DIFFICULTIES ENCOUNTERED IN LEARNING TRANSFORMATION GEOMETRY

A
THESIS
BY
AKHILESH YADAV

IN PARTIAL FULFILLMENT OF REQUIREMENTS OF THE 'DEGREE OR
MASTER'S DEGREE IN MATHEMATICS EDUCATION

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पत्र संख्याः-
Ref.

मितिः
Date: ....

Letter of Certificate

This is to certify that Mr. Akhilesh Yadav, a student of academic year 2072/073 with Campus Roll No. 374 Exam Roll No.7228247, Thesis No.1436 and T.U. Registration No 9-2-0306-2011.has completed this thesis under my supervision and guidance of prof. Dr. Binod Prasad Dhakal during the period prescribed by the rules and regulations of Tribhuvan University, Kirtipur, Kathmandu, Nepal. The thesis entitled on **"Difficulties Encountered in Learning Transformation Geometry"** embodies the results of his investigation conducted during the prescribed period under the Department of Mathematics Education, Central Department of Education, University Campus, Kirtipur, Kathmandu, Nepal. I recommend and forward this thesis for the evaluation as the partial requirements to award the degree of Master of Education.

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Prof. Dr. Bed Raj Acharya
(Department Head)

Date: 20 February, 2022

Letter of Approval

This thesis entitled "**Difficulties Encountered in Learning Transformation Geometry**" submitted by Mr. Akhilesh Yadav in partial fulfillment of the requirements for the Master's Degree in Education has been approved.

Viva-Voce Committee	Signature
Prof. Dr. Bed Raj Acharya	. ………………………
(Chairman)	
Assoc. Prof. Laxmi Narayan Yadav	………………………..
(External)	
Prof. Dr. Binod Prasad Dhakal	……………………....
(Supervisor)	

Date: 6 March, 2022

Recommendation for Acceptance

This is to certify that Mr. Akhilesh Yadav has completed his thesis entitled **"Difficulties Encountered in Learning Transformation Geometry"** under my supervision during the period prescribed the rules and regulation of Tribhuvan University, Kirtipur, Kathmandu, Nepal. I recommended and forward his thesis to the Department of Mathematics Education to evaluate in final viva-voce

....
Prof. Dr. Binod Prasad Dhakal
(Supervisor)

Date: 2022

Dedication

I want to dedicate this thesis to my father Mr. Ghanshyam Yadav and mother Mrs. Teeja Yadav who devoted their entire life for my study and made me what I am today.

Declaration

I hereby declare that to the best of my knowledge this thesis is original and this thesis contains no material which has been accepted for the award of other degree in any institutions. To the best of knowledge and belief this thesis contains no material previously published by any authors except due acknowledgement has been made.

…………………
Mr. Akhilesh Yadav

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Abstract

This is case study entitled" The learning difficulties in transformation geometry at secondary level" the purpose of this study was to identify the learning difficulties transformation geometry and find the way for minimizing difficulties. This study is conducted at Shree Balrampur secondary school in Rupandehi. It is qualitative research in descriptive nature. The data was collected of this study with interview, class observation and class test. The populations of this study were selected purposively from Rupandehi district. I had selected 10 students from Shree Balrampur secondary school with the permission of the head teacher, mathematics teacher and interested students. The researcher made an interview with concerning the students, math teacher, and head teacher, and then the collected data were analyzed by descriptive method.

The finding of the study shows that there were lots of difficulties. One component of arising difficulties on learning process in transformation geometry was the pre-knowledge and poor geometrical background of students and another was the traditional teachingby both trained and untrainedteacher. They teach exam oriented. The students faced difficulties on transformation geometry teaching and learning process because lack of using instructional material, non-effective teaching learning management, negligence for doing homework, due to lack of time and students are poor, irregular cannot give sufficient time in other than optional mathematics. Teacher generally traditional teaching method like lecture method and using teaching material. To minimize such kinds of difficulties there should must be student centered. Students had given opportunity to work along and together in the class. Continuous assessment system should be taken in practices.

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<div align="center">**INTRODUCTION**</div>

Background of the Study

The word "Mathematics" is derived from an ancient Greek word "mathema" which meant "to learn". So, mathematics is a process of learning and it is an expression of human mind concerned chiefly with idea, process of reasoning mathematics language in which we use ideograms and symbols instead to words. So mathematics is an organized structure of knowledge in which each proposition is deduced logically from previously proved proposition or assumption and it comprises skill, technique and arts by which men convey ideas concept and facts.

In this world of today nobody can live without mathematics even for single way. Mathematics is intimately involved in every moment of one's life. According to sidhy (1006, P.3)" Nowadays one cannot do without mathematics use of fundamental process of mathematics in daily life. A common man can get on sometimes very well without learning how to read and write but he can never pull on without learning how to count and calculate. The knowledge of mathematics fundamental process and the skill to use them are preliminary requirement of human being these days" Sentman at Elstate "Mathematics is port of experiences of all people regardless of how far they have gone in school. It is a foundation of scientific technological world as we live in today. The great advance which civilization has made in science and technology could have been without mathematics. In the creation of modern science and technology, there is a great rule of mathematics. Without mathematics those kinds of development in the field of science and technology are no possible.

Geometry is one of the most useful and important branches of mathematics. Geometry includes an enormous range of ideas and can view in many different ways. Ithas been interlocked with many subject and different views of human activities. The basic ideas of a mathematical system originated in geometry. The word geometry is derived from the Greek words geo-metria which means measuring of earth.

About the development of geometry According to Butler and Wren say "primitive people obtained their first knowledge of geometry from natural objected and later on from arts as well the needs that arose to understand and come to further the legacy of art, architecture, surveying, measurementetc. provides the stimulators the development of science of geometry". In 17th century is the science of dynamics field of pure geometry, algebraicgeometry, projectivegeometry, Euclideangeometry, transformation geometry.

In context of Nepal, bythe recommendation of NEC,1992 and higher-level NEC,1998, the commission has recommended a number of news topics to be incorporated in the school mathematics curriculum "Transformation geometry" is one of them which is introduced at grade 9and 10 of optional mathematics. Transformation geometry is one of the most useful and important branches of mathematics. In different properties of set object from one position to another position. And it deals with congruence and similarity mapping. Transformation geometry is an aspect of geometry which concern itself with the way geometrical shape of object are transformed into their image under Reflection, Rotation, Translation and Enlargement on plane. Rotation, Translation, Reflection with in geometrical transformation are used in daily life. In world there is much research on learning transformation geometry.

Only few studies had been done difficulties in learning transformation geometry. Examination council of Lesotho (2007, 2008) try to find out that student's performance in Rotation transformation and the finding was most students did not give the required solution of rotation for example when finding the point and center of Rotation. Hollebrands (2004) found that student have difficulties in identifying and naming transformation of rotation, finding the Centre. Angle of rotation and locating the exact image of a rotated figure after rotation also they had greater difficulties when using transformation to do proof. And also Austin (1983) and Shultz (1978) found that the direction of the movement of the translations had a definite impact on the difficulties of the problem. They found that translations to the right, then to the left were easier than diagonal translations, either than diagonal translationeither up and to the right or up and to the left. They also found that as the distance between the initial and final figure increasing in the translation. The students experienced increasing difficulty in performing the translation tasks.Kuchemann (1980) found that students had most difficulties with reflection over a diagonal line, the students were found to often ignore the angle or shape of the reflection line and perform a horizontal or vertical refection.

From the above studies I identified that there are various types of difficulties, these difficulties are generally the mistakes such as finding the center and angle of rotation, finding the reflection axis, slop of reflection on axis, finding the image of the objects, specifying the equation of the distance between the object and its image. Son (2006) Indicates that teacher also confused in reflection and rotation in their work. It would be a very important contribution for the literature to include all of the transformation concept and show the students have difficulties. However, no study was found covering the whole topic of transformation geometry. Therefore, this study helped to

find the difficulties in learning transformation geometry in optional mathematics and the way to remove such difficulties. Therefore, this research is considered to be important.

Statement of the Problem

There is increasing evidence that many students in the middle years (11-15) of schooling have tremendous misconception concerning a number of important transformation geometry ideas (Burgeretal, 1996). There are many possible reasons for this furthermore, a divergence of opinion exists in the mathematics community about the methods and outcomes of transformation geometry and as a result, textbook writers and producers of syllabuses have failed to agree on a clear set of objectives. Many teachers do not consider geometry and spatial relations to be important topic transformation geometry to be taught in school. Transformation geometry is essential branches of mathematics in primary level up to higher level. Therefore this chapter involved in primary level up to higher level. The major cause behind leaving this chapter in school and failing in this subject is due to the poor performance in mathematics.

In mathematics transformation geometry is subject which responsible behind failure and low performance of the students. Most of the students thought transformation geometry is boring and difficult chapter of mathematics subject. Most students did not give the required solution for example finding the reflection, slope of reflection on axis, finding the image of the objects, finding the point and center of rotations and also students confuse mix question with in reflection, rotation and translation. So, it is well appropriate to research about difficulties in learning

transformation geometry at grade nine. The research questions of this works are as follows

- What are the difficulties in learning transformation geometry at grade IX?
- How to minimize the learning difficulties in transformation geometry ate grade IX?

Objectives of the Study

The objectives of the study

- To identify the difficulties in learning transformation geometry at grade IX
- To analyze the causes of difficulties in learning transformation geometry at grade IX

Significance of Study

Mathematics is an essential part of school curriculum of Nepal. It has been shown as compulsory subject at all level of school education program. Mathematics is also included as optional subject at secondary level education. Mathematics is a powerful subject related human and their behavioral activities which help to fulfill daily life human needs. The low achievement is mathematics, low attraction in choosing optional mathematics and problem /difficulties in learning mathematics. Difficulties in learning geometry at secondary level are grating issue concern for all stakeholder, student their parents, teacher, educators and government sector concern with this field.

