Chapter I
INTRODUCTION

Background of the Study

Education is a fundamental human right and has been accepted as the primary means of a country all-round development. The country can be developed only when available resources are used at their optimum by linking education to the national reality and accepting the concepts of “Education for all” and “Education for development”. It is the most debating issue and a very sensitive part of culture in every modern society. Throughout the world, the culture in every modern society is associated to the planning of education policy and program. The vision of twenty-first century, however, it is to be centered on the formation of developed society in the world. Much knowledge in science, mathematics and social studies are demanded to be a literate citizen of twenty first century. Mathematics is divided into several branches as arithmetic, algebra, geometry, trigonometry, statistics, calculus etc. Simultaneous linear equation is one of the important part in algebra.

Linear equation, statement that a first degree polynomial that is, the sum of a set of terms, each of which is the product or a constant and the first power of a variable is equal to a constant. Specifically, a linear equation in *n* variables is of the form $a_0+a_1 x_1= \ ... = a_n \times_n = c$, in which x_1, $...\times_n$ are variables, the coefficients a_0 ... a_n are constants, and c is a constant. If there is more than one variable, the equation may be linear in some variables and not in the others. Thus, the equation $x + y = 3$ is linear in both x and y, whereas $x + y = 0$ is linear in x but not in y. Any equation of two variables. Linear in each represents a straight line in Cartesian coordinates; if the constant term $c = 0$, the line passes through the origin.

A set of equations that has a common solution is called a system of simultaneous equations. For example, in the system

$2x - y = 1$

$x + 2y = 8$

both equations are satisfied by the solution x = 2, y= 3. The point (2, 3) is the intersection of the straight lines represented by the two equations. See also Cramer's rules. **History of Simultaneous Equations Retrieved from;**

http://hom.wikidot.com/cramer-s-method- and-crammer-s-paradox)

As early as 200 B.C. the Chinese had devised a clever method for solving systems of two linear equations with two unknowns. Following the Chinese, in 1750, Gabriel Cramer (1704-1752), a Swiss mathematician, published the famous rule for solving systems of linear equations in his manuscript *Introduction to the Analysis of Algebraic Curves.* His method of solving systems of equations dealt with finding the equation of a plane curve passing through a certain number of fixed points. Following Cramer, in 1873, in 1873, Wilhelm Jordan (1842-1899), a German geodesist, published a book titled Handbuch der Vermessungkunde in which he discussed Gauss' method of elimination to convert a given system of linear equations to a triangular system. In this book he explained how the triangular system could then be further reduced to a diagonal one, which could be solved directly. This algorithm is called the Gauss Jordan Elimination method, which can still be found in the high school curriculum we use today.

Methods of Solving Simultaneous Linear Equations

We can use following methods to solve simultaneous linear equations.

- **Graphical Method**

In this method, first we find at least two points for a linear equation and plot the points and join the points which form a straight line. Similarly by same procedure another straight line is drawn in graph. Point of intersection two straight lines is the solution for x and y.

For example: Solve following equations by graphical method.

x + y = 4 _____ (i)
8x - 2y = 12 _____ (ii)

Step 1: for equation(i)

When x = 0, y = 4

and when y = 2, x = 2

Hence, straight line given by equation (i) passes through (0, 4) and (2, 2)

Step 2:

for equation (ii)

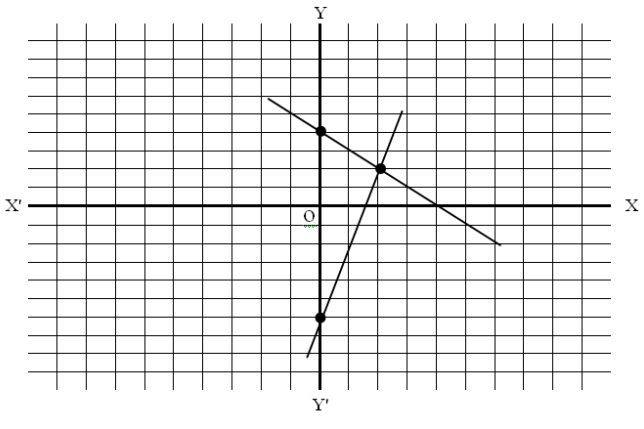
When x = 0, y = -6

and when y = 2 x = 2

Hence, straight line given by (ii) passes through (0, -6) and (2, 2)

Step 3:

Plotting above points in graph



Both straight lines intersected at (2, 2), thus, the coordinate pair (2, 2) is in fact a solution to the system of equations.

- **Elimination and Substitution Method**

There are two basic methods that are used to solve linear simultaneous equations: substitution and elimination. In this focus, we will highlight how each

method is used to solve a system of two equations with two unknowns; however, each method works for systems with more than two equations and more than two unknown.

In order to use substitution, we ultimately solve for one of the variables in the equations in terms of the other variable and substitute that value in the other equation. After substituting the one variable, you will have an equation in one variable only, which you may solve and then substitute back into the original equation to get the solution for the other variable.

