ERROR ANALYSIS IN SOLVING PROBLEMS OF CO-ORDINATE GEOMETRY

THESIS

BY

HARKA RAJ NYAUPANE

FOR THE PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION

SUBMITTED

TO

DEPARTMENT OF MATHEMATICS EDUCATION

CENTRAL DEPARTMENT OF EDUCATION

UNIVERSITY CAMPUS

TRIBHUVAN UNIVERSITY

KIRTIPUR, KATHMANDU

NEPAL, 2016

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Letter of Approval

Thesis

By

Harka Raj Nyaupane

Entitled

"Error Analysis in Solving Problems of Co-ordinate Geometry" has been
approved in partial fulfillment of the requirements for the Degree of Master of Education.

Committee of the Viva-Voce   **Signature**

1. Asso. Prof. Laxmi Narayan Yadav   ………………………

    (Chairman)

2. Prof. Dr. Hari Prasad Upadhyay   ……………………….

    (Member)

3. Dr. Eka Ratna Acharya   ………………………
    (Member)

Date: 08 Feb. 2016

Letter of Certificate

This is to certify that **Mr. Harka Raj Nyaupane,** a student of academic year 2069/2070 with exam Roll No. 281042/2070, Campus Roll No. 1402/2069, and T.U. Regd. No 9-2-552-32-2007 and thesis No 1067 has completed his thesis under my supervision, during the period prescribed by the rules and regulation of Tribhuvan University, Nepal. The thesis entitled **"Error Analysis in Solving Problems of Co-ordinate Geometry"** embodies the result of his investigation conducting the period of 2015 at the Department of Mathematics Education, University Campus, Kirtipur, Kathmandu. I hereby, recommend and forward that his thesis be submitted for the evaluation as partial requirement to award the Degree of Master of Education.

………………………   …………………………

 Dr. Eka Ratna Acharya   Asso. Prof. Laxmi NarayanYadav

  (Supervisor)   (Head)

Date: 08 Feb. 2016

ACKNOWLEDGEMENT

Abstract

The study entitled **"Error Analysis in Solving Problem of Co–ordinate Geometry"** explores the errors made by the Grade XI students in solving problems in co-ordinate geometry. The nature of this research is qualitative as well as qualitative and descriptive survey design. The total population of this study was 80 students studying in grade XI taken from three campuses; Ghodaghodi Multiple Campus, Tikapur Multiple Campus and Kailali Multiple Campus, Kailali.

The sample of this study was 60 students and three teachers from the selected campuses. The sampling procedure of this study was non random purposive sampling. The data were collected through problem solving test, class observation and interview with both teacher and students. The collected data were analyzed and interpreted by using Newman technique of error analysis theory.

The total number of errors committed by the students in solving verbal problems was 484. These errors were tabulated by checking answer sheet and by taking interview. Out of 484 errors 44 were from reading, 109 were from comprehension and 105 were from transformation, 162 were from process and 64 were from encoding, Most of the errors were committed by the students because of poor background in language, Some students were confused on the meaning of the words used in verbal problem by attaching their own meaning to them, Students often used mix-up rules because they do not really have relational understanding of what they are doing.

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Chapter I

INTRODUCTION

Background of the Study

Mathematics is the science of number and their operation interrelation and collection of skill and methods. At the primitive times mathematic was originated for counting by use of stones and tying knots in a string. Ancient people developed the mathematics structure, rules, formula, theories etc (Sidhu, 1975). It is a systematized, organized and exact branch of science.

It is useful in accounting, surveying, engineering and the physical sciences to biology, economic, and business and many aspects of everyday life. Now a day's one cannot do anything without use of fundamental process of mathematics in daily life. In the course of learning mathematics people do error and mistakes. Geometry is one of the most useful and important branch of mathematics for school education. Geometry includes on enormous range of ideas and can be viewed in many different ways. It has been interlocked with many other subject and different views of human activities. The basic ideas of a mathematical system originated in geometry twenty two or twenty three hundred years ago (Kelly and ladd1986).

Furthermore Kelly and Ladd write it is not certain who first had the idea of trying to prove a mathematical rule by reasoning rather than by testing it in different ways. Although, both Thales and Pythagoras have been given credit for this idea, originated in Greece around the sixth century. The mathematical of geometry grew with astonishing speed. By this time, the mathematician Euclid brought tighter and unified this knowledge by constructing the first definite ,formal system of mathematics in his treaties 'the element 'it is probable that 'Euclid, elements is not devoted to geometry alone, but it contain much number theory and geometric algebra .the work is composed of 13 books with 465 proposition (eves,1986).

Error and mistakes are taken as synonyms in layman's sense technically speaking, all mistakes are not errors .error occur as the result of lack of competence where as mistakes occurs due to physiological or psychological reasons or by careless. Mistake either may

be at competence level or performance level mistakes which are committed at performance level are called mistakes or lapses. Errors occurs because of lack of competence and they tend to occur times and again, so they are said to be systematic.

The mistake tends to occur due to carelessness as such it does not appear repeatedly, can be corrected by the performer himself. The term 'error' can be defined as a systematic deviation from the term of the code or a branch of the code due to inadequate knowledge of the code. Even if the learner's attention is drawn to the error he / she cannot make correction rather there may be chances of other errors. Coder (1996) points out the need to distinguish 'error' from mistakes. There is distinction between mistake and error. The demarcation line between them is competence of the learners. If the mistake is committed due to the lack of competence that is error and if the mistake is committed not due to the lack of competence but due to carelessness, fatigueless etc is mistake.

Statement of the Problem

Any research study aims to solve some specific questions. In this study it was to analyze the error in solving verbal problem on co-ordinate geometry. It is widely accepted fact that students are not solving /doing well in co ordinate geometry. However finding out the reasons are not the easy task for the specific treatment of the practical problems facing by the student in co ordinate geometry. For specific treatment of the practical problem facing by the students in co ordinate geometry may be divided into the identifiable small portions and efforts. They must be applied to those positions specifically.

There may be many reasons of committing errors in co ordinate geometry. Many students do not get sufficient exposure in co ordinate geometry due to the lack of qualified and trained teacher, lack of good implementation of teaching methods and lack of teaching materials. Teacher may not appropriate method according to need and interest and level of the students. Students come from different cultural and linguistic background to the college. Nepal is multicultural, multilingual, multi-religious country with more than are hundred twenty five ethnic group one hundred twenty five ethnic group and one hundred twenty three languages (CBS 2011). The language is one factor which plays

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significant role in making error. The researcher was interested to find out the errors in solving problems on co ordinate geometry and how the errors occur in solving problems. So the research had taken initiation on the chapter of co-ordinate geometry of Grade XI Basics Mathematics.

Objective of the Study

The main objectives of this study were as follows:

- To find the error made by students of Grade XI in solving problems in co-ordinate Geometry.
- To explore the cause of error in solving problems in co-ordinate Geometry.

Significance of the Study

Mathematics is an essential part of school curriculum. It is widely used to solve daily life problem in the society but students fear it and feel that it is complicated to grasp. Nepal is multicultural and multiethnic country. So in every ethnic group they have their own strategic to learn mathematics concept. This study was focused to explore the find the error made by students of Grade XI in solving problems in co ordinate Geometry and the cause of errors in solving problems in co ordinate Geometry, which can valuable for school administration teachers, students, researchers, curriculum .designer and other stakeholder related to education and the other researcher who wants to research about learning strategy of different students.

Since this study attempted to explore the errors in solving problems and explore the sources of errors it is equally beneficial and essential to the teacher, learners of other subjects like Physics and Engineering etc. In order to gain success in geometry it provides different ways of succession Most of the teachers and students take geometry as difficult and abstract subject. Teacher gives low priority of this section. As a result students in especially secondary and higher secondary level commit much errors relating to the theoretical proof of the theorem and solving verbal problem in co-ordinate geometry.

This study is invaluable to the stakeholders, who are directly or indirectly involved in teaching and learning activities of Mathematics such as; teachers, syllabus designer, policy maker etc.

Definition of the Related Terms

Error

Error is that mistakes which occur time and again in a systematic way.

Error analysis

Error analysis refers to the systematic study and analysis of the error made by the students. It is the continuous procedure used to analyze the errors in the course of the performance of the students.

Verbal error

The errors found in the solution of the verbal problem of co-ordinate geometry are defined as verbal error.

Mistake

Mistake means implies misconception or inadvertence that usually expresses less criticism than error. Regularly inputs stupidity or ignorance as a cause some degree of blame.

Students

Students refer the learners of Grade XI selected for the purpose of the study from Ghodaghodi Multiple Campus Sukhad, Kailali, Kailali Multiple Campus, Dhangadhi, Kailali and Tikapur Multiple Campus, Tikapur Kailali.

Reading error

An error would be classified as reading error if a student could not read a key world or symbol in the mathematical written problem to the extent that this prevented the student proceeding further along and appropriate problem solving path.

Comprehension error

If the students can't grasp the overall meaning of the given problem this type of error is classified as comprehension error.

Transformation error

If the students understand the question but can't transform it into mathematical expression this type of error is classified as transformation error.

Process error

An error was classified as process error when a student was able to identify the correct operation but did not know the procedures to carry out these operations accurately.

Encoding error

If the student make the correct solution to the question but can't express this solution into acceptable written form this type of error is classified as encoding error.

Symbolic error

An error was classified as symbolic error when the student was unable to recognize and use the mathematical symbol appropriately.

Sign error

If the students cannot understand and use the sign appropriately like +, -, /, etc. this type of error was categorized as sign error.

Mathematical knowledge

Mathematical concepts used by the students knowingly or unknowingly.

Delimitation of the Study

In the field of research scope and limitations refers to parameters that prevent researchers from pursuing further studies due to the time and budgetary constraints. Some researchers must explore a subject area and find results within a specific period of time.

Having a time limit is a limitation because it excludes the opportunity for individuals to make further discoveries their subject areas, which influences the amount of information that can be relayed to an audience. The study has the following limitations

- The study was limited is Ghodaghodi Multiple Campus, Sukhad, Kailali Multiple Campus, Dhangadhi and Tikapur Multiple Campus, Tikapur kailali.
- The study was concerned only with the errors committed in making solving verbal problem in co ordinate geometry by Grade XI students of Ghodaghodi Multiple Campus Sukhad, Kailali. So the result can't be generalized to all other context.
- The students were limited to the topic of co-ordinates geometry in Basic Mathematics in Grade XI.

Chapter II

REVIEW OF RELATED LITERATURES

This chapter deals the review of the related literature to this study. The literature review helps the researcher to know the works carries out in the area of his research project according to Wagle (1995) "*review of literature is an exacting task calling for a deep insight and clear perspective of the overall field. The main purpose of review of literature is to find out what work has been done in the field of the research studying being under taken*" review of related literature is a previous source of the further study of research task which is the important, essential and helpful for guidance of research in systematic manner by providing the general outline of the research study and avoid the unnecessary duplication. At the end, researcher justifies to the necessary of the study. Finding gap in this field and developing conceptual and theoretical framework.