Transformation geometry is a branch of geometry which helps to fulfill daily life human needs. Thought it is necessary to learn geometry and transformation

geometry. Most of students felt difficulties to learn it. Students have not clear concept about transformation geometry. Still students try to solve the transformation geometry question. 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 transformation geometry at secondary level. If learning difficulties experienced by students could be researched for transformation geometry learning in this study.

Therefore, this research was focused to identify the difficulties in learning transformation geometry at secondary level in community school. The researcher had tried to explore the difficulties being faced by teacher and students in learning transformation geometry at grade nine by observing the class when the transformation geometry was teaching. The following are the significance of the study:

- It is helpful to mathematics teacher and students for teaching and learning transformation geometry.
- It was helped to improve the topic transformation in secondary and higher secondary level
- It provides the appropriate information about difficulty faced by students in learning transformation geometry.
- This study provides a guideline to educators, curriculum planner, developer and researcher to find out the difficulties in learning transformation geometry.

Delimitation of the Study

Each study is no rigorously perfect and free from limitations. The research was case study research so it cannot be generalized to all over the students of different

place of notation, it had concerned with only one school of secondary level in Rupandehi district. The delimitation of the study was as follows

- This study concerned to only with Rupandehi district.

- This study is delimited only in secondary level.

- This study carried out a government school and problems of students to learn transformation geometry.

- This study was completed on the basic interview, observation from and recorded history of school.

- This study covered only transformation geometry part of optional mathematics at secondary level.

Definition of Related Term

Secondary level students: In this study student means these who are reading at secondary level and taken.

Learning problem: learning problem are the obstacles of the students which mostly influenced by unfavorable environment, understanding level, assimilation and pre-knowledge of students.

Transformation geometry: A geometric transformation is any bijection of a set to itself with some salient geometrical underpinning.

Concept: General idea about something. This involves understanding the components of a phenomenon

Shapes: Geometry shapes embedded in spatial objects and create an important part of geometry.

Chapter-II

REVIEW OF THE RELATED LITERATURE

Review of the related literature to compare the study which provides strong knowledge about the related topic, number of books research report papers and other booklets can be concerned with curriculum, teaching materials, methods and so on. Also, a review of the related literature is the source of the further study of the research which the better idea for the surveying in whole research. I have reviewed some of the literatures which are given below.

Empirical Literatures

Aktas (2017) Conducted research on "Understanding of 8 grade students about transformation geometry: perspectives on students mistakes" The study was conducted by using mixed method with 125, 8th grade students. He conclude the students understood that the translation transformation is a movement of replacement, but they had difficulty in the topics such as the direction of the transformation and the position of the shape within the transformation and students had difficulty in identifying the equation of the axis of symmetry for the images of the shapes under reflection, confused the rule that the points intersecting with the symmetry for the images of the shapes under reflection and also students problems in finding and practicing the angle of rotation about rotational transformation.

Kurtulus (2010) investigated "student's misconception and errors in transformation geometry" The study analyzed students' performance in two-dimensional transformation geometry. The subject of the study included 126 bachelor third year students; date was collected from seven exam questions. The result of the

analysis showed that these students did not understand how to apply rotational transformation. The mostly mistake observed showed that the students seemed to know the algebraic meaning of translation and also of rotation but they did not seem to understand the geometric meaning of these concepts.

Evbuomwan (2013) conducted research on "An investigation into the difficulties faced 8 grade students in the learning of transformation geometry". The study was conducted by van Hieles level of learning to investigate with 90 students by both written test and interview.Finding from the study revealed that students had difficulties in identifying and naming transformation of rotation, finding the center, angle of rotation and locating the exact image of a rotated figure after rotation. Also they had greater difficulties when using transformation to do proof.

Ozerem (2008) conducted research on "misconception in geometry and suggested solution for 8 th grade students" this study aim to find out the mistake, 28, 8 th grade students made in the last 4 exams including two midterms and two final exam. To collect data, students were tested on two midterms and final exams using open ended question on geometry. A descriptive methodology and students interviews were used in the study to analyze and interpret the result. The result from this study revealed that 8 th grade secondary school students have a number of misconception, lack of background knowledge, reasoning and basic operation mistakes at the topic mentioned above.

Hollebrands (2013) investigated "The nature of students understanding of geometrics transformations" Which included translation, reflections and rotations, in the context of technological tool. He implemented a seven-week instructional unit on geometry transformation. Student's conceptions of transformations as functions were

analyzed. He concludes that students understanding of key concepts including domain, variable, parameter, and relationships and properties of transformation were critical for supporting the development of deeper understandings of transformations.

Kekana (2016) Conducted a thesis entitled "UsingGeoGebra in transformation geometry based on the van Hiele model" The aim of this study was to investigate on a small scale the potential of the use of GeoGebra in teaching and learning of transformation geometry to grade 9 learners. By using mixed method for this research and 54 public schools selected by purposive sampling method, date collection tools were interviews, questionnaire, observation, survey paper and written test. The results are dissertations which are teacher and learners backgrounds their views on the use of GeoGebra, usage of GeoGebra as well as their evaluation of GeoGebra.

Thapa (2009) conducted research on "causes on students' difficulties in proving theorem of geometry at secondary level" the objective was to find the difficulties on the learning environment of the school. To find the difficulties concerning to pri-konwledge of students to find the difficulties of teacher and students' activities in the class room and to find the difficulties on instructional strategies. He concluded that careless of school administration andnon-effective learning management, student's week pri-knowledge about geometry, teacher support traditional teaching strategies in teaching geometry proof class. They have not used modern teaching techniques, method and materials at proving theorems of geometry.

Paudel (2014), did study on "difficulties in learning trigonometry". The nature of this study was qualitative. The main objective of this study was to find the cause of difficulties in learning trigonometry and to minimize the difficulties in learning trigonometry at secondary level. For the sample one public school and one private

school was selected. Class observation and interview was used for the date collection. The study concludes that there was not sufficient material for learning material for learning trigonometry and due to the lack of interactive classroom students feel difficulties in learning trigonometry.

KC (2009) conducted a thesis "A study of problem faced by students in mathematics at secondary level". The nature of this study was mixed design. This study followed survey design. He selected six schools from urban area of lumjung district randomly. Among them three were private and three were government schools. From each school one mathematics teacher and three mathematics students of grade 10 were selected as a sample for the study. From the data collection, a set of class observation from and interview schedule were used. He concludes that mathematics teaching isn't effective because of curriculum, textbook, physical facilities, teaching learning activates, materials, method and student's evaluation techniques, moreover, both trained and untrained teacher are similar problem like crowded numbers of students, lack of math lab, poor evaluation process, negative attitude toward.

Sharma (2011), did study on "learning difficulties in vector geometry at secondary level" the study conducted using qualitative method. The researcher selected mathematics teacher, head teacher and 7 students as the respondent for the interview of selected school. Collected dates were analyzed by the cross-match approach, triangulation approach with help of cognitive theory and burner constructivist theory. He concludes that the students and teachers both faced difficulties on vector geometry and also lack of instructional materials, non-effective

teaching learning management, method, poor evaluation system. There was a lack of motivation and encouragement about vector class.

Sah (2016) "Problem of teaching and learning mathematics in geometry at grade IX" the nature of this study was qualitative. The samples of this study are two mathematics teachers, five students, head teacher and five parents. From the data collection, a set of class observation from interview schedule were used. For the theoretical supports van Hieles five level of thoughts also taken. After collected date were analyzed by descriptive method. Researcher found that the teaching learning environment of home and school, pri-knowledge of students, learning activities seems to be exam oriented rather than practical oriented, poor of evaluation techniques, lack of appropriate teaching methods and material, students weak pre-knowledge about geometry and poor geometrical lack ground, complex and larger syllabus, careless of administration and no-effective learning management related problems faced by teacher and students in teaching learning geometry.

From above empirical reviews, the researcher focused on effect of culture, language, suitable method and effects of instructional materials to teach transformation geometry. Most of study followed qualitative and mixed method. For the theoretical supports van Hiele, constructivism and cognitive theory. However, no study was found covering the whole topic of transformation geometry in the literature. After studying overall literature. The researcher found that no research found that no research has been done regarding teaching problems in transformation geometry to find the gap. This study was focused on learning difficulties in transformation geometry.

Theoretical Literature

There is various learning theory related to children's learning development. How people learn and the ability to apply theories in teaching learning mathematics are important prerequisites for effective mathematics teaching. Many people have approached the study of intellectual development and the nature learning in different ways. This has result in several theories of learning. Most popular and widely accepted theories related to students learning of mathematics. There are various approaches propounded by Brunner, Dienes, Gagne, Piaget and Skinner. Here the research discusses about cognitive and constructivism use in transformation geometry.

Cognitive Theory

Cognitive development include reasoning, memory, problem- solving, and thinking skills that help young children understand and organize their world. For preschoolers, this evolves into complex mathematics thinking and scientific resoning.Children play an active role in their own cognitive development by exploring and testing the world around them, but they also need support from parents, teachers, and other adults (Diana and Hiebert). It also believed that how to teach is really difficult problem for the teacher, various method and techniques of teaching have developed by the pedagogies and utilized to developed various fact of the cognitive and affective domain.We all know that every student is different to each other. The knowledge of students depends on their pre-knowledge, their activeness, background of their family, society, culture and so on. It is really challenge to treat all the students having different base in a same time. Thus, students cannot learn equally. Effectively or meaningfully in the class. Also, they focus lot of difficulties learning mathematics. Therefore, this theory can be connected with this research. Upadhyay, (2007, p 38)

define the basic assumption of cognitive theory as identified four development stage and process by which children progress through them. The goal of the theory is to explain the mechanisms and process by which the infant and then the child develops into an individual who can reasons and thinks using hypothesis. Jean Piaget presents the most comprehensive view of this   theory according to whom, overall development follows the four-stage form birth to maturity. Those stages are sensory motor stage, pre-operational stage, concrete operational stage and formal stage. Cognitive stages take as maturation process in the sense that development is continuous and based on previous growth the operation is sequential and successive. Cognitive believes that sense impression is the primary source of information. Learning is a change in mental schema. It becomes knowledge only when the mind systematized it. Mental representation of the world plays a central role in individuals' perception, thoughts and action.

