic hard. So, we should take it by heart. The students are coming from that backgrounds are weak. So I also faced difficulty to teach them".*

(Mathematics Teacher's View)

From the above quoted teacher's view it could be seen that most of the students have difficulties in geometric portion. Due to the poor pre-knowledge and base knowledge of students in geometric portion, teacher also faced difficulty to teach vector

geometry. The main serious problem is the bad feelings towards geometry because students have taken it as hard subject and only learn it by rote process.

A major theme in the theoretical framework of Bruner is that learning is an active process in which learners construct new ideas or concepts based upon their current/past knowledge. The learner selects and transforms information, constructs hypothesis and makes decisions relying on a cognitive structure to do so. Cognitive structure (i.e. schema, mental models) provides meaning and organization to experiences and allows the individual to "go beyond the information given".

As far as instruction is concerned, the instructor should try and encourage students to discover principles by themselves. The instructor and student should engage in an active dialog (i.e. Socratic learning). The task of the instructor is to translate information to be learned into a format appropriate to the learner's current state of understanding. Curriculum should be organized in a spiral manner so that students continually build upon what they have already learned. Hence it is concluded that the student's pre-knowledge plays the most important role for mastery of learning in the vector geometry learning. So the scope and sequence of optional mathematics should be reviewed by Curriculum Development Centre.

At last researcher asked the teacher and students" what should we do to minimize such kinds of difficulties?" Then they reply

*"This is the new concept for secondary level. To learn vector geometry the geometric axiom and postulate are needed so that, it should be taught in lower secondary level too."* (Students view)

*"Most of the students feel difficulty in geometric axioms and postulates. So concerns axioms and postulates are to be taught before starting the vector geometry class".*

*(*Mathematics teachers view)

From above quoted view of students and teachers we conclude that vector geometry should be added into lower secondary level because it is a new concept for secondary level. Also teacher had to teach geometric axioms and postulates with their property by connecting with vector rules. To optimize learning for students who already have mathematical difficulties it is essential that educators have a robust pedagogical knowledge and positive attitude. Also Carnellor (2004, p 5) states that for many adults…mathematics generates unease and insecurity. ….These feelings probably originate from their own classroom experiences where mathematics consisted of drill, rules, and recipes, instead of understanding and application. This suggests that educators need to be quite clear about what mathematical concepts they feel comfortable teaching and where they need further learning.

**Output Difficulties**

Students with problems in output have unable to recall basic math facts, procedures, rules or formulas. Student did not apply the accurate formulas in some problems. Some students applied right formulas but they do not calculate exactly. Similarly, students were very slow to find out the solution of the problem by stepwise procedures. By observation of class work and class test, it was seen that most of the student's had difficulty with handwriting that slows down written work. They were very slow to copy from the whiteboard too. Also, students had difficulty in remembering the previously knowledge of class because they were not well understanding and good concept in vector geometric class. So they were feel difficulty in learning vector geometry. Similarly, researcher saw that a student was stopping at the middle part of the

solving problem. Then researcher asked why you are stopping? He replied "I forget the procedure of this problem". It shows that student's were confusing or forgetting vector geometric theorems that create output difficulties in learning vector geometry.

Researcher took a class test where the output difficulties of student in vector geometry were seen such as.



The above question was solved by one girl of class 10. She could not solution in details so she obtained only 0.5 marks out of four marks. The question has given $\overrightarrow{OA} = \vec{a}$ and $\overrightarrow{OB} = \vec{b}$ and $\overrightarrow{Om} = \vec{m}$ then we have to show $\vec{m} = \frac{1}{2}(\vec{a} + \vec{b})$, according to information of question, m is midpoint of $\overrightarrow{AB}$ so, she write $\overrightarrow{AM} = \overrightarrow{MB}$ which was wrong because of the direction. But she have to write $\overrightarrow{AM} = -\overrightarrow{MB}$. She uses correct procedure in between but her output was wrong because of using wrong formula. These problems were seen in many students. Similarly, most of the students did not completely solve the problems. In this test six questions were given but in average students solved only four questions. In solved questions there was not also complete solution. They were mismatched steps in between. So we could say students had many output difficulties in vector geometry.

Also from the episode 1, 2, 3 most of the students were slow hand writing and some of their hand writing is not clear. They were not completing the solution of the problems at the limited time. Also, most of the students did not complete the homework that

affected directly in their output result. Students feel difficulties because of discontinuity between practiced mathematical concepts in school and home (cited from poudyal, 2008, p. 37). Teacher asked one formula of the internal division of vector geometry but student could not give right answer or they were forgetting when this formula was taught in previous class. Some students discussed out of things, they were not giving attention in teaching learning so that their output was very slow. Students were slow to understand the process of the problems and forgetting very fast.