Empirical Literature

This topic deals about the research carried out in related field. There have been some researches carried out in errors committed in solving mathematical problems. Those researches are reviewed here in order to avoid duplication.

Marahatha (2002) studied on "A Study on Computational Error in Fraction by Grade VI Students in Chitwan District". The main findings were: Students generally commit more error in addition of fraction than in introduction of fraction. Thus the conclusion was derived from the result of null hypothesis in which the error mean was higher in addition of fraction than in the introduction of fraction, The mean error occurring in addition of fraction and subtraction of fractions were the same. It can be concluded that the grade VI students had the same difficulty in addition of fraction and subtraction of fractions, the mean error in multiplication of fraction is higher than introduction of fraction, Students' higher error in division of fractions than in multiplication of fraction, Errors are higher in division of fraction introduction of fraction and There is no effect of sex to commit the en areas of operation of fraction considered in this study.

Paudel (2002) concluded in the masters degree thesis entitle; "the occurrence of errors which solving word problems in mathematics by the lower secondary pupil" that; There

were 4.88% reading error, 6.37% comprehension error, 52.44% transformation errors, 11.89% process skill errors and 24.42% ending errors and Boys committed less error than the girls.

Bhatta (2003) conducted a study on "an error analysis in quadratic equation at Grade X". with the following objectives: To study the errors of Grade X students in understanding, knowledge of solving and application of application of quadratic equation, To study the error in the topic of quadratic equation with respect to: gender, location of school and types of schools and To study the computational error of Grade X students in understanding knowledge of solving and application of quadratic equation.

For this purpose, the researcher used diagnostics test in equation was developed the test was administered on a sample of students of Grade X of eight different schools of Kathmandu district. The data obtained were scored with the help of scoring key. T-test was used to compare the significant different between two sample mean. All difference was tested at 0.05 level of significance.

Pant (2005) studied on "computational errors of Grade IX students on operation of fraction on Chitwan district". The main finding of this study was; students commit more errors in introduction of fraction than in addition of fraction and more subtraction than in addition of fraction. Similarly, there was no effect of sex to commit the errors on the operation of fraction consider in her study.

Kafle (2006) studied on "Error analysis of the proof of the theorem in geometry in Grade IX". The study revealed that students had committed numbers of error in making proof of geometrical theories. The students committed error from the beginning of the solution to the deduction of the error. The concentration of the errors was seen on the reading and comprehension of the problem and in process skills. The data stated in the study shows that the students had felt difficultly in carrying out correct operation and did not follow correct procedure to carry out these operations accurately.

K.C. (2008) analyzed the errors committed by the students of grade IX in geometric transformation. In this forward analysis more error was found in process and transformation. There were 26% errors found in transformation and process. According

to his analysis the tendency of committing more errors were found in boys in comparisons to girls.

Panthi (2009) studied on "An error analysis in equation of Grade VII students" aim to identify the error committed by students on problem solving, compare the error with respect to gender. The study was an intuitionist research combined with interpretative in design. Newman error and hall errors on solution of simple linear equation techniques were the theoretical bases of this study.

The main findings of this study were total number of errors committed by the students on verbal problem and on numerical problem was 102 and 53 respectively, out of total error committed 71 errors were committed boys and 84 error committed by girls, the analysis showed that 10.7% errors at reading level 33.3% error at comprehension level, 25.5% error at transformation level, 17.6% errors at process skill errors and 13.7% encoding error, which concluded that students committed more error at comprehension level.

This study also showed that out of the total error, 5.6% was the deletion errors, 9.5% redistribution error, 3.8% transposing error, 22.6% omission error, 9.4% division error and 11.4% absence of structure error which concluded that student committed more errors while solving problem by omitting the terms on the problem.

Sharma (2009) studied "an error analysis in solving algebraic problems of Grade five students" he concluded that 75% of error occurred at the comprehension, 12%, 5%, 8% of errors occurred on process skill, encoding and careless of studies respectively and 40%, 34%, 26% error occurred on knowledge level, skill and application level, problem solving respectively.

The review of the studied that will be focused on the achievement in mathematics performance in difference age level, different Grade and different country. Most of they were focused to compare the error committed in mathematics and found that the student in stage of mathematic learning and in other country the studies that had been focused on solving the word problems in different age group.

In the light of the errors occurrence mention in the above studies, the expectation of the studies is that similar type of occurrence of errors committed by the students in solving word problem in mathematics at Grade V.

Upadhyaya (2011) did a research on the topic "The type of error mostly done by the students of Grade V in Janakpur Municipality" his main aim in this research was to find out that; students were observed using their own method with confusion. Students did use their methods but couldn't supply enough reason while putting down in examination paper. Most of the students couldn't understand the situation given in language form

Theoretical Framework

Newman (1977), an Australian language educator who in the mid-(1970s), developed a systematic procedure for analyzing errors made by students responding to written mathematical task. Since 1977 a steady streams of research papers has been published reporting "Newman data" in the Asia pacific region Australia, Bruneian, Indonesia, India, Malaysia, the Philippines and Thailand. The study was placed on pencil and paper test. The marked price of a book was $20. However for a sale 20% discount on the marked price was given. What is the sale price? According to Newman (1977), a person wishing to obtain a correct solution to word problems, this must ultimately precede the following hierarchy:

- Read the problem.
- Comprehend what is used.
- Carryout a mental transformation from the word of the question to the selection of an appropriate mathematical strategy.
- Apply the process skills demanded by the selected strategy and
- Encode the answer in an acceptable written form.

Clements (1980) illustrated the Newman technique with the diagram shown in figure given below. According to Clements (1980), errors due to the form of the question are essentially different from those in the other categories shown in figure given below because the source of difficulty resides fundamentally in the question itself rather than in the interaction between the problem solver and the question. The distinction is presented

in the figure by the category labeled "question form" being placed beside the five-stage hierarchy. Two other categories "careless" and "motivation" have also been shown as separate from the hierarchy because, as indicated, such error can occur at any stage of the problem_ solving process. A careless error, for example, could be a reading error or a comprehension error and so on. Similarly, someone who had read, comprehended and worked out an appropriate strategy for solving a problem might decline to proceed further in the hierarchy because of a lack of motivation. For example, a problem solver exclaim "what a trivial problem I can't be bothered doing it".

Chart Showing Theoretical Framework
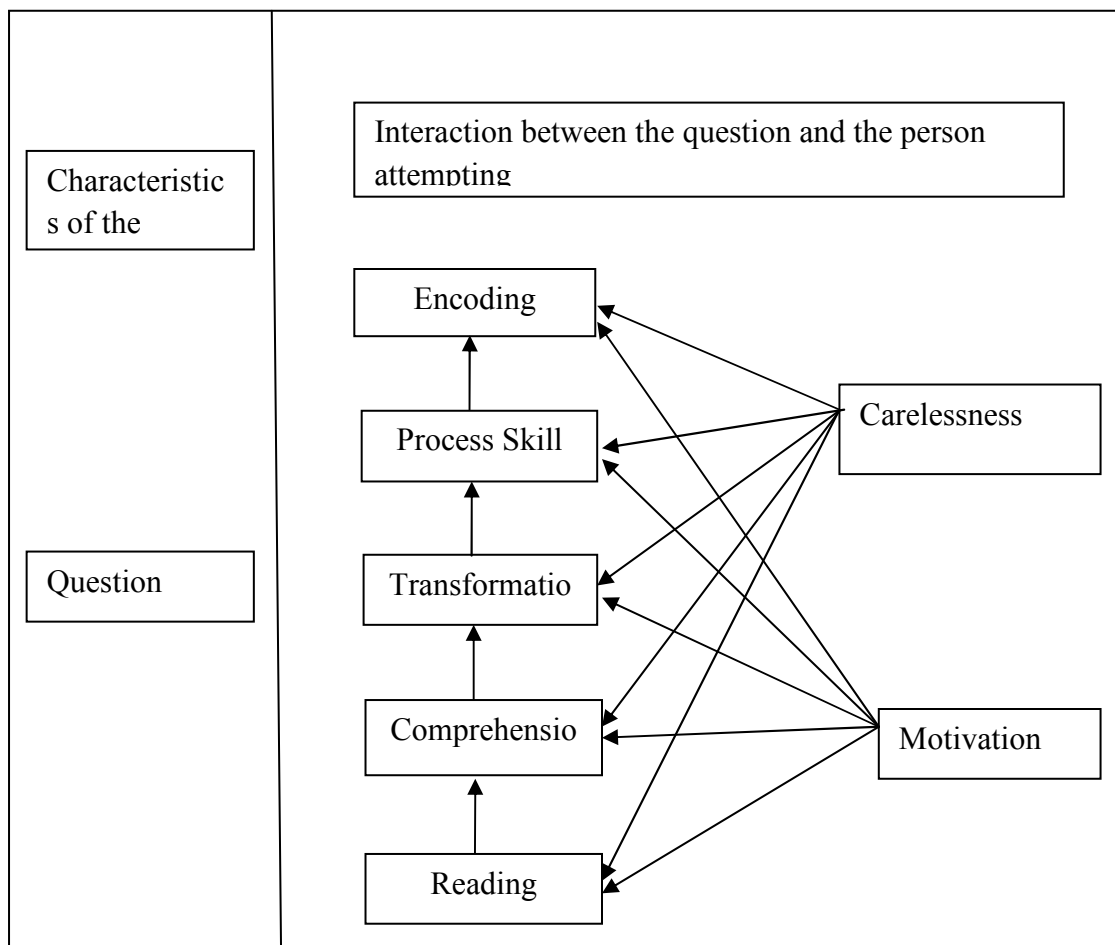
Figure: 1

Source :(Newman, 1983), the Newman hierarchy of errors causes

Newman has presented hierarchy of errors committed by the students which are intricately related with each others. In the hierarchy of errors the first stage of error is Reading error which occurs due to the lack of the motivation and carelessness of the students. When the students show less motivation and carelessness towards the topic they commit reading error.

When the students make reading error obviously that leads to commit comprehension error. If they have committed reading error they misunderstand and misinterpret the topic/question error. If the students have made comprehension errors then they lead to make transformation errors. When the students have wrong perception about rule or value they apply wrong value or sign in another condition that is called transformation error which is primarily caused by the reading and comprehension errors. Process errors are consequence of transformation error. Students commit process errors in subtraction, multiplication, addition, divided, putting the value in equation, applying sine, cosine, tangent etc. It is due to the transformation error, lack of motivation, carelessness etc. Due to the process skill errors or without process errors students happen to commit encoding errors. Sometimes students make encoding errors as a result of carelessness, impartial learning, lack of the knowledge of sing etc.

In conclusion, there are five hierarchies of errors; reading, comprehension, transformation, process and encoding errors. They have related with each others, one leads another error. All types of errors are caused by the motivation and carelessness as shown in above figure1.

Newman's theory of errors is applicable in study because students commit errors in five ways, reading, comprehension, transformation, process and encoding errors. Newman has discussed about the causes of errors. So that in this study, the researcher has to find out the errors committed in co ordinate geometry and to find out the source of errors. So this theory is relevant to accomplish this study.