Students need concrete opportunities to supplement the words and visuals that are represented in transformation geometry (Martine&Stramel).transformation geometry topics may be approached quite naturally through the manipulation of concrete objects or figure drawing ….initially, the child performs actions upon objects. But eventually, after the object becomes distinct image, the child is able to perform mental transformation s (action) upon these images……imagery evolves from an initial level of reproductive image based completely upon past perceptions to a level of true anticipatory images which are imagined to be the results of an unforeseen transformation (Williford,1972).At the formal operational stage of the child abstract thought, deductive reasoning and hypothesis testing are developed. It implies that in mathematics, numerical symbols give way to algebraic symbols, solving transformation geometry and algebraic logic as explained earlier at formal

operation stage above. Therefore, this learning theory is very important for teaching and learning transformation geometry in secondary level.

Constructivism Learning Theory

Constructivism becomes are related to educational theory to deal with the problem of mathematics. It resolves the problem of low achiever in mathematics. It is a theory based on observation and scientific study to deal the problem of learning. From this perspective, learning is viewed as the construction of personal meaning, and learning in the classroom is simply an extension of the same process by which the existing ideas were developed from student's activeengagement from the earliest age. People actively construct or create their own subjective representative of objective reality new information is linked to' prior knowledge thus mental representations are subjective. The constructivist classroom presents the learner with opportunities to build on prior knowledge and understanding to construct new knowledge and understanding from experience. Learners are allowed to deal with problems and they find meaning in them because of their real context. in solving their problems learners are encouraged to explore possibilities, invent alternative solutions, collaborate with other learners and finally present the best solution. Constructivist idea of learning can point towards number of different teaching practices. It encourages the student to involve themselves activity and use techniques of learner centered, group discussion, learning by doing, use outside tools to be more practical and gain high achievement in mathematicsclassroom easily.

The constructivism, theory believe in emphasizes on construction of mathematical realities by students through action. And other hand the social constructs believe on formation of knowledge through active construction and

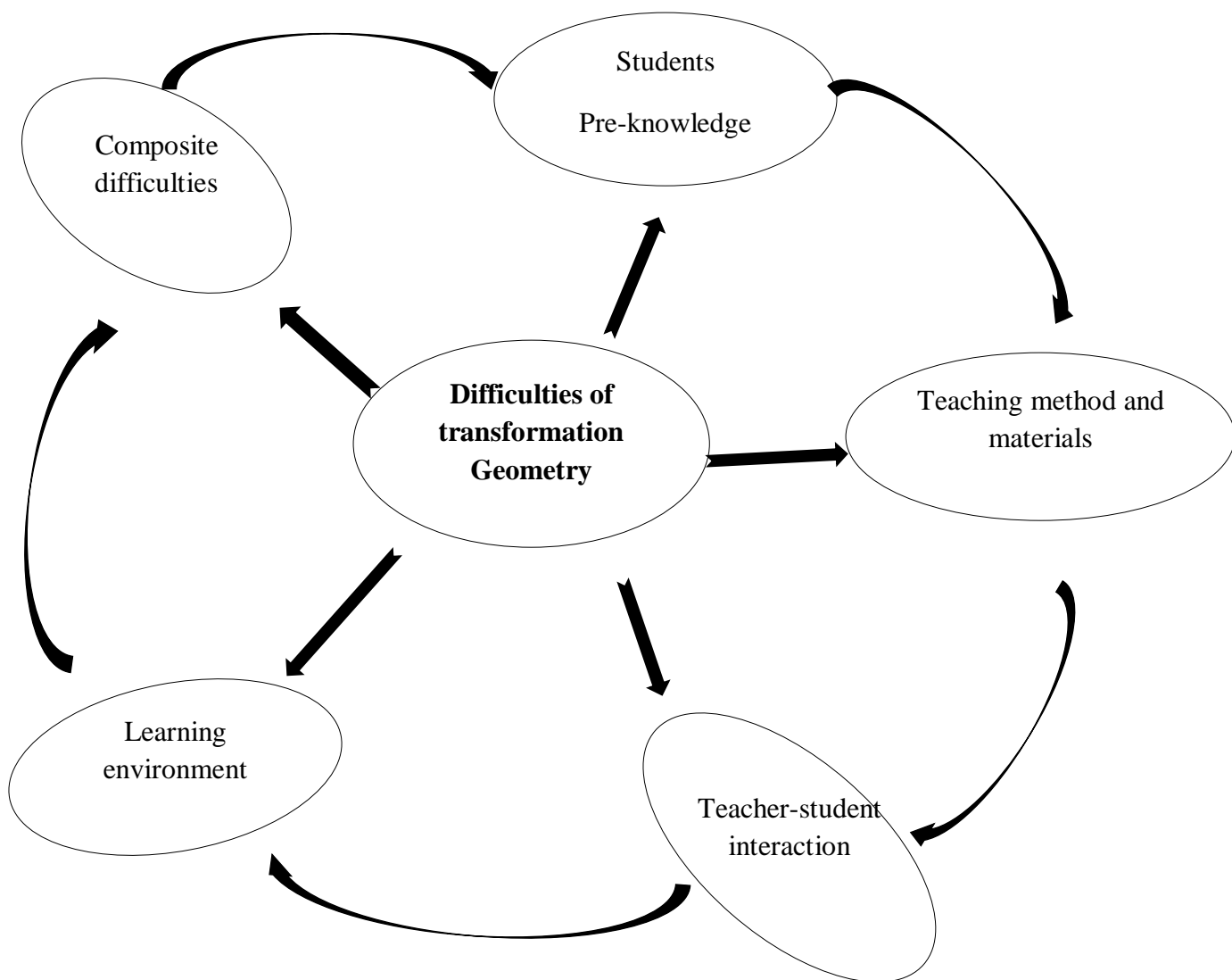reconstruction of theory and practices. The child needs some mediators like parents or peers to uplift

Difficulties in learning transformation geometry at secondary level his\her knowledge that exist with his\her parents. according to zone of proximal development '' it means that is Vogotskian, theory a range of tasks about the child can't yet handle along but can be with the help of more skilled parents.

Social constructivism believe that mathematics is social construction and cultural product and directs their criticism at radical constructivism pointing out the fact that it does not entail a theory of learning at alone being the theory of discovery problem solving and investigational learning. Vygotsky (1978) sates,'' every function in the child's cultural development appears twice first, on social another on the individual level, first between people (inter- psychological) and then inside the child (intra-psychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate actual relationship between individuals''.

Vygotsky pioneered research in learning science and mode a story argument for the need for students to demonstrate their knowledge by creating explanations and interpreting their work for others. Children are thinking in the overall context of the school environment as within variations they introduced into that environment. Therefore, constructivist theory is very important for teaching and learning transformation geometry at secondary level.

Conceptual Framework

This study tried to find out the difficulty in learning transformation at secondary level students. From the already described different empirical and theoretical literature, the following conceptual framework has purposed to identify the difficulties and find out how to minimize difficulties in learning transformation geometry at secondary level. The researcher concludes that learning difficulties in transformation geometry were following conceptual framework for this study.

Students
Pre-knowledge

Composite
difficulties

**Difficulties of
transformation
Geometry**

Teaching method and
materials

Learning
environment

Teacher-student
interaction

This conceptual framework describes about the difficulties in learning transformation geometry at secondary level mathematics students. There are mainly five causes of difficulties in learningtransformation geometry. So, teacher-students interaction, student's pre-knowledge, teaching methods and material, connection difficulties and learning environment difficulties in learning transformation geometry. It would be based on interview, observation and class test

Learning environment of school focuses those studentsand teacher made regular use manipulate materials, technology and actively participate in discourse and conjecture, verify reasoning and share solutions. Similarly, the character of children's home influences their intellectual development. Pre- knowledge of students are helpful to learn the new topic and teaching methods and material play the role of bridge in learning transformation geometry. Similarly, teacher- student's interactions are very importance to understand the transformation geometry.

Student's pre-knowledge

The skill and knowledge of mathematics is the regular ongoing process. In the process the previous knowledge and skills are the source improving current mathematics. In the sense, mathematics is to be taught by applying the formal skill and knowledge. The concept (knowledge and understanding) that are helpful to learn the new topic is pre-knowledge. Students should have the well concept of basic properties of (triangle, parallelogram, square, rectangle co-ordinate etc is pre-knowledge for transformation geometry.

Teaching Method and Materials

The selection and use of teaching methods and instructional materials plays a crucial role the effective classroom practice. There are various types of teaching methods that can be used in classroom practice. The selection of appropriate teaching method for particular topic of teaching methods that can be used in classroom practice. The selection of appropriate teaching method for particular topic can be considered as the measure aspect of effective classroom practices.

Teacher-student Interaction

Teaching is a tripollar system which is done between the teacher, students and learning environment in classroom. Teacher is the main agent for curriculum implementation, students perceive most behavior of teacher and impressed to teacher, so the role of teacher in class most important. The activates of teaching classroom are to guide student, motivate, monitoring students' progress encourage, create and facilitate the learning environment, and sure appropriate teaching materials, method, examples to achieve the objective of curriculum. The roles of students are to do the activities promoted by school curriculum and task by giving teacher as performer in classroom.

Learning Environment

Learning environment is the most important aspect of learning. Learning environment of school is seemed to the main component of well achieving in education. The learning environment of school is to create good images towards teachers, students, attaching to school, the location of school, physical facilities available in school, SLC result, involvement of student in extracurricular activities,

relation among the teacher, students, demography of mathematics teacher and head teacher, surrounding environment for students.