Researcher raised the question with student in the class "How much time do you spend to do practise at home and class? Why? Then their answer is as follow.

*"We are not given sufficient time for mathematics especially in vector geometry so it is difficult for learning. We forget any terms of vector geometry and formulas quickly due to the lack of practice and concept. We do not complete the copy from the board because teachers erase quickly. He said that time is limited so that we have to copy fast but our handwriting is slow".*                (Student's view)

*"Some of the students are very weak because they do not complete homework. They are not attentive in vector geometric class. In the classroom they are not intentionally participate in learning. They forget any terms and rules of vector geometry quickly due to the little practices at school and home.*(Mathematics Teacher's View)

From the above quoted views of student's and mathematics teachers, we could say that students did not sufficiently practice vector geometric theorems at school and home. Due to the lack of concept and practice they are not intentionally participate in learning so that they forget any terms, rules and procedure quickly. Similarly, their output is very low by their own behaviour.

The above activities in the classroom (from episode 1, 2, 3), class test and interview shows that students were unable to recall basic facts, procedures, rules and formulas of vector geometry. They did not succeed to carryout stepwise solution, they used wrong process. This shows that their output result was very poor. They were very slow to retrieve facts or pursue procedures. They had difficulties maintaining precision during arithmetical work. They were not maintains time so they left questions which causes poor output. They were forgetting formulas and steps of solution that keeps their result very low. Finally, it can conclude that students' learning is not well so that output difficulties are seen in vector geometry.

Researcher went to the selected school and asked to the student and teacher "what should we do to minimize the above difficulties in learning vector geometry?". Then they told

> *"Student should do much more practice at school and home to be*
> *habituated for writing quickly, correctly, and accurately."*
>
> *(*Mathematics teachers view)
>
> *"Teacher should use present techniques, methods, and materials*
> *by using technology so that the concept of vector geometry is*
> *being cleared".* *(*Students view)

By the above mentions we conclude that student have to practice at school and home properly for writhing quickly and correctly. Also the teacher should use present techniques and technology for clarifying concept of vector geometry. Also the NCTM (2006), states that technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning. Far from being just electronic downtime, the internet offers educators a huge range of research-based practices, interactive websites, resources, and lesson plans.

## Chapter – V

## SUMMARY, FINDINGS, CONCLUSIONS AND IMPLICATION

As stated in the introduction, the purpose of this study was to find the difficulties in learning vector geometry at secondary level and to minimize the difficulties in learning vector geometry at secondary level. In this chapter, summary, findings conclusion and recommendation for further study have been presented.

**Summary of the Study**

Vector geometry is very important for daily life of human being. It has important role in machine and generator which are daily helpful for human in all levels. Most of the students are failed in vector geometry due to the different difficulty. Similarly, some students have succeeded in it by rote learning but not by well understanding about it. So the researcher intended to study difficulties in learning vector geometry at secondary level as a research. The main objectives of this study were; to find the difficulties in learning vector geometry at secondary level and, to find the way for minimizing the difficulties in learning vector geometry.

The research was conducted in Shree Mulpani Higher Secondary school, Mulpani, Baglung. The design of the research was case study in which meanings were derived from the total logic and reasoning of why and how it was difficult, by linking with theories.

For the convenience of the study, the researcher selected a public school of Baglung district. The respondents were seven students, mathematics teacher and head teacher of selected school. Interview schedule, class observation form and test were used as a tool for the data collection procedure.

Most of the children have difficulty in learning vector geometry and difficulty is due to their learning disabilities and frequent absence in class. Students do not practice vector geometry at school and home because of the bad feelings towards the vector

geometry. Teacher never gives proper attention separately to the weak students. So that the student's learning is reduced day by day. Most students leave the questions of vector in exam due to the little practice and low concept. Similarly, due to the poor pre-knowledge and poor base knowledge of students in co-ordinate geometry, geometric axioms and  postulates teacher's faced difficulty in teaching vector geometry. Besides this, most of the students are unable to apply the accurate process of the problems. They mismatch some steps of the vector geometric theorem. They are becoming the main problems of the theorem when the problem is presented in longer verbal expression with technical word. So that, students' output result is very low, this can be seen from the result of class test. The causes of difficultly were the lack of participatory approach in vectors teaching, lack of diagnostic test and oral test.