Newman (1983) recommended that the following "question" or a request be used in interviews which are carried out in order to classify student's errors on written mathematical tasks. To understand the different types of error, those questions can be asked to the students.

Reading error

An error would be classified as reading error if a student could not read a key word or symbol in the mathematical written problem to the extent that this prevented the student proceeding further along and appropriate problem solving path. To recognize the reading error of the students the researcher can ask to the students; please read the question 'determine the equation of the state line through (1,-4) that makes an angle 45^0 with the state line 2x+3y+10=0?' If the students do not recognize word 'determine' and symbol '^{0}' (degree), that is called reading error.

Comprehension error

If the students can't grasp the overall meaning of the given problem this type of error is classified as comprehension error. To understand the comprehension level and the comprehension error, the researcher can ask to the students by pointing word or symbol, what does this word 'perpendicular' or symbol ' ' means.? If the students are able to read the problem well but cannot comprehend the meaning of word, symbol or question that is called comprehension error.

Transformation error

If the students understand the question but can't transform it into mathematical expression this type of error is classified as transformation error. To identify the transformation error made by the students the researcher can ask them 'please show how you start to find an answer to this question: the question if the students cannot transform sentence into mathematical form that is transformation error.

Process error

An error was classified as process error when a student was able to identify the correct operation but did not know the procedures to carry out these operations accurately. To find out the processing error the researcher can ask the question like show, how you get the answer? Tell what you are doing as your work? After that the researcher can let students work on a piece of paper if the students can chose an appropriate operation but cannot complete the operation accurately that is called processing error.

Encoding error

If the student make the correct solution to the question but can't express this solution into acceptable written form this type of error is classified as encoding error. To know the encoding ability of the students are asked to write down the answer to the question and the students can perform the correct operation but write the answer incorrectly that is known as encoding error.

Conceptual Framework of the Study

In the case of solving verbal problems, word problems are first transformed into mathematical problems and solution procedure is applied. This study was related to solving verbal problem on co-ordinate geometry. The research has applied Newman's errors analysis technique to find out the types and frequently of errors committed by the students while solving verbal problems on co-ordinate geometry and causes of those errors.

Conceptual framework
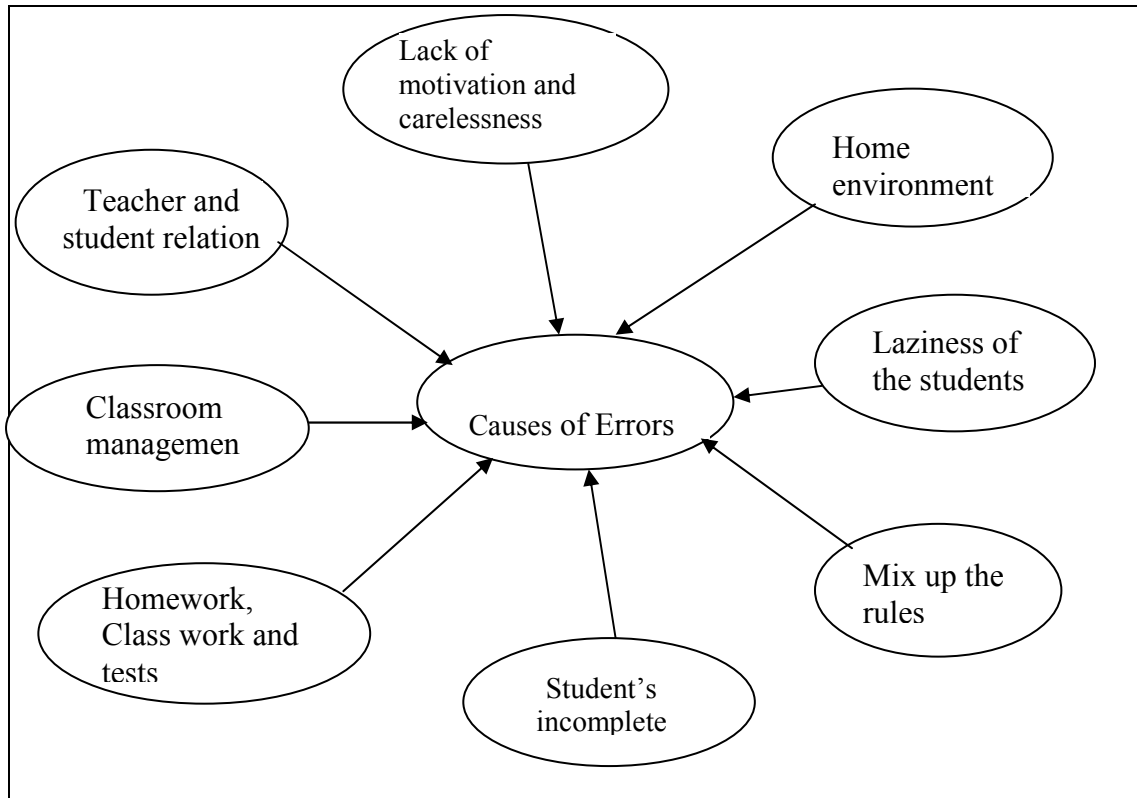
Figure No. 2   (Source: Pangani, 2010)

Students generally commit errors in solving verbal problems due to the different reason like lack of motivation and carelessness of the students, home environment, and laziness of the students, mix up rules, student's incomplete thinking, homework, class work and tests. Similarly classroom management and teacher students' relation etc. all these components of errors are interrelated. One component may bring the components or cause to committee error. If the students have lack of motivation and carelessness in the class they involve incomplete thinking. This incomplete thinking and less motivation arouse laziness of the students. Similarly home environment has crucial role in committing errors. If home environment is not good, students do not homework and not well prepare for the test. If the students do not homework the teacher student's relation may not be good which ultimately leads incomplete learning and they commit errors in learning. Classroom management is the focus point which hampers the learning of the students. If students do not get equal opportunity to the active participation in the classroom then, they learn partially and mix of the rules and ultimately commit more errors. In this research the researcher analyzed the errors on the basics of the components arranged as in the above framework (Fig No: 2).

Chapter III

METHOD AND PROCEDURES

This chapter deals about design of the study, population of the study, method of sampling, sample of the study, instrument of data collection, data collection procedure, identification of errors and data analysis procedure .

Design of the Study

The nature of this study is mixed method and descriptive survey research. Newman technique of error analysis had been theoretical base of this study.

Population and Sample of the Study

The total populations of this study were 80 students of Grade XI from three campuses, i.e. Ghodhaghodi Multiple Campus, Sukhad, Kailali Multiple Campus, Dhangadhi and Tikapur Multiple Campus, Tikapur Kailali. The study was conducted in single case sphere of Kailali District. In order to fulfill the objectives of this research, the researcher has taken sample to represent the total population. The sample of this study was 60 students and three teachers of Kailali district from three campuses. The campuses were Ghodhaghodi Multiple Campus, Sukhad; Kailali Multipal Campus, Dhangadhi and Tikapur Multipal Campus, Tikapur, Kailali. Twenty students were from each campus.

Method of Sampling

 The researcher selected the campus and the student random sampling method. The major objective of this study was to study the error analysis in solving problem on co-ordinate geometry. So relatively weak and talent students in co-ordinate geometry were chosen as the sample of the study. They were identified by the help of the regular mathematics teacher and their performance in the past examinations.

Tools of the Study

To collect the valid data three types of tools were adopted. They were problem solving test, class observation test, and Interview schedule.

- **Problem solving test**

   From the text book of basic mathematics of grade XI, ten questions were prepared for the validity and reliability of the test items. Pilot study was conducted on the sample of 10 students. Seven questions were included on the final test and remaining other questions was removed.

- **Class observation**

   To fulfill the second objective of the study, the researcher observed up to 5 days in class XI in each campus. So, the researcher observed how error occurs in solving problem on co-ordinate geometry.

- **Interview schedule**

   To fulfill the second objective of the study two types of open ended interview schedule was developed i.e. interview schedule for the 5 sample students from each campus and one sample teacher from each campus.

Validity and Reliability of Tools

Every research demands high degree of reliability and validity because it is one of the empirical studies of the phenomena. The validity of the test, class observation and interview schedule were maintained by the mathematics education teacher. To establish validity and reliability of the question for pilot test the researcher selected the questions which had been already asked in HSEB examinations. For the reliability of the final test the researcher carried out pilot test of the prepared test. 10 students of Ghodaghodi Multiple Campus, Sukhad, Kailali were used for pilot study. The researcher instructed clearly to the students about how to respond the test before administering the test paper.

Data Collection Procedure

Each of the selected Higher Secondary School was visited in order to administer the task. Three types of tools were used to fulfill the objectives. The first test was taken to students as problem solving test where the students had to solve the verbal problem in the answer sheet. Identification of error was really tough job because it should categorize according to Newman technique of error analysis. It was impossible to find out the

reading error and comprehension error through the answer sheet. So, interview was conducted to identify those errors. Next, to fulfill the second objectives of the study, another interview was conducted by using interview schedule on multi sample of 15 students. Classes were also observed by the researcher in order to fulfill the second objective.

Data Analysis Procedure

While collecting data the students were provided with test to find out the mistake in their answer sheet. Interview was conducted to find out the error which was difficult to find out by answer sheet. Second, interview was conducted on sample of 60 students and mathematics teachers of the sample Campus to find the causes of errors made by the students. Error committed by the students during problem solving test were classified according to Newman's Techniques of errors analysis.

The errors were later classified into five categories and find out the area of errors committed by the student as described by Newman techniques. These five categories are reading error, comprehension error, transformation error, process error and encoding error. The collected data were analyzed by quantitative method and percentage to analyze data more easily; the data which were collected for the second objective of the study were analyzed on the basis of class observation and interview reports. The data were analyzed descriptively with the help illustration and responses of the teacher and students.

Chapter IV

ANALYSIS AND INTERPRETATION

In this chapter deals with the analysis of the collected data were analyzed and interpreted. To make easier the analysis of the collected data, here the error made by the students in their answer papers, class observation and in their interviews were identified. The identified errors from answer copies, class observation and interviews were later classified as Newman described in Newman technique's errors analysis. There were altogether 7 test items in the test which was implemented to the students. The collected data were analyzed in term of

- Classification of error of verbal test item.
- Classification of error according to Newman technique of error analysis.
- Causes of errors committed by the students in verbal problem solving.
- Causes of reading error.
- Causes of comprehension error.
- Causes of transformation error.
- Causes of process skill error.
- Causes of encoding error.

Classification of Error of Verbal Test Item

In this section error made in problem solving test are classified according to the Newman's Techniques of error analysis. The whole errors are presented in the table 1 and further elaborated in table 2. Errors are classified into five categories which are: reading error, comprehension error, transformation error, process error and encoding error. Errors in each of the test items were classified and presented in percentage. In verbal test, test items were carried out from Grade eleven, co-ordinate geometry topic in which 2 from the straight lines and 3 from the pair of straight lines and 2 from the circle.484 errors were noticed in verbal test items. In each test items different number of errors was found out which was found out which are as follows.