Composite Transformation

The study of composite transformation increase understanding for the concept of congruence of two dimensional figures and provides meaning and closure to the mathematical system of transformation (Wesslenand Fernandez, 2005). The issues students experience with the concept of composite transformations include the difficulties experienced with each individual types of transformations and difficulties identifying and understanding the combination of composite transformation. Students often do not see congruence of figure when shape are placed in different orientations and that using different direction or distance movement still yields the same resulting shaped figure.

Chapter-III

METHODS AND PROCEDURES

This chapter presents the research method of study which was determined how the research becomes complete and systematic. This study was concerned with the problem faced by students learning transformation geometry in mathematics at grade nine. The major procedures followed in this study were as follows.

Research Design

Research design is the conceptual structure, strategy of the logical and systematic and direction of the research. Its main importance is to analyze date. The conducted study is essentially qualitative nature. The intended research was descriptive case study research. The study has based on case study designing in qualitative approach. Qualitative methodology deals with the collection of information formally and informally and using themes to draw conclusion about the views and attributes of people.

Selection of Case School

There were many types of school in Rupandehi district such as government, private, community-based school. But more schools were not teaching optional mathematics in secondary level. To fulfill the objective of researcher selected community school as Shree Balrampur secondary school, Rupandehi by using purposing method.

Selection of Case Respondent

Theresearcher of this case study was head teacher, mathematics teacher and 10 students (6 boys and 4 girls) who were taken optional mathematics in grade nine.

Sources of Data

There are two types of sources in study. One is primary sources and another is secondary sources of data. To get reliable information the researcher was used primary date for this purpose she\he himself visit the field use observation, interview and achievement test. Also, researcher collects some necessary data

Tools of the Study

The tools of the study were as follows

ClassTest

The researcher is fulfilling the objective of this research. The researcher conduced the mathematics achievement test for key students to find out the area of difficulties in transformation geometry (knowledge, comprehension, application, synthesis, analysis, evaluation) for achievement test, 12 question with subjective questions. The test is constructing in such formal that it covered the area of knowledge, comprehension, application, and synthesis and evaluation level. The researcher himself developed the achievement test based on the secondary level optional mathematics topic in transformation geometry. After the test was developed by researcher it was be discuss with school teachers and exports in order to assess on language, complexity and suitability of the items. The types of evaluation question 30 were marks with two mark and four marks.

Classroom Observation Form

During the 10 days classroom observation. I was observed seatingstructure, teacher activities, student's response and activities. In the period the considerations made no to disturb the natural setting inside the classroom. The main purpose of the classroom

observation has to find out the difficulties in learning transformation geometry. The researcher was more careful to make study more reliable.

Interview

Interviews are one of the most important tools of qualitative research. When properly used. Researchers often get better responses from interviews then other data gathering devises like the questionnaire (cuties El al, 2000). In this research, the researcher uses interviews with respondents. The researcher take interview with students, mathematics teacher and head teacher, interview was being taken with randomly selected students in classroom. It was the researcher to draw the actual information about difficulties of transformation geometry. Information from teacher, students and head teacher which help researcher to make conclusion more reliable and valid.

Reliability and Validity of Tools

The subject export, specialist and supervisor were used to check the reliability and validity of the collection tools. So, the researcher was used triangulation method for cross validation of the information obtain form respondents

Data Collection Procedure

The researcher was observed the class room using observation form ten days in grade IX. The researcher watch, listens, interacts and records the essential data from the information about learning environment and activates with mathematics teacher, head teacher and students with the help of interview schedule. The researcher was listed the replied of respondents curiously and note properly. By observing surrounding environment of school, condition of mathematics tool, availability of teaching materials in mathematics lab, other facilities of school

Data Analysis and Interpretation Procedure

Data interpretation is the systematic process of presenting and showing its effect. This analysis of date is important thing while preparing research report. In this study primary data was present and analysis. The collected data from primary sources by interviews, mathematics' achievement test and observation were analysis and interpret on the basis of the framework by using descriptive method. All information was collected from sources and match with information from review documents. The data was collected by interview and observation with student, mathematics teacher and head teacher. The collected information at first categorizes according to category of the response and different themes were given in the text of interview test, observation note. These themes were considered as a code and the similar code similar code version of respondent class of students was collected together and explain in their perspectives. The collected data was analysis by cross approach. The researcher also uses triangulation method for analysis of data because to take the common data obtain from interview, class observation and achievement test. At last, the main themes were analysis with the help of cognitive and constructive theory.

Chapter–IV

ANALYSIS AND INTERPRETATION OF DATA

This chapter deals with the analysis and interpretation of the collected data. This was descriptive qualitative research related to the difficulties in learning transformation geometry at secondary level. To fulfill the objectives of this study the researcher selected Shree Balrampur secondary school, Rupandehi. The objectives of this study were to find the difficulties in learning transformation geometry at secondary level and to find the way for minimizing difficulties in learning transformation geometry at secondary level. Observation, interview and achievement test were used for the data collection as a main tool. 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 (which are also given in conceptual framework). Teaching methods and material difficulties, student's pre-knowledge difficulties teacher student's interaction difficulties, compositetransformation difficulties and learning environment difficulties. Mention data were collected through interview, observation and achievement test. Researcher took interview with the students, mathematics teacher and head teacher with the help of interview guidelines tools respectively. Also, the researcher had done class observation form to observe the activities of students and teacher at the teaching transformation geometry. At that period researcher observed carefully and every notable activity of students and teacher. The data were analyzed and interpreted by the information taken from math teacher interview, student's interview, and head teacher interview and classroom observation. These data were analyzed by analytical method.

Teaching Method and Materials

Teaching method and instructional materials plays a crucial role for the effective classroom practices. There are various types of teaching methods such as lecture method, discussion method, and problem solving method, inductive and deductive method that can be used in classroom practice. The choose of teaching method for a particular topic can be considered as the measure aspect of effective classroom practices. Teaching method is a way communication from which students can be able to gain knowledge about the subject matter and materials that provide the mental picture of abstract things and helps students to make strong concept about this subject matter for a long time. But maximum teachers used only lecture method. In classroom lightly teacher used teaching materials like geo-board, graph paper, geometry box;low-cost material is not used in classroom. Generally, teachers used only chalk, duster and textbook in mathematics classroom.

Episode: 1

One day researcher went to school with ready to observe the class. After three hours peon rang the bell fifth periods. In fifth period researcher and optional mathematics teacher entered the classroom with daily uses material chalk, duster and text book. All students stood up and said well after noon sir then teacher replied by saying well after noon and sit down everybody. Teacher told the students we going to start new chapter transformation geometry. Teacher wrote the topic on blackboard. Firstly, teacher asks question to students "what is transformation? Few students gave right answer but maximum students cannot gave answer. After some time, teacher defined the concept of transformation and transformations type'sgaves with some examples without materials. Teacher solved two problems of reflections and

asked the students to do remaining exercise as the homework assignment. At last teacher said next day I went to teach rotation"

From the review of the classroom observation. The researcher concludes that lack of participatory approach between the students and teachers in the classroom. Teacher solved question of reflection without few participations of students and there is lack of using teaching materials in classroom teaching. Teacher only look on white board. He cannot see students' activities and use like lecture method and rote learning in classroom.

After researcher took face to face interview of math teacher, students and head teacher. The finding given below

"We haven't taken especially formal training in optional mathematics or mathematics but I always use child centered method and I used teaching material rather than daily user and made students concept of any solve question of transformation geometry" **(math teacher)**

The above quoted views of teacher made a contradiction with the researcher class observation. Teacher maximum used in classroom lecture method and rote learning and less using teaching material in optional mathematics classroom.

"The teacher solves the problems of transformation geometry in the white board and did not use any materials while drawing and showing figures in the transformation chapter'' **(Students views)**

The above quoted view of students shows that the teacher did not have used any teaching materials. It shows that there was lack of teaching materials. Teachers were not using teaching materials. They did not know how to used teaching materials.

"All know truth the economic status depends vital role to fulfill all things in everywhere same as we have crisis of economics" **(head teacher view)**

From the above view of head teacher shows that there is lack of economic resources in my school.

Hence, it is concluded that the cause of becoming difficulties in teaching learning transformation geometry was teacher applied generally traditional teaching like lecture method &rote learning method because teacher hasn't taken any formal training about teaching method and materials. Teacher doesn't use any teaching materials like graph paper, geometry box and other effective teaching materials in transformation geometry class. Teacher used only teaching material chalk, duster and textbook because there is a lack of economic resources. So, learners are less participation in transformation class and fell difficulties.

Also, the researcher asked to the students and teachers, what should we do? Show that such difficulties are to be minimized. Then they told

"Teacher should be teaching differently than usual manner by using technology as for possible" **(students views***)*

*"Teachers are qualified and they teach well but the students gained poor result and difficulty so it w*ould *be better to send them for especially formal training in optional mathematics or mathematics"* **(head teacher views)**

"I think I have to teach this chapter using more teaching materials with better planning and active the students in my class. I have to use more child centered method and give them more basic concept about this chapter" **(math teacher views)**

From above mentions views. It can conclude that, teacher have to teach differently method by using technology, so that their mind is not being divert about out of thinks. The teachers always teach in optional mathematics (transformation geometry) classroom. It is compulsory to use teaching material and differently teaching method like problem solving method, discussion method, and question answer method. According to desire of student's teacher have to create learning environment in the class room. The filling of head teacher towards teacher positive, but the question is that why students are in difficulties or gained poor result in exam then other subject instead of teachers and good environment of school. So, for minimizing difficulty he wanted to send them of especially formal training in optional mathematics or mathematics. In near future the school administration is going to manage required teaching material for optional mathematics. So that their teaching process is best

Students' pre-knowledge

Mathematics is abstract subject. It has many facts, theory and other conceptual understanding. The basic knowledge or pre- knowledge of lower grade is the key factors to affect the present grade. Prior knowledge is base also important potential determinant of later performance of students. In this process the previous knowledge and skills are the source improving current mathematics. In this sense, mathematics is to be taught by applying the formal skill and knowledge. The concept (knowledge and understanding) that are helpful to learn the new topic is pre- knowledge. Students

should have the well concept of basic properties of geometry (triangle, parallelogram, square), co-ordinate geometry and vector geometry etc. as pre-knowledge for transformation geometry pre-knowledge is the most important to learning that effect the achievement in transformation geometry.