**Discussion of Findings**

On the basis of analysis and interpretation of the result the findings of this study were as follows: Most of the students have distraction during the vector geometry tasks. They have miss-behaviours that appear in geometric class that is also responsible for their low output. Many students, despite a good understanding of mathematical concepts are inconsistent at computing. They make error because they misread magnitude incorrectly without caring direction. Students did not follow sequential order of the solution in vector geometric theorems. They were entangled in multiple steps or using postulates and theorem which are already being proved.  Students are confused by the language or terminology to prove vector geometric theorems. They had difficulty to make figure according to question due to the poor pre-knowledge. Many students have difficulty for making meaningful connections within and across mathematical experience. For instance, students may not readily comprehend the relation between magnitude and direction they represent. This makes them harder to recall and apply in new situation. Due to the weak pre-knowledge and poor geometrical background of

students, teachers also feel difficulty to teach vector geometry. Most of the students have not good output or result in vector geometry. They used wrong formulas and do not follow exact procedures. Similarly, they were not internally participating due to the bad feelings towards vector geometry. There was not inclusive environment and remedial teaching in the class room. Mostly the teacher used teacher centred method in the classroom. So the teacher was active and students were passive in teaching learning process. Student did not do sufficient practice of vector geometry at home due to the poor concept and understanding.

There was lack of motivation and encouragement about vector geometry in the class. Due to the lack of teacher training especially for teaching new concept about vector geometry they are not successful. Teachers were unable to perceive well concept of teaching vector geometry to students. Subject matter of vector geometry was limited in the text book.

**Conclusions**

The major finding of this study shows that there were myriads of difficulties. This had made both teacher and students' a passive agent in dealing with vector geometry teaching and learning. These difficulties were categorized into seven different sections. They were attention difficulties, computational difficulties, organizational difficulties, language difficulties, connection difficulties, output difficulties and difficulty due to the lack of pre-knowledge of student. One component of arising difficulties on learning process in vector geometry was the pre-knowledge and poor geometrical background of students. And another was the traditional teaching strategies in vector geometry class by both trained and untrained teacher. Teachers had not implemented the modern techniques, methods and materials for vector geometric teaching and learning. It seems to be exam oriented rather than it is applicable. Most of the students were less interested on mathematics especially on vector geometry learning.

It was difficult to create interest on students because vector geometry was regarded as an abstract subject matter. The students' and teachers' had faced difficulty on vector geometry teaching and learning process because of the poor evaluation system, poor geometrical background, negligence for doing homework, lack of using instructional materials, non effective teaching learning management were some examples. To minimize such kinds of difficulties, there should be continuous communication among students and teachers and teaching strategy must be student centred. Students' had given opportunity to work alone and together in the class. Continuous assessment system should be taken in practice.

**Implication**

This case study research was about learning difficulties in vector geometry at secondary level. The findings and conclusions of this study were based on low performer government school. So it couldn't be generalized. But this study can bring new avenue to diagnose the difficulties in learning vector geometry of other schools. This study certainly helped to minimize the learning difficulties in learning vector geometry in future. The findings and conclusions provided by the study, the recommendations for further study can be presented as: The teacher should teach vector geometry by applying the basic concepts. The teacher should use student centred method for teaching vector geometry and his role as a facilitator. He should encourage the students and give motivation for the study. He should use continuous assessment system. A similar study can be done for primary and lower secondary level in other topics. Teacher can create the new techniques for easy vector geometry learning. Also this study was conducted using small sample thus the findings of the study could not be generalize in the broad sense. Thus it would be more valuable if the study would be done with covering broad areas.

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**Appendix-1**

**Observation guidelines for children's participation and their activities in learning vector geometry in the classroom**

The observation of the selected class had been taken on the basis of following main topic and noted in details every day.

a.  Attention difficulties in vector geometry
- Students are distracted or fidgety during math tasks
- lose his or her place while working on a vector problem
- students are appear mentally fatigued or overly tired when doing math

a.  Effect of language in learning vector geometry.
- difficulty with the vocabulary of math, confused by language in word problems
- not know when irrelevant information is included or when information is given out of sequence
- trouble in learning or recalling abstract terms, difficulty understanding directions

b.  Computational difficulties in learning vector geometry.
- Inconsistent while compute word problem into verbal.
- Inconsistent while written angle of given value.

c.  Organizational difficulties in vector geometry.
- Difficulties in sequencing of multiple steps.
- become entangled in multiple steps or elements of a problem
- difficulties to identify salient aspects of a mathematical situation, particularly in word problems

d.  Output difficulties in vector geometry
- to recall basic math facts, procedures, rules, or formulas
- very slow to retrieve facts or pursue procedures
- difficulties maintaining accuracy during vector work
- forget what he or she is doing in the middle of a math problem

e.  Teaching strategies and using materials on vector class.

f.  Requirement of pre-knowledge of students for vector learning.