Table 1: Distribution of errors committed in test

No.	Test Items	No. of Error	Percent
1.	Find the acute angle between the two lines x -3y - 6=0 and y=2x + 5.	45	9.29%
2.	Determine the equation of the straight line through (1,-4) that makes an angle of 45^0 with the straight line 2x + 3y + 7=0.	77	15.90%
3.	Find the equation of the bisectors of the angles between the represented by $22x^2$ - 6xy - y^2=0.	72	14.87%
4.	Find the value of the K so that the length of tangent from (5, 4) to the line.	62	12.80%
5.	Find the center and radius of the circle whose equation is x^2 +y^2 +4x - 6y + 4 =0.	78	16.11%
6.	Prove that 2x2 + 7xy + 3y2 – 4x -7y + 2=0 represents two straight lines.	60	12.39%
7.	Show that the straight lines joining the origin to the point of intersection of the line x/a + y/b=1 and the curve x^2 + y^2 = c^2 are at right angles if 1/a^2 + 1/b^2 = 2/c^2.	90	18.59%
	Total errors	484	100%

Table No.1 shows that student felt difficulty in question number 1 because they did 45 times errors. These errors were reading, comprehension, transformation, process and encoding error like some of the students mispronounced the word said acute and some of the students made reading error in equation such as they said x-3y-6-=0 instead of x-3y+6=0 etc and other error mention in Appendix VII-XII. Students committed these errors because lack of practices, carelessness, and lack of knowledge related to co-ordinate geometry, lack of concept of equation etc. So the question number 1 was asked from the concept of angle between two straight lines. In which, there was given two equation of two straight lines and student needed to find out the angle formed from those straight lines.

Question No.2 was also asked from the concept of angle between two straight lines and 77 times. These errors were reading, comprehension, transformation, process and encoding error like some of the students said 45 only instead of 45^0, some of the student mispronounced the word said 'through', some of the students made reading error in equation such as they said 2x+3y+7-=0 instead of 2x-3y+7=0 etc and other error mention in Appendix VII-XII. Students committed these errors because lack of practices, lack of time manages, carelessness, lack of knowledge of mathematical symbol, lack of knowledge related to co-ordinate geometry.

Question No.3 was based on the concept of pair of straight line on which student were given a homogeneous equation of second degree to find out the equation of the bisectors of the angles between the represented line. They had made 72 times. These errors were reading, comprehension, transformation, process and encoding error like some of the students said 45 only instead of 45^0, some of the students mispronounced the word said 'bisector', some of the students made reading error in equation such as they said22x-6xy-y=0 instead of $22x^2$-6xy-y^2-=0 etc and other error mention in Appendix VII-XII. Students committed these errors because lack of practices, carelessness, lack of knowledge of this topic, lack of related to co-ordinate geometry, less concerning and unfamiliar to the subject etc.

Question No. 4 was based on the concept of circle to find the value of K so that the length of the tangent to the line on which students made 62 times. These errors were reading, comprehension, transformation, process and encoding error like some of the students mispronounced the word said 'tangent', some of the students made reading error in equation such as they said (54) instead of (5,4) etc and other error mention in Appendix VII-XII. Students committed these errors because lack of practices, lack of time manages, lack of change to read to at home, laziness, test phobia, related to co-ordinate geometry etc.

Question No.5 also was based on circle and students were needed to find the center point and radius of the circle on which they made 78 times. These errors were reading, comprehension, transformation, process and encoding error like some of the students mispronounced the word said 'equation', some of them made reading error in equation

such as they said $x^2+y^2+4x+6y+4=0$ instead of $x^2+y^2+4x-6y+4=0$ etc and other error mention in Appendix VII-XII. Students committed these errors because lack of practices, lack of knowledge, lack of laziness, test phobia, mother tongue, lack of motivation to the teacher etc.

Question number 6 and 7 was based on pair of straight lines and students were needed to find the straight lines represent the equation is $2x^2 + 7xy + 3y2 – 4x -7y + 2=0$ and the straight line joining the origin to the point of intersection of the given line on which they made 60 and 90 times error. These errors were reading, comprehension, transformation, process and encoding error like some of the students mispronounced the word said 'intersection', some of the students made reading error in equation such as they said $1/a2+1/b2$ instead of $1/a^2+1/b^2$ etc and other error mention in Appendix VII-XII. Students committed these errors because lack of practices, lack of knowledge, lack of laziness, lack of motivation to the teacher, lack of clarity etc.

Classification of Error According to Newman Technique of Error Analysis

Students were solved the various problem, various error might be committed in that step. According to Newman, while solving the verbal problem, five steps of error might be committed. Newman has categorized it into reading error, compression error, transformation error, process error and encoding error. Errors found in question while implementing test were categorized according to Newman's technique of error analysis. Errors were collected from interview too. The error was kept in reading error when the students were unable to read the question properly. This error was found out giving them question to read. The error was kept under the comprehension error when they were unable to receive what the question asked. It was found out through answer sheet and interview. The error was kept under transformation error, when the students were unable to change word problem into mathematical expression. The error was kept under process error when they committed error in processing the answer. At last, the error was kept in encoding error when they committed the error in verbal answer. In this way, the errors are categorized in the following table.

Table 2: Distribution of Errors

	Types of Error					Total
	Reading	Comprehension	Transformation	Process	Encoding	
No. of Errors	44	109	105	162	64	484
Percent	9.09%	22.52%	21.69%	33.47%	13.22%	100

From the above Table No. 2 errors are very low in reading and more in process. So 9.09% errors were committed in reading where as 33.47% errors were committed in process. 22.52% errors were committed in comprehension on the other hands 21.69% and 13.22% errors were committed in transformation and encoding respectively. Students felt fewer problems in reading but more in process and comprehension errors.

Classification of Errors Occurred in Question No.1 (concept of angle between two straight lines)

Question No. 1 was asked from angle between two straight lines. The question was "find the acute angle between the two lines X-3Y-6=0 and Y=2X+5. Thus we seen there are two equations of the straight lines and students needed to find out the angle formed with these straight lines with the help of formula on co-ordinate geometry. Students also needed to help from a given table or scientific calculator to find out the degree of angle. But many errors were committed.

Table 3: Classification of Errors in Q. No. 1

	Types of Error					Total
	Reading	Comprehension	Transformation	Process	Encoding	
No. of Errors	3	13	10	15	4	45
Percent	6.66%	28.88%	22.22%	33.33%	8.88%	100

From the analysis of table No.3, 45 errors were found in question 1 out of 484. These errors were reading, comprehension, transformation, process and encoding error like some of the students mispronounced the word said acute, some of the students made reading error in equation such as they said x-3y-6-=0 instead of x-3y+6=0 and some them

made reading in equation such as they said y 2x+5 instead of y=2x+5 etc and other error mention in Appendix VII-XII. Students committed these errors due to lack of practices and carelessness. There was lack of practice, word meaning, knowledge of previous class, concept of equation as well as laziness of the problem etc. According to Newman technique of error analysis, 6.66% of reading error was found which was few and 33.33% errors were found in process which was very high. Other like as 28.88%, 22.22% and 8.88% errors were found in comprehension, transformation and encoding respectively. In conclusion, this problem was felt less difficult in reading and more difficult in process.

In the question No.1 "find the acute angle between the two lines x-3y-6=0 and y=2x+5". A process error committed by one of the sampled student named Kundan Joshi at Tikapur Multiple Campus, Kailali was under.

Student Name :- Kundan Joshi

Campus Name :- Tikapur Multiple Campus

Roll No :- 60

No1   Find the acute angle between the lines
       $x = 3y - 6 = 0$ and $y = 2x + 5$

Sol^n

the two line are given,

$x - 3y - 6 = 0$ and

$y = 2x + 5$ so if slope is $\frac{1}{3}$ and 2

let θ be the angle beth this two eqn so

$\tan\theta = \dfrac{m_1 - m_2}{1 + m_1 m_2}$

$= \dfrac{\frac{1}{3} - 2}{1 + \frac{1}{3} \cdot 2}$

$= \dfrac{\frac{1-6}{3}}{\frac{5+2}{3}}$

$= \dfrac{-5}{5}$

$= -1$

$\therefore \theta = 135°$

Classification of Errors Occurred in Question No.2 (Concept of angle between two straight lines)

Question No. 2 was also asked from the concept of angle between two straight lines. the question asked was "determine the equation of the straight line through (1,-4) that makes an angle of 45^0 with the straight line 2x+3y+7=0. In this problem student needed to find the equation of the straight line passing through the given point. The error committed in this question has been prepared below in table 4.

Table 4: Classification of Errors in Q. No.2

	Types of Error					Total
	Reading	Comprehension	Transformation	Process	Encoding	
No. of Errors	7	16	18	26	10	77
Percent	9.09%	20.77%	23.37%	33.76%	12.98%	100

". A transformation error committed by one of the random sampled students named Harish Giri given below.
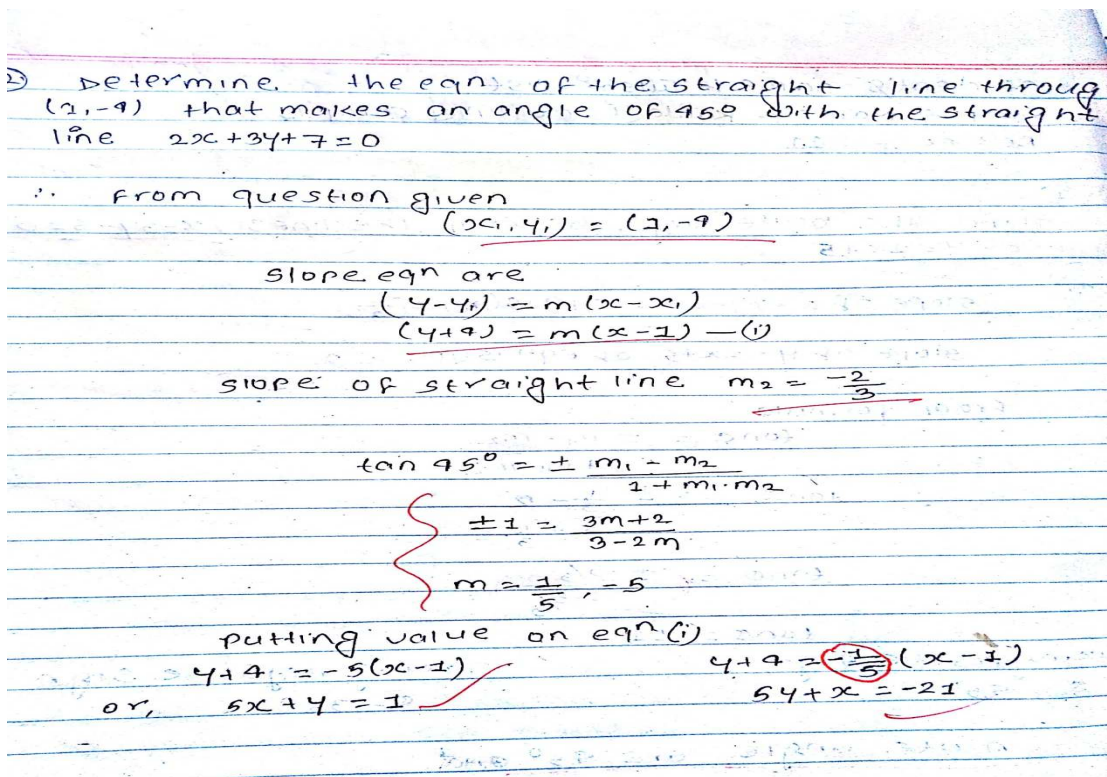
Table No. 4 shows that 77 errors were committed in question number 2 which was 9.29% out of 484 errors. These errors were reading, comprehension, transformation, process and encoding error like some of the students said 45 only instead of 45^0, some of them mispronounced the word said 'through', some of the students made reading error in equation such as they said 2x+3y+7-=0 instead of 2x-3y+7=0 etc and other error mention in Appendix VII-XII. Students committed these errors because lack of practices, lack of time manages, carelessness, lack of knowledge of mathematical symbol, related to co-ordinate geometry. Centering in question 2, 9.09%, 20.77%, 23.37%, 33.76% and 12.98% error had been found out in reading, comprehension, transformation, process and encoding respectively. In which more error was found in process, which was more than one third of error. In conclusion, there were fewer problems in reading and more in processing.