Researcher constructed 6 level questions (Blooms taxonomy of cognitive) for written test to find out the student's transformation geometry difficulties in pre-knowledge. These difficulties analyze, the researcher discuss in 6 ways. There are following:

Difficulties in knowledge

Researcher took a class test which makes a knowledge difficulty for the students in transformation geometry. The question was what is mean by transformation geometry? And how many classify the transformation geometry. Write list now.

१) स्थानान्तरण ज्यमिती भनेको के हो ? यसलाई कति प्रकारमा वर्गिकरण गर्न सकिन्छ लेख

3

उत्तर :- स्थानान्तरण ज्यमिती भनेको कुनै पनि
चित्रण वा वस्तुलाई एक ठाउँ
बाट अर्को ठाउँमा सर्नुलाई
स्थानान्तरण ज्यमिती भनिन्छ ।
यसलाई २ प्रकारमा वर्गिकरण
गर्न सकिन्छ ।
क) परावर्तन
ख) परिक्रमण
ग)
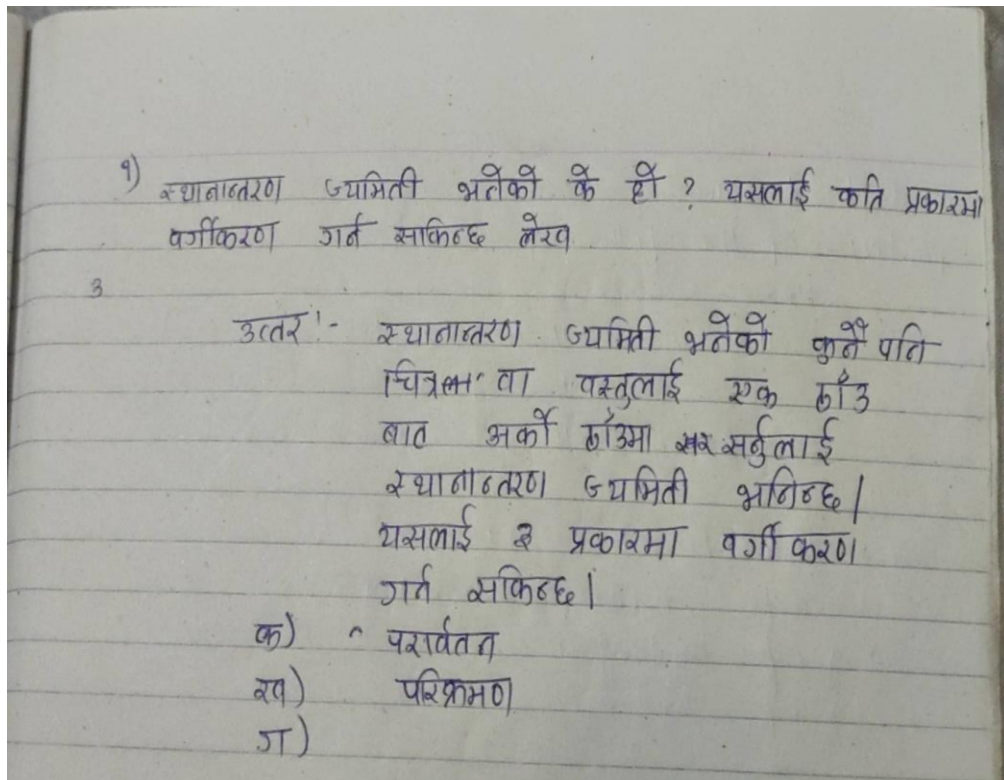
From above solution shows that students have difficulties in knowledge level knowledge level questions means to be able to answer exactly what the question say. Here the correct answer is transformation geometry is a set of object are transformed from one position to another position by rule and it deals with congruence or similarity mapping but students only can write transformation geometry is transformed of any object from one position to another position. Here they did not care about the rule,which are followed in transformation Geometry. Only three students can write all the types of transformation geometry and seven students unable to write all the types transformation Geometry. These showed students have difficulties in knowledge level.

Difficulties in Comprehension

The basic level of understanding it involves the ability to know what is being communicated in order to make use of the information is called comprehension level. Researcher took a class test which makes comprehension difficulty for the students in transformation geometry. Where question let A (3, 5) is mapped to (3, -5). Find the axis of reflection.
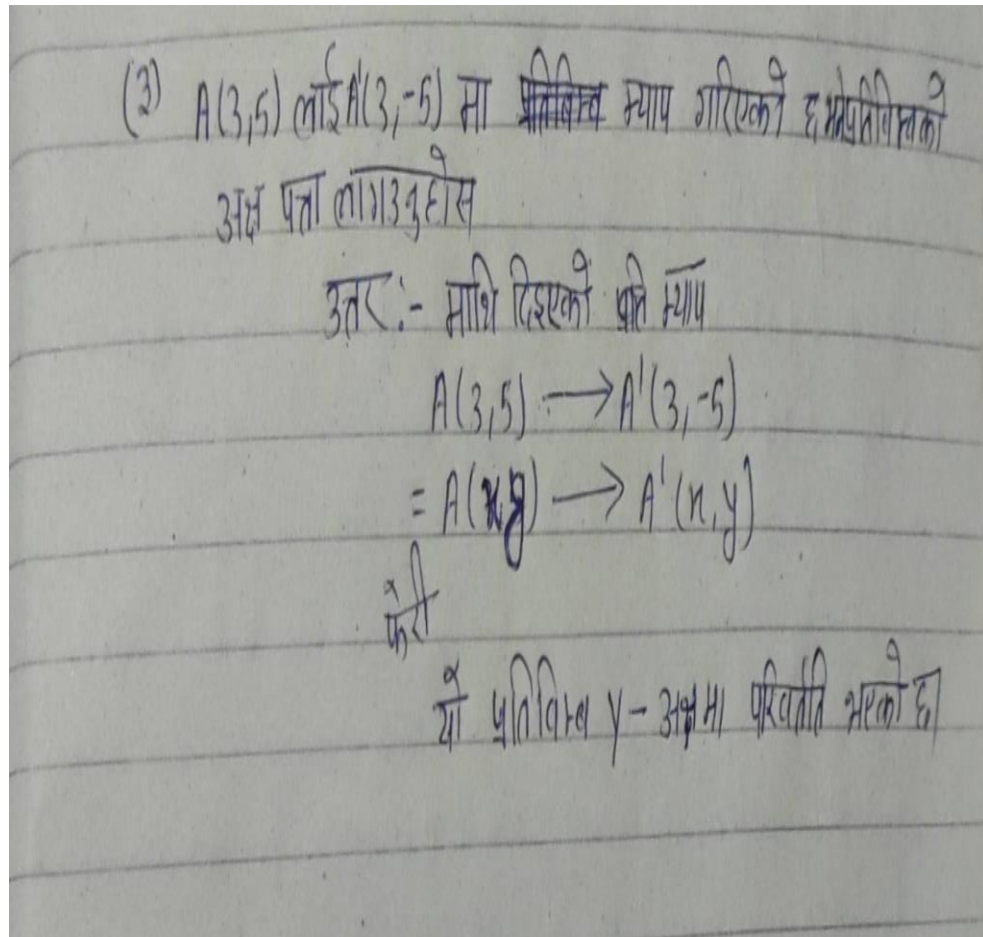
As above solution show that students have difficulties in Comprehension level.

Here, The reflection of this point

$A(3,5) \rightarrow A'(3,-5)$

Or $P(x,y) \xrightarrow{x-axis} P'(x,-y)$ is in x-axis,

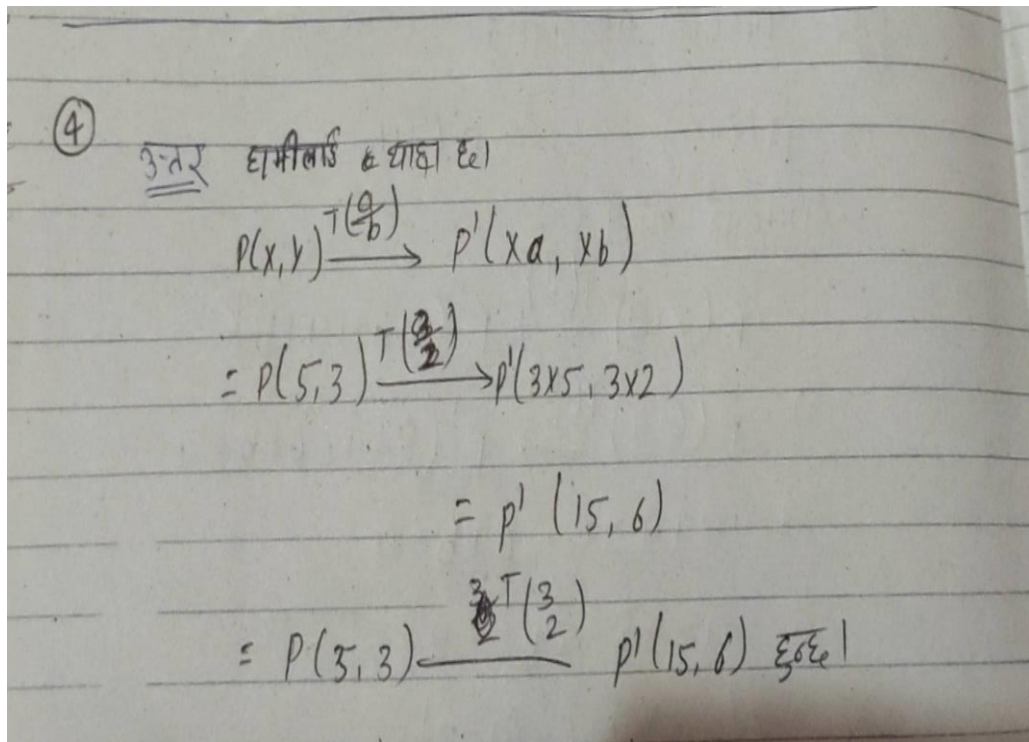But students unable to give the correct answer they reflect the point

$A(3,5) \rightarrow A'(3,-5)$ in y-axis. Students are confused which formula use there. Only

four students find out required axis and six students unable to find out the required

axis. These showed students have difficulties in Comprehension level.