- Co-ordinate geometric concept, General Concept of Transformation
- General Concept of trigonometry and matrix, Geometric axioms and postulates with their properties.

## Appendix-2

### Interview Guidelines for Mathematics Students

Name of student ……………………………        Caste ………………..

Class ……………..    Position in the class ………………    Roll no. ………………

Gender ………..        Address …………………………………………………….

The interview with the mathematics students had been taken on the basis of following main topics:

a.  Attention Difficulties in vector geometry
    - Students feel  distracted or fidgety during math tasks
    - lose his or her place while working on a vector problem
    - What are the causes of feeling difficulty in vector geometry? How is attention effect in learning vector geometry?
b.  Effect of language in learning vector geometry.
    - difficulty with the vocabulary of math
    - not know when irrelevant information is included or when information is given out of sequence
    -  trouble in learning or recalling abstract terms, difficulty understanding directions
    - How is language of theorem effect in your learning? The terminology and vocabulary are harmful in learning vector geometry? What is your opinion towards it?
c.  Organizational difficulties in vector geometry.
    - Difficulties in sequencing of multiple steps.
    - become entangled in multiple steps or elements of a problem

- difficulties to identify salient aspects of a mathematical situation, particularly in word problems
- How are mathematical term dealt by your teacher in your class? How do you feel?
- Which terms or procedure especially confuses you? So that, our learning is affected?

d. Output difficulties in vector geometry.
   - very slow to retrieve facts or pursue procedures
   - difficulties maintaining accuracy during vector work
   - forget what he or she is doing in the middle of a math problem
   - How much time do you spend to do practice vector geometry at home and class?
   - How is your writing speed? How could you manage time in exam and while copy from the board?

e. Connection difficulties
   - To prove vector theorem is it necessary to add or move rules and formula from their direction? If so how do you feel while doing so?

f. Computational difficulties
   - While proving out of the theorem of vector geometry are you carefully and seriously focused and inter with plan? What is your opinion towards it?

g. Requirement of pre-knowledge of students for vector learning.
   - Co-ordinate geometric concept, axioms and postulates.
   - To know the vector concept we have a knowledge about co-ordinates geometry, geometric axioms and postulates with their properties, do you know about properties of Parallelogram, Right angle triangle, Centroid, Medians, Quadrilateral, Rhombus.

h. Main interesting area in learning vector geometry

**Appendix-3**

**Interview Guidelines for Mathematics Teacher**

Name of teacher: ……………………………… Gender: …………….

Teaching experience: ……… Types of training ……… Duration ………………

Class …………. Teacher's spends time in classroom ………….

The interview with the mathematics teacher will be taken on the basis of following main topics and some questions.

a. Attention Difficulties in vector geometry
   - be distracted or fidgety during math tasks
   - lose his or her place while working on a vector problem
   - appear mentally fatigued or overly tired when doing math
   - What are the causes of feeling difficulty in vector geometry? How is attention effect in learning vector geometry?

b. Effect of language in learning vector geometry.
   - difficulty with the vocabulary of math
   - confused by language in word problems
   - not know when irrelevant information is included or when information is given out of sequence
   - trouble in learning or recalling abstract terms
   - difficulty understanding directions
   - How is language of theorem effect in students learning? The terminology and vocabulary are harmful in learning vector geometry? What is your opinion towards it?

c. Computational difficulties in learning vector geometry.
   - Inconsistent while compute word problem into verbal.
   - Inconsistent while written angle of given value.
   - While proving out of the theorem of vector geometry students are carefully and seriously focused and inter with plan? What is your opinion towards it?

d. Organizational difficulties in vector geometry.
   - Difficulties in sequencing of multiple steps.

- become entangled in multiple steps or elements of a problem
- difficulties to identify salient aspects of a mathematical situation, particularly in word problems
- How are mathematical term dealt you in your class?
- Which terms or procedure especially confuses for student? So that, their learning is affected?

e.  Connection difficulties

   To prove vector theorem is it necessary to add or move rules and formula from their direction? If so how students feel while doing so?

f.  Output difficulties in vector geometry
- to recall basic math facts, procedures, rules, or formulas
- very slow to retrieve facts or pursue procedures
- difficulties maintaining accuracy during vector work
- forget what he or she is doing in the middle of a math problem
- How much time does a student spend to do practice vector geometry at home and class?
- How is their writing speed? How could they manage time in exam and while copy from the board?

g.  Requirement of pre-knowledge of students for vector learning.

h.  Co-ordinate geometric concept, axioms and postulates.
- To know the vector concept we have a knowledge about co-ordinates geometry, geometric axioms and postulates with their properties, do you know about properties of Parallelogram, Right angle triangle, Centroid, Medians, Quadrilateral, Rhombus.

i.  Main interesting area in learning vector geometry

**Appendix-4**

**Interview guidelines for Head Teacher**

Name ………………………………                   Date …………….