In the question No 2 "Determine the equation of the straight line through (1,-4) that makes an angle of 45^0 with the straight line 2x+3y+7=0.

Classification of Errors Occurred in Question No. 3 (concept of pair of straight lines)

Question No. 3 was based on concept of pair of straight lines. The question asked was "Find the equation of bisector of the angles between the represented by $2x^2$-6xy-y^2=0. The error committed in this question has been presented below in Table 5.

Table 5: classification of Errors in Q.No.3

	Types of Error					Total
	Reading	Comprehension	Transformation	Process	Encoding	
No. of Errors	8	16	13	24	11	72
Percent	11.11%	22.22%	18.05%	33.33%	15.27%	100

Table No. 5 shows that very few errors have been committed in reading. The central focus of error was found in process. From the analysis of table No. 5, 72 errors were found in question No. 3 out of 484. They had made 72 times. These errors were reading, comprehension, transformation, process and encoding error like some of the students mispronounced the word said 'bisector', some of the students made reading error in equation such as they said $22x^2$-6xy-y^2-=0 instead of 22x-6xy-y=0 etc and other error mention in Appendix VII-XII. Students committed these errors because there was lack of

practice, less manage classroom, mother tongue, lack of teaching learning material and noisy classroom. lack of practices, carelessness, lack of knowledge of this topic, lack of related to co-ordinate geometry, less concerning and unfamiliar to the subject etc. According to Newman technique of error analysis, 11.11% of reading error was found which was few and 33.33% error were found in process error which was high. So likewise 22.22%, 18.05% and 15.27% of errors were found in comprehension, transformation and encoding respectively. In conclusion this problem was felt less difficult in reading and more difficult in process

Classification of Errors Occurred in Question No. 4 (Concept of circle)

Question No. 4 was asked from the concept of circle. The question asked was find the value of K so that length of tangent from (5, 4) to the line. Here, we can see the question formed with two different equations. Student need to find out the value of K and the length of tangent from (5, 4) to the line. The error committed in this question has been prepared below:

Table 6: Classification of Errors in Q.No.4

	Types of Error					Total
	Reading	Comprehension	Transformation	Process	Encoding	
No. of Errors	4	7	9	24	18	62
Percent	6.45%	11.29%	14.51%	38.70%	25%	100

Table No. 6 shows that comparatively low numbers of errors were committed in Question No. 4. Only 62 errors were found out of 484. These errors were reading, comprehension, transformation, process and encoding error like some of the students mispronounced the word said 'tangent', some of the students made reading error in equation such as they said (54) instead of (5,4) etc and other error mention in Appendix VII-XII. Students committed these errors because lack of practices, lack of time manages, lack of change to read to at home, laziness, test phobia, related to co-ordinate geometry etc. In the question no. 4 "find the value of K so that length of tangent from (5, 4) to the line an encoding error by one of the randomly selected student named Bishnu Thapa

ore, $a = 2$, $h = -3$ & $b = 0 -1$.

The equation of the bisector are given by,

$h(x^2 - y^2) = xy(a-b)$

$\Rightarrow$ $-3(x^2 - y^2) = xy(2+1)$

$\Rightarrow$ $-3(x^2 - y^2) = 3xy$

$\Rightarrow$ $-x^2 + y^2 = xy$

$\Rightarrow$ $x^2 + xy - y^2 = 0$.

Ans 4. find the value of k so that the length of the tangent from $(5,4)$ to the circle is $x^2 + y^2 + 2ky = 0$

Soln: Given the equation of the circle $x^2 + y^2 + 2k$ at the point $(5,4)$ to the circle is

$\sqrt{x^2 + y^2 + 2gx + 2fy + c}$

i.e, $L = \sqrt{5^2 + 4^2 + 2.0.5 + 2.k.4 + 0}$

$\Rightarrow$ $1 = \sqrt{25 + 16 + 8k}$

Squaring on both side

$\Rightarrow$ $41 + 8k = 1$.

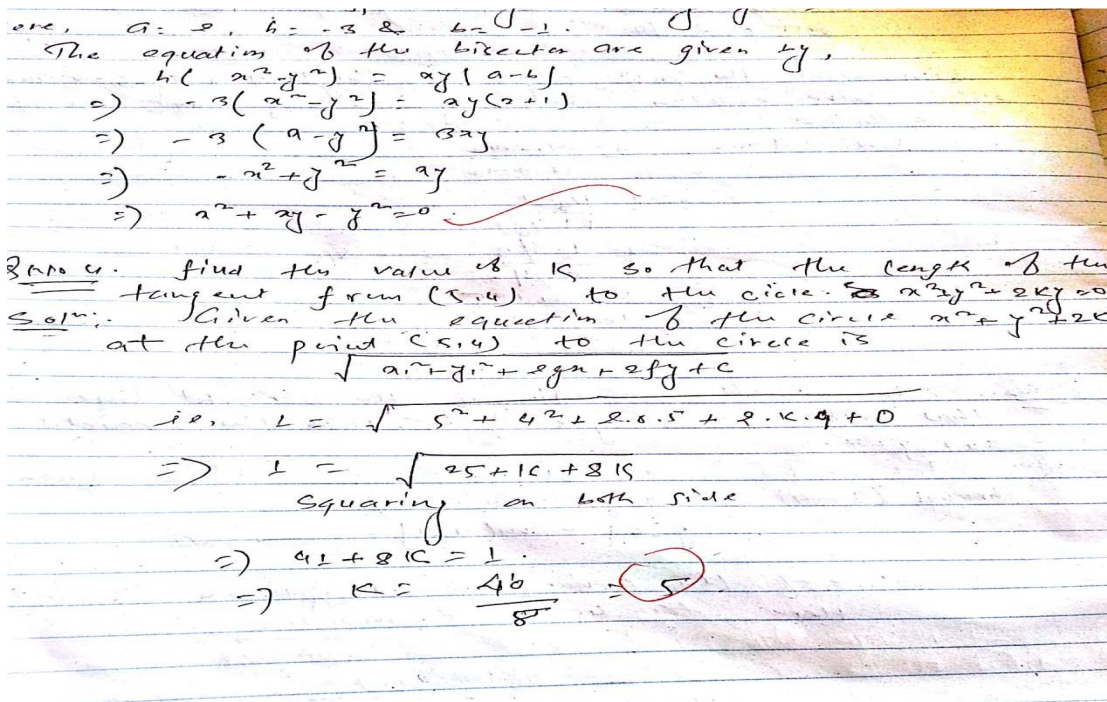$\Rightarrow$ $k = \dfrac{46}{8} = 5$

Classification of Error Occurred in Question No. 5 (Concept of circle)

Question No. 5 which was asked from the concept of circle. The question asked was "find the center and radius of the circle whose equation is $x^2 + y^2 + 4x - 6y + 4 = 0$". Student felt difficulty and made several errors which are presented in the table below:

Table 7: Classification of Errors in Q.No.5

	Types of Error					Total
	Reading	Comprehension	Transformation	Process	Encoding	
No. of Errors	6	24	24	20	4	78
Percent	5.12	30.76	30.76	25.64	4.92	100

The above table shows that 78 errors were committed in question No.5out of 484 medium number of error was committed in this question. These errors were reading, comprehension, transformation, process and encoding error like some of the students mispronounced the word said 'equation', some of the students made reading error in equation such as they said $x^2 + y^2 + 4x + 6y + 4 = 0$ instead of $x^2 + y^2 + 4x - 6y + 4 = 0$ etc and other error mention in Appendix VII-XII. Students committed these errors because lack of practices, lack of knowledge, lack of laziness, test phobia, mother tongue, lack of motivation to the teacher etc. From this, it is clear that the question No. 5 was

comparatively easy. Only six errors was made in reading and 24 error were made in comprehension and transformation. In the question No. 5 "Find the center and radius of the circle whose equation is $x^2+y^2+4x-6y+4=0$. And encoding error committed by one of the selected student named Ganesh Ghimire is presented below as an example of process error.

Q.1) Find the acute angle between the lines
$x-3y-6=0$ and $y=2x+5$

Sol^n, The given equation are $x-3y-6=0$ and $y=2x+5$
and the slope of these eq^n are $\frac{1}{3}$ and 2.
let θ be the angle between them
$$\tan\theta = \pm\left(\frac{m_1+m_2}{1+m_1m_2}\right)$$

$$= \pm\frac{\frac{1}{3}+2}{1+\frac{2}{3}}$$

$$= \pm\frac{+\frac{5}{3}}{\frac{5}{3}}$$

$$= \pm 1$$

$$\therefore \theta = 45° \text{ or } 135$$

After tabulation and calculation of the data obtained by verbal problem solving test and interview with sample students the process of finding the errors in verbal problem solving test on co-ordinate geometry was over. At the time of analyzing the researcher concluded that the students commit less number of errors on reading and more in process stage of solving verbal problem into the mathematics expression.

Classification of Error Occurred in Question No. 6 (Concept of pair of straight line)

Question No. 6 was the question which was asked from the concept of pair of straight line. The question asked "prove that $2x^2+7xy+3y^2-4x-7y+2=0$ represent two straight lines". Student felt difficulty and made several errors which are presented in the table below:

Table 8: Classification of Errors in Q.No.6

	Types of Error					Total
	Reading	Comprehension	Transformation	Process	Encoding	
No. of Errors	4	13	15	23	5	60
Percent	6.66%	21.66%	25%	38.33%	8.33%	100

The encoding error committed by one of the selected student named is presented Upesh Nyaupane below as an example of process error given below

The above Table shows that 60 errors were committed in question No.6; medium number of error was committed in this question. These errors were reading, comprehension, transformation, process and encoding error like some of the students mispronounced the word said 'represents', some of the students made reading error in equation such as they said 2x2+7xy+3y2-4x-7y+2=0 instead of $2x^2+7xy+3y^2-4x-7y+2=0$ etc and other error mention in Appendix VII-XII. Students committed these errors because Without good response to the teacher, lack of knowledge of previous class, less manage classroom, test phobia, mother tongue, laziness, large class size, lack of teaching learning materials and lack of motivation by mathematics teacher From this, it is clear that the question No. 6 was comparatively hard. Four errors were made in reading, 13 errors were made in comprehension, and 15 errors were made in transformation. In the question No. 5 "prove that $2x^2+7xy+3y^2-4x-7y+2=0$ represent two straight lines.