Difficulties in Application

Application level question means teachers ask students to take information they already knows and apply it to a new situation. In this above researcher was constructed a question which was what is translation? Let P (5, 3) beat any point, V (3, 2) be a translation vector. Find the image of the point P.

Here the correct answer is

$$P(5,3) \xrightarrow{T\binom{3}{2}} P'(3+5, 3+2)$$

Or $P(5,3) \xrightarrow{T\binom{3}{2}} P'(8,5)$ by using the formula

$$P(x,y) \xrightarrow{T\binom{a}{b}} P'(x+a, y+b)$$ But students used multiplication in the place of addition such as

$$P(x,y) \xrightarrow{T\binom{a}{b}} P'(xa, yb)$$

or $P(5,3) \xrightarrow{T\binom{3}{2}} P'(3 \times 5, 3 \times 2)$

$$P(5,3) \xrightarrow{T\binom{3}{2}} P'(15,6)$$

Which is wrong only three students can gave the accurate answer and seven student couldn't gave the correct answer. This showed that lots students did not know the meaning of variable and constant also students unknown the operation which was used in constant and variable. Thus the researcher found that students have difficulties in application level.

Difficulties in Analysis

The ability to break down information into its integral parts and to identify the relationship of each part of the total organization is called analysis level question. Researcher took a class test which makes analysis difficulty for the students in the transformation geometry. Which were question if the image of point A (6, 4) is A' (8, 6), find the image of point P (4, 3) by the same translation.

The correct answer of this question is

$P(6,4) \rightarrow P'8,6)$

$P(x,y) \xrightarrow{T\binom{a}{b}} P'(x+a, y+b)$ Or

$P(6,4) \xrightarrow{T\binom{a}{b}} P'(6+a, 4+b)$

Now,

Or $6 + a = 8 \; and \; 4 + b = 6$

$a = 2 \qquad and \qquad b = 4$

$T\binom{a}{b} = (2,2)$

And the image of point P(4,3) by same translation is

$P(4,3) \xrightarrow{T\binom{2}{2}} P'(4+2, 3+2)$

$P(4,3) \xrightarrow{T\binom{2}{2}} P'(6,5)$ Ao

But from the above solution, It justified that students were unable to find the value of translation (a,b) moreover they were unable to find the image of P(3,4) by the same translation. Thus the researcher found that students have difficulties in analysis level.

Difficulties in Evaluation

Researcher took a class test which makes an evaluation difficulty for the students in Transformation geometry. The question was the triangle formed by the point P (2, 3), Q (3, 6) and R (4, 5)are reflected on the X-axis and the image so formed as also reflected in Y-axis. Find the coordinate of the image formed.

प्रश्न न. ४ को उत्तर

दिइस्को विन्दुलाई x- अक्षमा परावर्वन गदा

हामीलाई थाहा छ

$P(x,y) \xrightarrow{x-अक्ष} P'(x,-y)$

$P(2,3) \xrightarrow{य-अक्ष} P'(2,-3)$

$Q(3,6) \xrightarrow{य-अक्ष} Q'(3,-6)$

$R(4,5) \xrightarrow{य-अक्ष} R'(4,-5)$

कोटि अक्षो शर्ती अनुसार य-अक्ष

$P(x,y) \xrightarrow{य-अक्ष} P'(-x,y)$

$P(2,3) \xrightarrow{य-} P'(-2,3)$

$Q(3,6) \xrightarrow{य-} Q'(-3,6)$

$R(4,5) \xrightarrow{य-} R'(-4,5)$
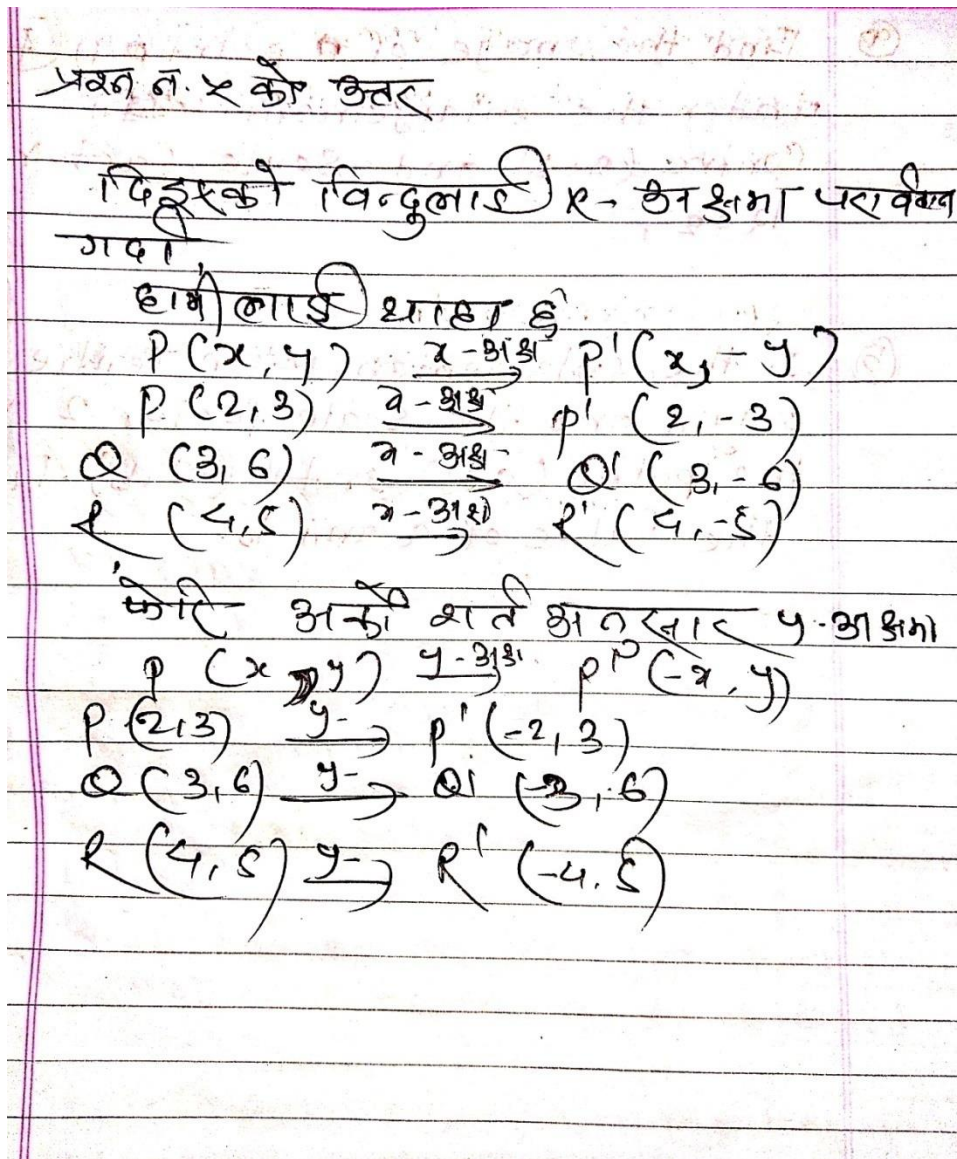
From the Solution it justifies that write the students were able to correct answer of first part but they were unable to write correct answer of second part because the correct way of solution is as we know that

$$P(x,y) \xrightarrow{x-axis} P'(x,-y)$$

$$P(2,3) \xrightarrow{x-axis} P'(2,-3)$$

$$Q(1,4) \xrightarrow{x-axis} Q'(3,-6)$$

$$R(3,2) \xrightarrow{y=-x} R'(4,-5)$$

Again

$$p(x,y) \xrightarrow{y-axis} P'(-x,y)$$

$$P(2,-3) \xrightarrow{y-axis} P'(-2,-3)$$

$$Q(3,-6) \xrightarrow{y-axis} Q'(-3,-6)$$

$$R'(-2,-3) \xrightarrow{y-axis} R'(-4,5)$$

Here they were unable to understand question that in second condition they need to reflect the images of P(2,3), Q(3,6) and R(4,6) which are p'$(2,-3)$, Q'(3,6) and $R'(4,5)$ on y-axis. Thus, researcher found that students have difficulties in evaluation level.

After the researcher took face to face interview of students, math teacher and head teacher with guideline them.

*"We don't study geometry in lower classes. In that class we did not study geometry well and teacher also teach us geometry at end of academic year. But teacher did not encourage us to learn geometry. They did not tell about important of geometry in higher classes. So, we are very weak in geometry portion***" (students view)**

The above quoted views of students showed that they had not read coordinate geometry in the lower classes. The teacher taught geometry part in the last of academic year. The teachers had not told the importance and use of geometry in higher classes. Therefore, these students were weak in transformation geometry.

*"We haven't full knowledge about geometry and geometry part. So, we fill very difficult in solving problem of transformation geomet*ry**" (students view)**

The above quoted views of students show that they don't have full knowledge about geometry and geometry parts therefore we have fell very difficult solving problem of transformation geometry.

"Generally, most of the students feel geometric portion of any topic is hard and they shouldn't take interest in geometry portion. So, the backgrounds of the students are very weak. Also, I have face trouble to teach transformation geometry"

(math teacher view)

The above view of teacher shows that students had not basic knowledge of transformation geometry. Due to the poor knowledge and base knowledge of students in coordinate geometry, vector geometry and other geometry portion. Therefore, teacher had faced problem to teach transformation geometry. The main cause of difficulty in students was bed feeling towards transformation geometry that is harder chapter and only learns it by rote process.