Gender: …………….                   Qualification …………………..

Teaching experience: ……………….      Religion ………………..

Address ……………………………………………………………

The interview with the head teacher will be taken on the basis of following main topics with question:

a. Student participation in school and learning.

b. Learning environment at school.
    - Teaching materials for mathematics in school.

c. Extra class provided by school for weak students.

d. Facilities provided for reluctant student.

e. Attention Difficulties in vector geometry
    - What are the causes of feeling difficulty in vector geometry? How is attention effect in learning vector geometry?

f. Effect of language in learning vector geometry.
    - confused by language in word problems

g. How is language of theorem effect in students learning? The terminology and vocabulary are harmful in learning mathematics?

h. Computational difficulties in learning vector geometry.
    - While proving out of the theorem of vector geometry students are carefully and seriously focused and inter with plan? What is your opinion towards it?

i. Organizational difficulties in vector geometry.
    - How are mathematical term dealt by mathematics teacher's in his class?
    - Which terms or procedure especially confuses for student? So that, their learning is affected?

j. Output difficulties in vector geometry

- to recall basic math facts, procedures, rules, or formulas, very slow to retrieve facts or pursue procedures

k. Requirement of pre-knowledge of students for vector learning.

# Appendix-5

**The questions for the class test to know organizational, computational and output difficulties.**

प्रश्न नं १ यदि $\vec{a}$ = 4 $\vec{i}$ +3$\vec{j}$ र $\vec{b}$ = -3 $\vec{i}$ +4$\vec{j}$ छ भने प्रमाणीत गर्नुहोस $\vec{a}$ र $\vec{b}$ आपसमा लम्ब छन ।

If $\vec{a}$ = 4 $\vec{i}$ +3$\vec{j}$ and $\vec{b}$ =3 $\vec{i}$ +4$\vec{j}$ then prove that $\vec{a}$ and $\vec{b}$ are perpendicular to each other.

प्रश्न नं २ यदि विन्दु A को स्थिति भेक्टर $\vec{a}$ विन्दु B को स्थिति भेक्टर $\vec{b}$ र रेखाखण्ड AB को मध्यविन्दु M छ भने M को स्थिति भेक्टर $\vec{m} = \frac{1}{2}(\vec{a} + \vec{b})$ हुन्छ भनि भेक्टर विधिवाट प्रमाणीत गर्नुहोस ।

Prove by vector method If a position vector of A is $\vec{a}$ , B is $\vec{b}$ and m is midpoint of AB then the position vector of M is $\vec{m} = \frac{1}{2}(\vec{a} + \vec{b})$

प्रश्न नं ३ एउटा समकोणी त्रिभुजको कर्णको मध्यविन्दु शिर्षविन्दुवाट समदुरीमा पर्दछ भनी भेक्टर विधिवाट प्रमाणित गर्नुहोस ।

The midpoint of hypotenuse is equidistance from the vertex of right angle triangle. Proved by vector method.

प्रश्न नं ४ कुनै पनी चर्तुभुजका भुजाहरुको मध्यविन्दु क्रमश जोड्दा वन्ने चित्र समानन्तर चर्तुभुज हुन्छ भनी भेक्टर विधिवाट प्रमाणीत गर्नुहोस ।

Prove by vectorically, The line joining the middle point of sides of quadrilateral taken in order is parallelogram.

प्रश्न नं ५ वृतार्धमा वनेको परिधिकोकोण एक समकोण हुन्छ भनी भेक्टर विधिवाट प्रमाणीत गर्नुहोस ।

The angle of circumference of semi circle is right angle. prove vectorically.

प्रश्न नं ६ चर्तुभुजका विर्कणहरु समकोण हुने गरी समद्विभाजन हुन्छन भनी भेक्टर विधिवाट प्रमाणीत गर्नुहोस ।

The diagonals of quadrilateral bisect each other at right angles prove by vector method.

प्रश्न नं ७ त्रिभुजको गुरुत्वकेन्द्र (भारकेन्द्र ) को स्थिति भेक्टर यसको शिर्षहरुका स्थिति भेक्टरहरुको योगफलको एकतिहाइ हुन्छ भनी भेक्टर विधिवाट प्रमाणीत गर्नुहोस ।

Prove that the position vector of the centroid of a triangle is one third the sum of the position vectors of its vertices.