Classification of Errors Occurred in Question No. 7 (concept of pair of straight lines)

Question No. 7 was based on concept of pair of straight lines. The question asked was "Show that the straight lines joining the origin to the point of intersection of the line x/a + y/b=1 and the curve $x^2 + y^2 = c^2$ are at right angles if $1/a^2 + 1/b^2 = 2/c^{2}$". The error committed in this question has been presented below in Table 5.

Table 9: classification of Errors in Q.No.7

		Types of Error				Total
	Reading	Comprehension	Transformation	Process	Encoding	
No. of Errors	12	20	16	30	12	90
Percent	12.24%	22.22%	17.77%	33.33%	13.33%	100

. This problem was felt high difficult in reading and more difficult in process. A transformation error committed by one of the random sampled students named Krishna Sapkota as given below.

Q.N. 7

Prove that the straight lines joining the origin to the point of intersection of the line $x/a + y/b = 1$ and the curve $x^2 + y^2 = c^2$ are at right angles if

$$1/a^2 + 1/b^2 = 2/c^2$$

Solution.

The equation of the given curve is

$$x^2 + y^2 = c^2 \qquad \text{——(1)}$$

The equation of the given line is

$$x/a + y/b = 1$$

$$\frac{bx + ay}{ab} = 1 \qquad \text{——(ii)}$$

making eq^n (i) homogeneous with the help of eq^n (ii) we get.

$$x^2 + y^2 = c^2 \left(\frac{x + ay}{a}\right)^2$$

or. $a^2 x^2 + a^2 y^2 = c^2 x^2 + 2axyc^2 + c^2 a^2 y^2$

if coeff of x^2 + coeff of $y^2 = 0$

$$a^2 - c^2 + a^2 - c^2 a^2 = 0$$
$$2a^2 - c^2 a^2 = c^2$$
$$a^2(2 - c^2) = c^2$$
$$2/c^2 - 1 = 1/a^2$$

$$\frac{2}{c^2} = \frac{1}{a^2} - 1$$

Table No. 7 shows that very relatively few errors have been committed in reading. The central focus of error was found in process. From the analysis of table No. 9, 90 errors were found in question No. 7 out of 484. These errors were reading, comprehension, transformation, process and encoding error like some of the students mispronounced the word said 'intersection', some of the students made reading error in equation such as they said 1/a2+1/b2 instead of $1/a^2 + 1/b^2$ etc and other error mention in Appendix VII-XII. Students committed these errors because lack of practice, classroom management, teaching learning material, knowledge, motivation from teacher, clarity etc. similarly, they committed errors because of noisy classroom, laziness and mother tongue. According to Newman technique of error analysis, 12.24% of reading error was found which was few and 33.33% error were found in process error which was high. So

likewise 22.22%, 17.77% and 13.33% of errors were found in comprehension, transformation and encoding respectively

Causes of Errors Committed by the Students in Verbal Problem Solving

The second objective of this study was to find out the causes of errors committed by the students while solving verbal problem in coordinate geometry. Error were identified and classified through the test. Next, the researcher had to find causes .It was very difficult task. The researcher observed the class for five days. The researcher observed the class by using class observation form as mentioned in Appendix XIII-XIV. In each selected campus in order to find out how and why the students commit errors. In the class observation the researcher found the causes of committing error. Students committed error in different campuses due to the lack of basic knowledge of the co ordinate geometry, different term and symbol related to co ordinate geometry, focus more in process rather than reading question by the teacher, due to lack of proper class management, less emphasis on homework and class work by the teacher. Students committed different errors because there was less interaction between teacher and students. Students gave little or no attention toward the teacher that leads them to make errors. The researcher found out the causes of errors through the class observation. On the problem solving test students were committed together 484 errors. These errors were classified and analyzed on the basics of Newman technique of error analysis.

To find the causes the errors interview was conducted on the mini samples students and mathematics teacher of the sample Campuses. There are different causes of committing error students and teacher gave many reason which help to enhance in committing errors. They commit error Parent's occupation and education, opportunity to learn at home, classroom management, teacher behavior in the classroom, class work and homework, Punishment, rewards etc provided by the mathematics teachers to students, Students, relation with mathematics teachers and campus administrator, Lack of classroom management and noise, Partial attention to the teacher's explanation, Students only listen in class but do not participate in discussion, Tension at home is also one of the causes of comprehension error.

At the time of interview sample students felt a bit difficult to present their view because they were seen unable to give the causes why they made error on solving verbal problem themselves. The different views or causes presented b y the students about the errors on solving verbal problem were sum up on the following point.

- Lack of clarity often comes in the form of ambiguity
- Bad handwriting is an error that the student makes in communicating with himself or herself.
- Not reading directions. Students often do not read the instructions on a test carefully, and so in some cases they give the right answer to the wrong problem.
- Loss of invisible parentheses. This is not an erroneous belief rather; it is a sloppy technique of writing.
- Less reading, less concerning, no degree of repetition, unfamiliar to the subject matter.
- Lack of change to read at home, not proper instruction of the teacher, lack of word meaning.
- Without good rapport to the teacher, lack of knowledge of previous class, less manage classroom, test phobia, mother tongue.
- Laziness, large class size, lack of teaching learning materials and lack of motivation by mathematics teacher.

On the other hand, some similarities and some differences were found on the view of teacher about the causes of errors committed by the students. The researcher observed the class and mentioned the causes of errors in class observation form. Interview was conducted on the basis of five types of errors committed by students in first test. Views of teachers class observation report and causes presented by the teachers were arranged on the two teachers and five students' views in each following headings.

- Causes of reading error.
- Causes of comprehension error.
- Causes of transformation error.
- Causes of process skill error.
- Causes of encoding error.

Here only those views are coated which are logically appropriate in class observation and interview with students and teachers.

Causes of Reading Error

The error was kept in reading error when the students were unable to read the question properly. This error was found out by giving them question to read. Only 9.09% of errors were committed by the students in verbal problem solving test and interview which was conducted by the researcher. For example Determine the equation of a straight line through (1,-4) that makes an angle of 45^0 with the straight line 2x+3y+7=0 and Show that the straight lines joining the origin to the point of intersection of the line x/a + y/b=1 and the curve $x^2 + y^2 = c^2$ are at right angles if $1/a^2 + 1/b^2 = 2/c^2$. While reading the above question students made reading error like some of them said 45 only instead of 45^0, some of them mispronounced the word intersection and some of them made reading error in equation such as they said 2x+3y-=0 instead of 2x+3y+7=0.

At the time of interview about the causes of reading error I asked to the mathematics teacher of Tikapur Multiple Campus, what do you think the reason of committing reading error by the students? *He told that: students commit reading error because of hesitation with the teacher and peer group they feel weak themselves and sometimes test-phobia.*

I asked the mathematics teacher of Ghodaghodi Multiple Campus, what do you think the reason of committing reading error by the students? He told that: *students have difficulty in reading the question due to the lack of knowledge of technique term in mathematics*

At the time of interview with the students I asked what does make you commit reading error. Students replied

- Most of the errors are committed by the students because of poor background in language.
- Less important is given on reading question in classroom by the mathematics teacher.

- Lack of knowledge to recognize the symbols which are used in mathematics.
- Reading error occurs due to the unclear voice of respondent.
- Student commit reading error because some of them learn Nepali as the second language and English as the third language but daily practice they use their mother tongue.

In conclusion, after listening the causes of reading error by the teacher and students the researcher knew hesitation, poor background of language, knowledge of technique term, symbol, voice, etc. are the responsible causes of reading errors. Teacher needs to encourage the students; teacher should pay special attention to the language. Sometimes reading verbal problem competitor should be run by the mathematics teacher to minimize the reading errors.

Causes of Comprehension Error

The error was kept under the under the comprehension error when students were unable to receive what question asked. It was found out through interview. Students were committed 109 errors out of 484. For example determine the equation of a straight line through (1,-4) that makes an angle of 45^0 with the straight line 2x+3y+7=0? and Find the centre and radius of the circle whose equation is x^2 +y^2 + 4x-6y+4=0. These questions were asked to read to the students. Students read the question clearly but they were unable to understand the symbol ' $0'$ (degree) and sign + ,- etc.

At the time of interview about searching the causes of comprehension errors, I asked to the mathematics teachers of Ghodaghodi Multiple Campus, Does the environment of the classroom affect to commit the comprehension error? He told: *The yes, the students who have difficulty with comprehension are due to monotonous environment of classroom.*

I asked to the mathematics teacher of Kailali Multiple Campus, why students make comprehension error? He told that: *Some students are confused on the meaning of the words used in verbal problems by attaching their own meaning to them.* Students replied

- Students have difficulty in comprehension due to the lack of knowledge of technical term in mathematics.
- Some student performs the comprehension error due to the lack of pre- requisite knowledge.
- Some student performs comprehension error due to the bad relation with the mathematics teacher.
- Lack of classroom management and noise.
- Partial attention to the teacher's explanation.
- Students only listen in class but do not participate in discussion
- Tension at home is also one of the causes of comprehension error.

In conclusion, after listening the causes of comprehension error by the teacher and students the researcher knew that studying the above statements presented by the different mathematics teachers the researcher draw that comprehension error occurred due to monotonous environment, own meaning, lack of knowledge of technical term, lack of attention to the teacher's explanation. To minimize the comprehension error the mathematics teacher need to give fundamental knowledge about the topic before starting the new chapter opportunity should be given to the students to express the question in their own words after reading.

Causes of Transformation Error

An error was classified as transformation error if the student had understood what the question about but was unable to express that in mathematical expression and unable to identify the operation or sequence of operation needed to solve the problems. Medium number of error was committed by the students in this level that is 86 out of 484, which is about 17.76%. It was found through the answer sheet. For example: determine the equation of a straight line through (1,-4) that makes an angle of 45^0 with the straight line 2x+3y+7=0 and find the equation of the bisectors of the angles between the represented

by $2x^2$-$6xy$-y^2 =0. Students committed the transformation error mention in an Appendix VII-XII.