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

"I motivated them that this chapter is not so difficulty and give pre-knowledge about this chapter before starting to question solving. Also inform them about co-ordinate geometry, vector geometry andgeometry concept" **(math teacher view)**

"This is the new concept for secondary level. To learn transformation geometry the co- ordinate and vector geometry are needed so that, it should be taught in lower secondary level too" **(studentsview)**

From above quoted view of students and teachers we conclude that transformation geometry should be added into lower secondary level because it is a new concept for secondary level. Also, teacher had to teach co-ordinate, vector geometry and other geometry by connecting with transformation geometry and teacher should motivate the students towards transformation geometry and give the basic knowledge before the solving question. So, we conclude that the above process does be applied to minimize the difficulty in transformation geometry.

Teacher –student interaction

Classroom interaction plays vital role in learning process. Interaction between students and student, teacher and student affect the learning achievement of the students. So, the role of teacher activities in classroom is most important. The activities of teacher in classroom are guide student, create and facilitate the learning environment, encourage, motivate, monitoring student's progress. Sometimes students feel confuse any problem in the lesson; they interact with their subject teacher. Therefore, the role of teacher – student interaction in classroom most important for effective learning.

<div align="center">

Episode-2

</div>

"The researcher went to school with ready to observe the class. The teacher entered in the classroom, with daily uses materials such as chalks, duster and textbook etc. he wrote the topic Rotation in the blackboard and started to teach. He did not review pervious lesson. First, he clear concept about rotation with lecture method and wrote formula in blackboard. He had done whole exercise of rotation and he asked the students whether they understand completely. The teacher asked the

students to do remaining exercise as the homework assignment and he say today class over. At last teacher said next day I went to teach translation transformation"

From the review of the classroom observation, the researcher concludes that there was no interaction between students and teacher in classroom. Classroom was teacher dominated and not student oriented and totally deductive. Teacher had ignored the question from the students and did not treat favorably. The co-operation between teacher and students couldn't establish. Most of the students had confusion about the lesion of Rotation transformation but they could not say about it because there was not an interactive environment. So, students feel problems in learning transformation geometry.

After researcher took face to face interview of student and math teacher with guideline them, we found following

"There is good environment between teacher and student in our school. Our teachers are helpful students can ask questions in class time and out of school time teacher also solved the problem" **(head teacher views)**

The above quoted view of head teacher shows there is good relationship between teacher and students. Students have asked any question in class time or out of class teacher solved the problem.

"There is good relation between math teacher and students. He always teaching in classroom interacted to every student. If we ask any question in classroom, he can give answer and solve question also give more suggestion in subject matter" **(students view)**

"Our mathematics teacher is helpful. But he always interacts only talent students" **(students view)**

The above quoted views of students made a contradiction with researcher class observation, few interactions between teacher and students. Teacher especially talent students interact only in optional mathematics class room.

"Every optional mathematics students are very laborious. But he cannot give sufficient time in optional mathematics. If they can ask question in out of class time, I will solve questions and more suggestion about subject matter" **(math teacher view)**

The above quoted view of teacher shows that he is helpful. Students cannot give sufficient time in mathematics. Students ask question any time. Teacher solves question and give more suggestion about subject matter.

Hence, it is concluded that there is good relationship between teacher and students in school. But the cause of learning problems in transformation geometry due to few interactions between students and teacher in class room, Teacher focus always talent student, inactive environment of student in classroom, teacher dominated classroom and students cannot give sufficient time in other then optional mathematics. Most of the students had confusion about the lesion of transformation geometry but they could not say about it because there was not an interactive environment. So, students feel difficulties in learning transformation geometry.

Also, the researchers asked to the students and teacher, what should we do? Show that such difficulties are to be minimized. Then they told

"Interacting with students more about question and with them in each step of the problem solving. Also give sufficient time those students who are weak in this chapter" **(math teacher view)**

"Teacher should provide good interactive environment in the classroom. Which motivate the weak students to learn more about the transformation geometry" **(students view)**

"The teacher should discuss method about the transformation geometry and then use proper material with using step wise to solve transformation problem" **(Students view)**

From above mentions views that we could minimized this difficulty the researcher concluded that teacher always teach in classroom interacting with students more about question and with them in each step of the problem solving. Also give sufficient time those students who are weak in this chapter and the teacher should discuss method about the transformation geometry and then use proper material with using step wise to solve transformation problem and teacher provide good interacting environment in the class. Which motivate the weak students to learn more about the transformation geometry.Such that their teaching process is best.

Learning Environment

Learning environment of school is seemed to the main component of well achieving in education. The learning environment of school is to create good image towards teachers, student attaching to school. Student's performance and perception were depending upon the learning environment of school. The physical facilities of

school, the location of school, available and arrangement of desk and benches, students and teacher's behavior at school comes under learning environment at school

The researcher went to schools and observes class time school is peaceful. The physical facilities contained classroom, furniture has appropriate as number of student but teaching materials (geo-board, geometry box, graph paper), play ground in school so not good managed. Especially optional mathematics students have not fix classroom. These students always read another classroom or school filed without any teaching materials.

After researcher took face to face interview of students and teacher with guidelines them

"Especially our school family wanted to extend teaching materials and optional mathematics classroom from previous year but our school financial committee was not positive on it. I hoped we were convince them and fulfill our special requirements as could we possible" **(head teacher view)**

The above view of head teacher shows that school administration could not provide required classroom and materials to the students because school financial committee was not positive on it. In future they convinced them and going to made their school sufficient from all aspect as soon possible.

"I have to teach transformation geometry by using chalk, duster and textbook only. Other special materials were not provided by school" **(math teacher view)**

The above view of teacher show that there were not sufficient mathematical and teaching aids it shows that there was lack of mathematical material.

"Yes, sir optional mathematics subject teaching hasn't fix room or no class room for students. Sometimes teacher teach out of classroom without any teaching material. **(Student views)**

The above quoted views of students show that school administration had not managed classroom and teaching material for students.

From the above analysis the researcher concluded that there was lack of physical facilities like playground, classroom, teaching material, poor classroom interaction and no inclusive environment in the classroom. The teacher teaches transformation geometry by using traditional method and chalk, duster and textbook only used teaching material. He did not give any new techniques in transformation geometry. So, the student feels difficulties in learning transformation geometry.

Also, the researcher asked to the students and teacher, what should we do? Show that such difficulties are to be minimized. Then they told

"To minimize this problem, it should be providing teaching materials, well managed classroom, opt lab and sufficient practical materials of math" **(Math teacher views)**

"To minimize this problem first school administration, provide well class room, teaching material, and teacher should teach differently method by using ICT as for possible. **(Students view)**

From this view we could minimized this causes the researcher concluded that school administration should be provide well managed classroom, teaching material, optional mathematics lab and other physical facilities in school and the teacher should be provide teaching material and use discussion method, child center method,

inductive method etc. method use in transformation classroom. Then their teaching process is best.

Composite Transformation

Students have difficulty making connection within and across mathematical experiences. For instance, a student may not readily comprehend the relation between reflection, rotation, translation and enlargement. This kind of connection was not able to made, students math skills may not be anchored in any meaningful or relevant manner. This makes them harder to recall and new situations.

The researcher took a class test which makes connection difficulty for the students in transformation geometry. The question was

ΔPQR With vertices P (1, 4), Q (1, 2) and R (3, 2) is reflected in the line y=-x. determine the image of $\Delta P'Q'R'$ and this image is rotated through 90^0 in clockwise direction about origin. Find the coordinate of $\Delta P"Q"R"$.

उ ११ को प्रश्नानुसार

ΔPQR , P(1,4), Q(1,2) and R(3,2) लाई
परावर्तन लाइन y=-x मा गर्दा
हामीलाई थाहा

$P(x,y) \xrightarrow{y=-x} P'(-y,-x)$

$P(1,4) \xrightarrow{y=-x} P'(-4,-1)$

$Q(1,2) \xrightarrow{y=-x} Q'(-2,-1)$

$R(3,2) \xrightarrow{y=-x} R'(-2,-3)$

फेरि ΔPQR लाई 90^0 clockwise मा परिक्रमण गर्दा
हामीलाई थाहा छ

$P(x,y) \xrightarrow[O(0,0)]{90^0} P'(-y,x)$

$P(1,4) \xrightarrow{90^0} P'(-1,4)$

$Q(1,2) \xrightarrow{90^0} Q'(-1,2)$

$R(3,2) \xrightarrow{90^0} R'(-3,2)$

From the above solution it justified that write the students were able to correct answer of first part but they were unable to write correct answer of second part because the correct way of solution is As we know that

$$P(x,y) \xrightarrow{y=-x} P'(-y,-x)$$

$$P(1,4) \xrightarrow{y=-x} P'(-4,-1)$$

$$Q(1,4) \xrightarrow{y=-x} Q'(-2,-1)$$

$$R(3,2) \xrightarrow{y=-x} R'(-2,-3)$$

Again

$$p(x,y) \xrightarrow{[90^0,Q(0,0)]} P'(-y,x)$$

$$p'(-4,-1) \xrightarrow{90^0} P''(1,-4)$$

$$Q'(-2,-1) \xrightarrow{90^0} Q''(1,-2)$$

$$R'(-2,-3) \xrightarrow{90^0} R'(3,-2)$$

Here they were unable to understand the problem. Only three students can gave the accurate answer, five student could not gave the correct answer and two students leave question, students can't find ideas and can't make connection between reflection and rotation. So the researcher found that students have difficulties in composite transformation.

After researcher took face to face interview of students with guideline then

"I easily understand the problem but I cannot find the ideas what is find out. Also, I unable tomake the connection of ideas and fact, so I fell difficulties" **(students view)**

The above quoted view of students shows that students have connection difficulties in transformation geometry.