Example: Solve the system of equations by substitution

$$3y - 2x = 11$$
$$Y + 2x = 9$$

Step 1: Solve one of the equations for one of the variables

$$Y = 9 - 2x$$

Step 2: Substitute the expression found in Step 1 into the second equation

$$3\,(9-2x) - 2x = 11$$

Step 3: Solve the equation in Step 2 for the variable x.

$$3\,(9-2x) - 2x = 11$$
$$27 - 6x - 2x = 11$$
$$-6x - 2x = -16$$
$$-8x = -16$$
$$x = 2$$

Step 4: Substitute the x – value found in Step 3 into the original equation to solve for the y-variable

$$y + 2\,(2) = 9$$
$$y + 4 = 9$$
$$y = 5$$

When using substitution and elimination it is essential to stress the importance of checking your solutions. Thus, we must substitute the (x, y) coordinate pair that we found into both equations to make sure it satisfies both equations.

$$3(5) - 2(2) = 11$$
$$(5) + 2(2) = 9$$

Therefore, the coordinate pair (2,5) is a solution for the system of equations.

The elimination method is also called the addition method. In order to use Elimination to solve a system of equations, we will modify the equations so that for one variable, its coefficients in the two equations cancel out by being opposites of one another. We only need to modify the equations if we are given equations where we cannot eliminate a variable by addition or subtraction directly (i.e. 2x and -2x).

Example: Solve the system of equations by elimination

$$4x + 3y = -2$$
$$8x - 2y = 12$$

Step 1: Multiply the top equation by a multiple of 2 and the bottom equation by a multiple of 3 in order to get the y-variable to cancel out. We now have the following of equations.

$$2(4x + 3y = -2)$$
$$3(8x - 2y = 12)$$
$$8x + 6y = -4$$
$$24x - 6y = 36$$

Step 2: Solve or x by adding the two equations together and cancelling out the y-term.

$$8x + 6y = -4$$
$$\underline{+\ 24x - 6y = 36}$$
$$32x = 32$$
$$x = 1$$

Step 3: Solve for y by substituting x back into one of the original equations.

$$4(1) + 3y = -2$$
$$4 + 3y = -2$$
$$3y = -6$$
$$y = -2$$

Thus, we have the coordinate pair (1, -2) as the solution to this system of equations. Just like we did above, it is important to check the solution to make sure it satisfies both equations.

$$4\,(1) + 3\,(-2) = -2$$
$$8\,(1) - 2\,(-2) = 12$$

In does satisfy both of the equations, thus, the coordinate pair (1, -2) in fact a solution to the system of equations.

In practical life, students of mathematics are typically evaluated by counting the number of correct and incorrect responses 'know mathematics' and students committing more errors 'do not know mathematics'. If an entire school is taking a standardized test the result may be used to decide grade placement, promotion, scholarship or perhaps the success of the school program. Occurrence of errors study differs from quantitative evaluation by attending to pattern of missed problems. Its purpose is not to evaluate how much the student knows, but rather to describe what are the students could not get the subject matter or knowledge. This explanation simply plays one or two roles as an aid to classroom teaching and as a method of research.

Error analysis is a technique that teacher uses an educational devices for analyzing clues to solve some of the server learning problem of their students. It allows the researcher to pin point the computational mistakes being made by students and interpret the reason for mistake. Asking question to compute a problem while explaining to the teacher the process used can provide excellent information about the nature and causes of the errors or difficulties. Further, the teacher can discover and analyze the students' response to detect learning difficulties through the intelligent use of inventory and diagnostic test along with personal interviews and plan the specific remedial measures to correct error and remove difficulties. And the researcher researches in simultaneous linear equations of grade 10 students who do error in mathematics in Dhading district.

A systematic analysis and comparison of occurrence of error made by the students is of considerable importance. In the past, errors were considered as a bad sign in learning and teaching process. Now days the scenario has been changed

completely. Errors no longer are taken as bad sign in learning. It is believed that it is natural to make mistake then, perhaps there is no learning. In fact, it is an important component in minimizing the errors in learning process and developing competence. The study of learner's error occurrence in solving word problem has great importance on mathematics teaching and learning. In this sense, error analysis is a stepwise procedure that is used to identify the errors.

Error analysis in mathematics teaching strives to identify the nature of error a learner may commit in dealing with a particular type of assignment. The result of such analysis may help to the teacher to appropriate corrective teaching for the individual learner and make recommendations to the curriculum developers for producing further instructional materials.

Statement of Problems

Most of the problems in mathematics are asked in the forms of verbal problem. Errorsoccurred frequently in solving these verbal problems. This indicates the low level of achievement. Word problems abound both on Mathematics tests and in everyday life. A word problem tells a story. It may also present a situation in terms of constants or variable or both.