At the time of interview, I asked to the mathematics teacher of Tikapur Multiple Campus, how the students make transformation error? He told that: *Teacher teach the verbal problem with some explanation and ask the general and regular question like; understand? Most of these questions are answered in group, yes sir, but rarely do they think about concepts meaning and reasoning. So, the students commit transformation errors.*

I asked to the mathematics teacher of Ghodaghodi Multiple Campus, How the students make transformation error? He told that*: In attempt to make thing easy for the students some teachers have given incomplete explanation by focusing in certain salient feature that illustrate only some of the feature of the concept.*

At the time of interview with the students I asked, what are the possible causes of making transformation error? Students replied following causes.

- Students commit transformation errors due to the lack of concept and meaning of the mathematical word
- Transformation error occurs due to unable to identify the correct operation to solve the problem
- Students commit transformation error because teacher focuses on the calculation but do not give emphasis or do not explain about the question properly.
- Students commit transformation error because of lack of pre-requisite knowledge of their previous classes and classroom discussion.

In conclusion, after listening the causes of transformation error by the teacher and students the researcher knew that transformation error occurred due to incomplete explanation, lack of mathematical concept, skill and more emphasis on calculations part of mathematics. To minimize the transformation error the teacher should give clear concept about mathematical terms which are used in respective topic.

Causes of Process Error

An error was classified as process error when a student's been unable to identify the correct operation and did not know the procedures to carry out these operations accurately. In verbal problem solving test students committed 162 errors out of 484. It was33.47%.It was found out through the answer sheet of the test. For example Find the acute angle between the two lines x-3y-6=0and y=2x+5 and Find the equation of the bisectors of the angles between the represented by $2x^2$-6xy-y^2 =0. Students committed the transformation error mention in an Appendix VII-XII.

At the time of interview, I asked to the mathematics teacher of Ghodaghodi Multiple Campus. What are the causes of process error? He told that*: students often mix-up rules because do not really have relation understanding of what they are doing.*

I asked to the mathematics teachers of Kailali Multiple Campus. What are the causes of process error? He told that*: students are often trained to follow instruction meticulously seldom supported by conceptual justification. They do not think of alternatives and are uncomfortable with them*.

At the time of interview with the students, what do you think the causes of committing process error? Students replied:

- Lack of teaching material which are used in teaching verbal problem in co- ordinate geometry.
- Lack of Mathematical skill which are essentials to solve the verbal problem.
- Lack of practice to solve the verbal problem at home and outside.

In conclusion, after listening the causes of process error by the teacher and students the researcher knew that from the study of above statement the researcher found that process skill error occurred due to mix-up of rules, lack of thinking alternative, not listening the teacher explanation properly, less practicing the problem. To minimize the process skill error teacher must force the students to solve the problem time and again.

Causes of Encoding Error

An error was classified as encoding if the student correctly worked the solution to the problem but could not express the solution in an acceptable written form. Students had committed 64 errors out of 484. It was the second less percent in the test. It was found out through the answer sheet of problem solving test For example, Find the acute angle between the two lines x-3y-6=0and y=2x+5 and Find the value of k so that the length of tangent from (5, 4) to the circle $x^2+y^2+2ky=0$ is 1. Students solved the solution correctly but at the end of these questions they wrote 45 and 5 instead of 45^0 and -5 etc respectively. Students committed the transformation error mention in an Appendix VII-XII.

At the time of interview, I asked to the mathematics teacher of Tikapur Multiple Campus, Why students and teacher commit encoding error in solving mathematical problems? He told that: *Most of the teachers as well as students focus on finding the answer of the problem but they do not take care but keeping the solution procedure in order.*

I asked to the mathematics teacher of Ghodaghodi multiple Campus, Why students and teacher commit encoding error in solving mathematical problems? He told that: *Sometimes teacher solves the mathematical problem in up –down, left right (i.e. not in sequence) due to lack of blackboard and students copy the same. Students may follow the same in solving other problems too. So, encoding errors occur.*

At the time of interview with the students I asked, what may be the possible reason behind committing encoding error? Students replied:

- Sometimes limitation of time in test.
- Encoding error occurred due to the carelessness of students.
- Lack of homework and class work checking.

In conclusion, after listening the causes of encoding error by the teacher and students the researcher knew that encoding error is occurred due to carelessness, importance is given to finding the answer and less important to arranging the procedure.

Chapter V

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMENDATIONS

This chapter deals with the summary, findings, conclusion and recommendations concerning the analysis of error of co-ordinate geometry in Grade XI. This chapter is divided into four sections; summary, finding, conclusion and recommendation of the study.

Summary

The study was aimed at fulfilling two objectives. They were to find the errors committed by students of Grade XI in solving verbal problem on co-ordinate geometry and to find the causes of error made by the students. The sample in this study consisted of sixty students from three Campuses of Kailali District. The Campus were purposively selected. Newman technique of error analysis was adopted as the theoretical base of this study. Verbal problem solving test was adopted. Test consisted of seven questions. Errors from the test were analyzed by applying Newman technique of error analysis. Collection of data was done in three ways.

In first way error collected from the answer sheets. In second way the errors were collected by interview and Causes of error also collected through interview and third way error collected by class observation. From the verbal test all the identified errors were classified into five categories as described by Newman and frequency of each type of error was tabulated. The five categories of the errors were reading error, comprehension error, transformation error, process error and encoding error. If a student could not read the key word in the written problem such error was labeled as reading error. An error was classified as comprehension error if the student could not grasp the overall meaning of the words and therefore unable to understand the meaning of the problem. An error was counted as transformation error if the student was unable to identify the sequence of operation needed to solve the problem.

When a student did not know the procedure to carry out the operation accusatorily then process error was committed there. At last an error was classified as encoding error of the students if correctly worked out the solution to the problem but could not express

the solution in an acceptable written from. The errors in each of seven problems were classified and later the errors in the total were tabulated and discussed. To fulfill the second objective of the study interview and class observation was conducted with the mathematics teacher and students of the sample campus. Different views presented by different teachers on different types of errors were arranged and discussed.

Major Findings

The main findings of this study are as follows,

- The total numbers of errors committed by the students in solving verbal problems were 484. These errors were tabulated by checking answer sheet and by taking interview. Out of 484 errors 44 were from reading, 109 were from comprehension 105 were from transformation, 162 were from process and 64 were from encoding. These error mentions in Appendix VII-XII.

- Student had average knowledge of angle of two straight lines, equation of a pair of straight lines and circle. They were found to be curious on the co-ordinate geometry. They needed more practices. So, many errors were found while solving verbal problem in co-ordinate geometry.

- In verbal problem solving test, least errors were found in reading and most of the errors were found in comprehension and process.

- In test question number five was seen easy in which 5.12% of error was occurred and question numbers six was seen difficult in which 38.33% of error was occurred.

- Students had difficulty in reading and understanding the question due to lack of knowledge of technical term in mathematics.

- Most of the errors are committed by the students because of poor background in language.

- Some students are confused on the meaning of the words used in verbal problem by attaching their own meaning to them.

- Students often mix-up rules because they do not really have relational understanding of what they are doing.

- Using salient features by the teachers on teaching verbal problem restrict the students from compete understanding of the verbal problems.

- A fixed attitude (not alternative) restricts the students from alternative ways of solving verbal problems.

Conclusion

From the study it was concluded that: the students commit errors from the beginning (reading level) to the deduction of result (encoding level) the concentration of error was seen on the process level where the students committed 38.32% errors. This result shows that maximum number of students was failed in the stage of processing the mathematical problem due to lack of knowledge of proper process and practice. Next concentration of errors was on transformation and comprehension level, where the students committed 30.76% errors. This shows many students have no idea about what the verbal problem asks from them and how to solve.

The researcher also tried to find out the causes of errors and found that students have difficulty with reading because of find it hard to establish a context for a particular text to predict the meaning of the text and anticipate words that are likely to occur within it. The students who have difficulty with transformation are due to lack of discussion in classroom. Students are not given ample opportunity to use their own method of solving the problems. The students who have difficulty with process due to mix- up rules because they do not really have relational understanding of what are they doing. Encoding errors are due to the lack of regular practice of mathematical problem. It is lack of class work and homework. The researcher found learning problems of students due to which they committed errors. Some students are confused on the meaning of the words used in verbal problems by attaching their own meaning to them.

Sometimes the students pay only partial attention to the teacher's explanation as a result of less actives, tiredness or monotonous tone of teacher. Consequently, they can

recollect only part of explanation and then try to pick it up with their own logic which may be faulty.

In attempt to make things easy for the students, some teachers gave incomplete explanation by focusing on certain salient feature that illustrates only some of the feature of concept. Since students are often trained to follow instruction meticulously, seldom supported by conceptual justification, they do not think of alternatives and are uncomfortable with them.

When a teacher teaches, most of the students just listen the explanation and do not participate in the discussion. Teachers must involve the students in the teaching and learning process to do better in solving verbal problems. To assist these students, teacher can provide orientation to the text before they read the problem.

Recommendations

This topic deals with the recommendation given for the educational implication and further study. The researcher intended that the recommendations given for educational implication should be used in classroom teaching learning activities and the recommendation for the future study should be helpful to the other researcher to carry out other related researches.

Recommendations for the educational implications

On the basis of the above result and conclusion the following recommendations are proposed for the educational implications and improvement in teaching learning. On the basis of finding and conclusion the following recommendations for educational implications are made.

- Before starting the chapter, the teacher has to give the fundamental knowledge about the topics.

- Teachers of mathematics should give different assignment to the students asking elaborated writing in mathematical concepts in their own language.

- Students become puzzled when new chapter approaches to them at Higher Secondary level. So, any topic should be introduced from lower level.

- Most of the errors are committed by the students because of poor background in language. Teacher should pay special attention to the language. Mathematical concept should be explained in detail by using simple language with illustrations.

- The teacher should encourage the student to solve the problem through different ways.

- Correction of errors should be down with the participation of students.

- Opportunity should be given to the student to express the question in their own word after reading.

- The teacher should change teaching strategies after getting the cause of errors.

- Classroom management and teaching material should be managed to minimize the error.

- The teacher should promote student understanding of the technical terms, geometrical terms rather than explaining directly from the teachers side while teaching in the class.

- Student's errors in the solutions of problems in geometry be analyzed regularly.

- The teacher should encourage the students to solving verbal problem in co-ordinate geometry in different ways.

- Should be targeted to develop sound background in geometry at secondary levels to study geometry at higher levels successfully.

Research areas for further study

The result and the conclusion of this study generate some other areas for research. Some of them are presented here:

- What would be the result of error analysis in secondary and higher secondary Grades?

- What would be effects of error analysis in the teaching learning of mathematics in the classroom?

- How the results of error analysis be used in the classroom teaching learning activities?

- How the frequencies of the errors in geometry be reduced of the students of higher secondary grades?

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Appendices

Appendix I

Problem solving test questions

1. Find the acute angle between the two lines x-3y-6=0and y=2x+5.

2. Determine the equation of a straight line through (1,-4) that makes an angle of 45^0 with the straight line 2x+3y+7=0.