*"Students have focus on Rota learning also they have lack of pre-knowledge and students do not have sufficient practice.***"** **(Math teacher view)**

*"Student cannot understand which transformation use first and they are confused about question. Most of the students have memorizationproblem about the basic concept of each transformation" (***Math teacher view)**

The above quoted view of students shows that there were lacks of clear concept about transformation geometry. Also, there were seen lack of practice and skills about transformation geometry with students. These causes are related with the teacher too, because they are raised by the teaching technique, methods, using materials and teachers understanding about transformation 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 in transformation geometry

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

"To *minimize this problem, give more questions connect with reflection, rotation, translation and enlargement for practicemore*" **(math teacher view)**

*"I am planning to take unit test regularly by selecting such kind of problem which is connecting to reflection, rotation, translation and enlargement to each other***"** **(math teacher view)**

"Teacher should teach this type of problem connecting with define, formula, and clarify eachstep discuss with students" **(students view)**

From these quoted views of teachers, we conclude that it would be better to take unit test by selecting problem which is also connected to another topic. Also the teacher should went to give more questions connect to each transformation for more practice.

Chapter-V

SUMMARY, FINDINGS, CONCLUSION AND RECOMMENDATIONS

This chapter consists of summary of findings, conclusion and recommendations. The purpose of this study was to find the causes of difficulties in learning transformation geometry at secondary level and to minimize the difficulties in learning transformation geometry at secondary level. In this chapter summary, finding, conclusion and recommendations for further study have been presented.

Summary

The statement of problem of this study as finding the causes of difficulties faced by mathematics in learning transformation geometry at secondary level. It is qualitative research in descriptive nature. The main objectiveof this case study was to find the causes of student's difficulties in learning transformation geometry at secondary level and to find the way for minimizing the difficulties in learning transformation geometry.

The research was conducted in Shree Balrampur Secondary school in Rupandehi. The design of the research was case study in which meaning were taken from logic, reasoning, exam and linking with theories. The case study of 10 students sample was carried out and method/tools were interview, classroom observation and exam test to support the finding of the study construct vision and cognitive learning theory.

Findings

On the basis of analysis and interpretation of the result the finding of this study were as follows.

- The physical facilities of the school were not sufficient for class room, desk bench and white board.

- Mostly the teacher used teacher centered method in classroom. So the teacher was active and students were passive in teaching learning process.

- The school has not sufficient mathematics materials like geometry box, mirrors

- There was not classroom interaction. Some students tried to interact with their teacher but the teacher used lecture method. So they did not get the chance to interact with their teacher.

- Students are confused by the language and symbols to solve the question.

- Many students have difficulties in composite transformation question like rotation- reflection and reflection-translation and rotation-translation etc.

- The poor basis knowledge of students the teacher faced problem to teach transformation geometry.

- Students are bad feeling towards transformation geometry this is hard chapter and we should by hate the terms of transformation.

- Teacher was not fully prepared about the lesson of transformation geometry. So it created the difficulties in learning transformation geometry.

- Students are more weeks, irregular; they haven't sufficient time to practice in classroom.

- There was not inclusion environment and remedial teaching in the classroom.

- Parents did not provide sufficient materials which are related to transformations geometry.

- There was not regularity of the students in optional mathematics classroom.

Conclusion

The above major finding of this study shows that students faced difficulties in learning transformation geometry. On the basis of the finding of study the researcher concluded that

- Students have pri-knowledge and poor geometrical background for transformation geometry

- There was a not sufficient material for learning transformation geometry so students feel difficulties

- Due to the lack of interactive classroom.

- The traditional teaching strategies in geometry class by untrained teachers had remained as a main problem

- Teacher had not implemented the modern techniques, method and materials for transformation geometry.

- Most of students had less interest in transformation geometry learning. It was difficulties to create interest on students because geometry was regarded as abstract subject matters

- The students and teacher had faced problems on transformation geometry teaching- learning process because poor evaluation system, negligence of homework, lack of instructional materials, non-effective teaching-learning managements, home environment to study were some example

- Maximum students have difficulties in maxed transformation question like Rotation, reflection, translation and enlargement.

To minimize these problems, there should be continuous communication among students, parents, parents, and teacher and teaching strategy must be students centered.

Recommendations For Further Researcher

The case study was about the cause of facing difficulties of students on transformation geometry in Rupandehi district. This research is limited particular topic transformation in optional mathematics. So the finding and conclusions drawn from the study cannot be generalized in all the subjects and schools.

Observing the above finding and conclusion, the researcher has presented the following recommendation which will benefit to the concern authority to bring further improvement in transformation geometry teaching and learning. Standing over the foundation of the study, the followed suggestions:

- The teacher should teach transformation geometry by applying basis concepts.
- Teacher can used discussion, question- answer, inductive, deductive, child center method in class room practice.
- School administration should manage compulsory extra mathematics class to the students according to their level.
- Teacher gives and checks home-work on every day.
- Teacher used no-cost or low cost teaching materials, teacher guides etc.
- If possible, the teacher should construct figure also for the solution of the transformation geometry problems.

- The school administration should provide some refreshment training to the transformation geometry.

- Parents and school administration should encourage the students to come school regularity.

- Parent should give sufficient time for the study of their children at home. they should provide sufficient material like practice books, copies, geometrical tools, graph copy for their children

- This study will help to identification the causes of student's difficulties in learning transformation geometry in future.

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APPENDIX- A

Interview schedule with students

(Guideline to researcher)

School name…………………………………………………..

Types of school……   a. government   b. private

Name……………   class…… roll no……………..

Position in class…   Sitting position in the class...

Gender: caste/ ethnicity…

Focuses points of interviews

- Teaching methods

- Encouragement provides to students

- Teacher and students behaviors

- Learning environment of classroom

- Pre-knowledge, understanding of students in learning transformation geometry

- Faced difficulties in learning transformation geometry

- Class work and homework

- Punctuating and dedicate of teacher and students

- Relation of mathematics teacher and students

Interview schedule for mathematics teacher

(Guidelines to researcher)

Name…………………………………………………. Age……

Gender:…………………………………………religion:…..

Caste/ethnicity:………………………..Qualification:……………

Teaching subject:…………………. experience in other field……

Training…………………………. Experience in other field……..

Focuses points of interview:

- Lesson plan, teaching strategies, materials for teaching learning transformation geometry.

- Requirement of pre-knowledge of students for learning transformation geometry.

- Engorgement and motivation in transformation geometry class.

- Class work and homework.

- Reinforcement, feedback provided by mathematics teacher to students in transformation class.

- Teacher and students behavior on learning transformation geometry.

- Relation of mathematics teacher with students.

- Learning environment of classroom.

Interview schedule with headmaster

School name:……………………………………………………….

Types of school: a government ()   b. private ()

Name:……………………………… age:……………………….

Gender:……………………………..religion……………………..

Caste/ethnicity:………………………. Qualification:………………

Teaching subject:…………………….   Teaching experience………..

Experience as headmaster:

Focus points of interview:

- Physical facilities of school

- Instructional strategies.(method, plan, material)

- Management of school administration committee

- Learning environment

- Seminar conference and training to mathematical as teacher

- Public image towards school, parents involvement in school

APPENDIX_D

The question for the class test to know pre-knowledge and composite difficulties.

Knowledge level

1. What is mean by transformation geometry? And how many classify the transformation geometry?
2. When a point (x, y) is reflected over the x-axis, what are coordinates of its image?

Comprehension level

1. Find the image of the point A (3,-2) and B (-3, 6) under the reflection about the x-axis.
2. Translate the point A(3,5) and B(5,-3) using the translation vector (3,2)

Application level

1. The triangle with vertices A (2, 3),B (4, 5) and C (6, 2) is reflected in the line X=3, find the coordinate of the points.
2. PQR with vertices at P(2,3) ,Q(3,6) and R(4,5) is rotated through 180 in clockwise direction about the point A(0,0). find the coordinate of the vertices of the image

Synthesis

1. Point (3, 2) is reflected on the X-axis. The image so obtained is rotated about origin through +90 find the coordinate of this image.
2. Find the coordinate of the image of the point (-4,6) when it is first translated by (6, -4) and the reflected on the X-axis

Analysis

1. If the image of the point A(6,4) is A'(8,6), find the image of point P(4,3) by the same translation.
2. The image of point A (4, 5) and B (6, 3) are A'(-5, 4) and B'(a, b) about the origin. Find value of a and b.

Evaluation

1. The triangle ΔPQR whose vertices are P (2, 3), Q (3, 6) and R (4, 5) is reflected on the X-axis and the image so formed is also reflected in Y-axis. Find the coordinate of the image formed.

2. Draw the triangle ΔMNP whose vertices are M (4,-2), N (2, 1) and P (5, 2) rotate triangle MNP through clockwise 180° about (1,1) and followed by +90° about (1,1) and draw the image points on the graph.

Class observation from

Name and address of the school:…………………………………………….

Class start at:…………………….class end at:……………………………..

Name of subject teacher:……………………………………………………….

Topic or lesson:………………………………………………………………….

Total no of students………total no of students present in observation class………..

Date…………………….period………………………..time……………

The following observation from was used to observe the learning difficulties in the transformation geometry

Topic	S.N.	Items	Yes	S.T.	No.
Learning Environment	1	Availability of furniture			
	2.	Writing board			
	3.	Suitable of furniture			
	4.	Classroom method			
Teaching Methods and Materials'	5.	Lecture method			
	6.	Discussion			
	7.	Problem Solving			
	8	Geo-board			
	9	No cast material			
	10	Graph paper			
	11.	Availability of other material and math's lab			
Teacher-Students Interactions	12.	Love and affection			
	13.	Biasness			
	14.	Anger			
	15	Respects			
	16	Used polite language			

	17	Student teacher relationship			
Students Pre-Knowledge	18	Co-ordinate			
	19	Geometry Properties			
	20	Definition			
Composite Transformation	21	Definition of Transformation			
	22	Symbols of transformation			
	23	Formula of transformation			
	24	Composite question practice			