3. Find the equation of the bisectors of the angles between the represented by $2x^2$-$6xy-y^2$=0.

4. Find the value of k so that the length of tangent from (5, 4) to the circle $x^2+y^2+2ky=0$ is 1

5. Find the centre and radius of the circle whose equation is x^2+y^2+4x -6y+4=0.

6. Prove that $2x^2+7xy+3y^2-4x-7y+2=0$ represent two straight lines.

7. Show that the straight lines joining the origin to the point of intersection of the line x/a + y/b=1 and the curve $x^2 + y^2 = c^2$ are at right angles if $1/a^2 + 1/b^2 = 2/c^2$.

Appendix II

Test questions for pilot study

1. Find the acute angle between the two lines x-3y-6=0and y=2x+5.

2. Find the equation of the circle whose center is the point of intersection of x +2y-1=0 and 2x-y-7=0 which is passes through (3,1).

3. Determine the equation of a straight line through (1,-4) that makes an angle of 45^0 with the straight line 2x+3y+7=0.

4. Find the equation of the bisectors of the angles between the represented by $2x^2-6xy-y^2=0$.

5. Find the value of k so that the length of tangent from (5, 4) to the to the circle $x^2+y^2+2ky=0$ is 1.

6. Lines through the centroid of the triangle with vertices at (3,-4), (-2,1), (5,0) and
   i) parallel to the line x-3y=4 and ii) perpendicular to the line x-3y=4.

7. Find the centre and radius of the circle whose equation is x^2+y^2+4x -6y+4=0.

8. Fine the equation of any line perpendicular to the line. ax+by+c=0.

9. Prove that $2x^2+7xy+3y^2$-4x-7y+2=0 represent two straight lines.

10. Show that the straight lines joining the origin to the point of intersection of the line x/a + y/b=1 and the curve $x^2 + y^2 = c^2$ are at right angles if $1/a^2 + 1/b^2 = 2/c^2$.

Guideline for the interview with mathematics teacher

Respected Teacher,

I am student of mathematics education in Central Department of Education in Kirtipur, Kathmandu. I am doing a research on "Error Analysis In Solving Verbal Problem In Co-ordinate Geometry", the main objectives of my research is to find the error made by students of grade XI in solving verbal problems in co-ordinate geometry and to explain the causes of errors in solving verbal problems in co-ordinate geometry. To fulfill the objectives of the study I would like to take your view and idea on why students commit errors. Your view and ideas are only used to complete this study not for other purpose. I hope you do not feel any difficulty to help me to complete my study.

Teacher's name:

Campus's name:

Experience:

Training:

Age:

Sex:

Location of campus:

- What do you think the reason of committing reading error by the students?
- Does the environment of the classroom effect to commit the comprehension error?
- How the students make transformation error?
- What are the causes of process error?
- What do you think the causes of committing process error?
- Why students and teacher commit encoding error in solving mathematical problem.
- What may be the possible reason behind committing encoding error?

Appendix IV

Guideline for interview with mathematics students

Dear students, please give your own feelings and experiences in learning mathematics.

How the following factors made you to do errors in mathematics?

- What do you think the reason of committing reading error by the students?
- Does the environment of the classroom effect to commit the comprehension error?
- How the students make transformation error?
- What are the causes of process error?
- What do you think the causes of committing process error?
- Why students and teacher commit encoding error in solving mathematical problem.
- What may be the possible reason behind committing encoding error?

Name: Sex:

Class: Ethnicity:

Roll No: Place of birth:

Position in class: Places of residence:

Appendix V

Sample Campus, Students and teacher

S.N.	Name of Campus	Number of students		Number of Teacher
		Boys	Girls	
1.	Tikapur Multiple Campus	14	6	1
2.	Ghodaghodi Multiple Campus	17	3	1
3.	Kailali Multiple Campus	13	7	1

Appendix VI

Sample students for interview

S.N.	Name of Campus	Number of students		Total
		Boys	Girls	
1.	Tikapur Multiple Campus	4	1	5
2.	Ghodaghodi Multiple Campus	3	2	5
3.	Kailali Multiple Campus	2	3	5

Test item solved by the student

Example 6   Q.N.6

1. prove that $2x^2 + 7xy + 3y^2 - 4x - 7y + 2 = 0$ represents two straight straight

Straight lines.

solutions:

Comparing the equation with the general equation

of second degree,

$ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$

transformation error

So, we get,

$a = 2$, $h = 7/2$, $b = 3$, $g = 2$, $f = -7/2$, $c = 2$

The condition of the general equation of second degree

to represent two straight line is,

$a+b+c$

$abc + 2ghf - af^2 - bg^2 + ch^2 = 0$ —————— (1)

putting the value, a, b, c, g, f and c in eqn

(1) we get,

Taking L.H.S $= 2 \times 3 \times 2 + 2 \times 2 \times 7/2 \cdot -7/2 - 2 \times \frac{49}{4} - 3 \times 4$

$+ 2 \times \frac{49}{4}$

process error

$= 12 \cdot -49 - \frac{49}{2} - 12 + \frac{49}{2}$

$= \boxed{-49}$

Test item solved by the student

(Q3) find the equation of the bisectors of the angles between the lines represented by

$$2x^2 - 6xy - y^2 = 0$$

$\rightarrow$ sol^n, Let given eqn $2x^2 - 6xy - y^2$ is

Compared with $ax^2 + 2Hxy + by^2$

Then, $a = 2$ & $2H = -6$ $\Rightarrow -3$ and transformation error

the eqn of the bisectors are given below

$$h(x^2 + y^2) = (a - b)xy$$

process error

$$-3(x^2 + y^2) = (2+1)xy$$

$$-3(x^2 + y^2) = 3xy$$

$$y^2 - x^2 + xy = 0$$

Test item solved by the student

Q.N. 7

prove that the straight lines joining the origin to the point of intersection of the line $x/a + y/b = 1$ and the curve $x^2 + y^2 = c^2$ are at right angles if

$$1/a^2 + 1/b^2 = 2/c^2$$

Solution.

The equation of the given curve is

$$x^2 + y^2 = c^2 \qquad (1)$$

The equation of the given line is

$$x/a + y/b = 1$$

$$\frac{bx + ay}{ab} = 1 \qquad (II)$$

making eqn (i) homogeneous with the help q eqn (ii) we get.

$$x^2 + y^2 = c^2 \left(\frac{x + ay}{a}\right)^2 \qquad \text{← transasformation error}$$

or. $a^2 x^2 + a^2 y^2 = c^2 x^2 + 2axyc^2 + c^2 a^2 y^2$

if coeff q x^2 + coeff q $y^2 = 0$

$$a^2 - c^2 + a^2 - c^2 a^2 = 0$$

process error →

$$2a^2 - c^2 a^2 = c^2$$

$$a^2(2 - c^2) = c^2$$

$$2/c^2 - 1 = 1/a^2$$

transasformation error →

$$1/a^2 + 1 = 2/c^2$$

$$\frac{2}{c^2} = \frac{1}{a^2} - 1$$

1) Determine the eqn of the straight line through (1,-4) that makes an angle of 45° with the straight line $2x + 3y + 7 = 0$

∴ From question given
$$(x_1, y_1) = (1, -4)$$

Slope eqn are
$$(y - y_1) = m(x - x_1)$$
$$(y + 4) = m(x - 1) — (i)$$

Slope of straight line $m_2 = -\frac{2}{3}$

$$\tan 45° = \pm \frac{m_1 - m_2}{1 + m_1 . m_2}$$

$$\pm 1 = \frac{3m + 2}{3 - 2m}$$ transformation error

$$m = \frac{1}{5}, -5$$

putting value on eqn (i)

$y + 4 = -5(x - 1)$

or, $5x + y = 1$

$y + 4 = -\frac{1}{5}(x - 1)$

$5y + x = -21$

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Test item solved by the student

Student Name :- Kundan Joshi

Campus Name :- Tikapur Multiple campus

Roll No :- 60

NO1   Find the acute angle between the line
$x = 5y - 6 = 0$ and $y = 2x + 5$

Sol^n

the two line are given,
$x - 5y - 6 = 0$ and
$y = 2x + 5$ so if slope is $\frac{1}{5}$ and 2

let θ be the angle beth this too eqn so

$$\tan\theta = \frac{m_1 - m_2}{1 + m_1 m_2}$$

$$= \frac{\frac{1}{5} - 2}{1 + \frac{1}{5} \cdot 2}$$

$$= \frac{\frac{1-6}{3}}{\frac{5+2}{3}}$$ process error

$$= \frac{-5}{5}$$

$$= -1$$

encoding error

$\therefore \theta = 135°$

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Appendix XII

Test item solved by the student

5) Find the centre and radius of the circle whose equation is:

$$x^2 + y^2 + 4x - 6y + 4 = 0$$

Solution: Given circle is:

$$x^2 + y^2 + 4x - 6y + 4 = 0$$

$$\Rightarrow x^2 + 4x + y^2 - 6y + 4 = 0$$

$$\Rightarrow x^2 + 2 \cdot x \cdot 2 + 2^2 + y^2 - 2 \cdot y \cdot 3 + 3^2 = 2^2 - 4 + 3^2$$

$$\Rightarrow (x+2)^2 + (y-3)^2 = 3^2$$

Hence the centre of the circle is:

$$(g, f) = (2, +3)$$

Radius $(r) = 3^2$ ⟵ encoding error

2) Find the value of k so that the legth of the tangent from (5,4) to the circle $x^2 + y^2 + 2ky = 0$ is 1

Ans The length of the tangent from (5,4) to the circle is,

$$1 = \sqrt{x_1^2 + y_1^2 + 2gx_1 + 2fy_1 + c}$$

$$1 = \sqrt{5^2 + 4^2 + 2 \cdot 0 \cdot 5 + 2 \cdot k \cdot 4 + 0}$$

process error $1 = \sqrt{25 + 16 + 8k}$

squaring on both side

$$25 + 16 + 8k = 1$$

$$41 + 8k = 1$$

$$8k = -40$$

$$k = -\frac{40}{8} \quad 5$$ ⟵ Encoding error

$$k = 5$$

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Appendix XIII

Students Class observation form

Name of the observer: date:

Topic: time:

Activities	Yes	No
Replied to the teacher.		
Show interest in topic.		
Ask to the teacher.		
Clean classroom environment.		
Students have basic knowledge to the topic.		
Understand the language to the teacher.		
Involving different activities.		
Follow to the teacher.		
Involve in group discussion.		
Do the class work given by the teacher.		

:

Appendix XIV

Teacher class observation form

Teachers Name: date:

Topic: observer:

Teaching characteristic	Comments
1. Organization Appropriate selection of aims, objectives and content. Appropriate organization of content. Planning the use of resources and materials.	
2. Presentation Clear introduction, continuity with other sessions and students' knowledge. Clarity of aims and objectives. Clarity of presentation and organization. Appropriate pace and timing. Attempts to respond to student needs. Attitude to students (manner, style). Summary and reference to future work.	
3. Teaching approach and aids Choice of teaching/learning approach and its relevance to learner group. Methods used to check/evaluate learning. Choice and use of teaching activities. Effective use of question and answer. Encouragement of student interaction. Management of the session, including opening and closure.	
4. Student response Level of participation. Level of attention and interest. General class atmosphere.	
5. General observations	