As we know Algebra is one of the important branches of Mathematics at Secondary level. This level is foundation for the upper levels. Verbal problems are the basics for the understanding of Mathematics. Unless the Mathematics is well understood, students cannot achieve more in this subject. But in ground reality student feel more difficulty in doing word problem than any other topic or aspects of Mathematics. Researcher himself a Mathematics teacher, he has been teaching Mathematics in Secondary level for last five years. He found different types of errors of students in solving verbal problems of simultaneous linear equations in different examinations and in class work activities. Therefore, for the improvement of students' error and effective classroom teaching it is necessary to do research. To do better in Mathematics students must do these problems efficiently. So, this study is mainly concerned with the identification and comparison of errors committed by grade X students in solving written Mathematics tasks. In this study the researcher mainly indented to answer the following questions.

- What sort of error do students commit in solving verbal problems of simultaneous equations?
- Does the error made by students' differ on solving verbal problems?
- What are the causes of error committed by the students?

Objectives of the Study

The main objectives of this study were:

- To identify the error committed by students on problem solving where students' first mistake was taken as error.
- To analyze the error committed by students in problem solving by using Newman and Clements technique of error analysis.
- To investigate the causes of error in solving verbal problems of simultaneous linear equations.

Significance of the Study

Simultaneous equations are the part of algebra in mathematics course, especially at secondary level. In different science and other related subjects, simultaneous equations are used in the solution of problems, to name but a very few, where pupils have a rich opportunity to apply their mathematical knowledge in the situation of the real world. In other words, to use mathematics as a tool. The purpose of this inquiry was to identify and classify by relative frequency, the most common error made by the sample of pupils in their attempts to solve simultaneous equation, so the study would have the following significances:

This study would help teacher on following aspects.

- It helps teacher to identify student’s error on solving problem on simultaneous equation.
- It helps teacher to minimize students’ errors.
- It helps to rearrange their teaching strategies and adopt suitable methods to teach verbal problems in simultaneous equations.

This study would help mathematicians on following aspects.

- It helps mathematicians to find out something facts related to this topic.
- They can use its result on their further research.

- This study would be significant for researchers and curriculum designer as this study report would open the doors for further research in their field.
- This study is supposed to be significant for the students as this study help to find out the general pattern of error in solving verbal problems in simultaneous equation. By this it would help them correct those areas where errors occur mostly.
- This study would facilitate the design and development of improved teaching strategies in the classroom.
- It would attempt to analyze and improve the teaching and learning at this topic which would be important.
- This study would help in the improvement of day to day classroom teaching.

Delimitation of the Study

The study was delimited under the following aspects:

- The study was delimited in Dhading district.
- The study was delimited only to the error made by students on solving simultaneous equations' problems.
- Only students studying at tenth grade was considered as sample population for the purpose of this research.
- The samples of the schools were selected by using stratified random sampling.

Operational Definition of Terms

Error

The difference between a computed or measured value and a true or theoretically correct value is called error. Here, the first mistake done by the students during the solution of the problem is taken as error.

Reading error

Inability of student to read the words in the question such that s/he can't grasp all the information of the questions.

Comprehension error

Students who are unable to grasp the overall meaning of the words but cannot proceed along the appropriate problems solving path. In other words, students can read the problems well but cannot comprehend the meaning of the words, symbol or questions.

Transformation error

Students unable to identify the sequences of the operation needed to solve the problems. In other words, an error which makes the student unable to identify the operation or sequences of the operation needed to solve the problem and unable to transform sentences to mathematical form.

Process skill error

Students do not know the procedure to carry out the operation correctly. In other words, an error if the student can choose an appropriate operation but cannot complete the operation accurately.

Encoding error

Students who are not able to express the solution in an acceptable written form. In other words, an error, if the student can perform the correct operations but writes the answer incorrectly.

Motivation error

If the student declined to proceed further due to his/her psychological reasons, this type of error will be classified as motivation error.

Carelessness error

If the student commits error in written test but corrects the error himself while interviewed, this type of error will be classified as carelessness error.

Chapter II
REVIEW OF RELATED LITERATURES

Review of related literature is a source of further study of research task. It takes the research task to be undertaken in a better perspective and is essential for guidance of research planning. There are many literatures on the other field of study but very few attempts have been made to study on the error in simultaneous equations at secondary level. This chapter deals with review of the related literature and theoretical frame work needed for this study. Mainly the literature included previous thesis, books, and journal and internet materials. Different related literature become helpful in understanding different aspect of error analysis of simultaneous equations. There are so many researches about mathematics but there are not exactly same as "An analysis of Student's Error in Solving Verbal Problems" in the context of Nepal. Some of the related researches are as follows:

Roberts (1968) studied the failure strategies of third graders and identified four types of errors. These include; wrong operation, obvious computational errors, defective algorithm and random responses.

Newman (1977) studied on one hundred and twenty four low achieving grade six pupils and found that reading, comprehension and transformation errors made by low achieving pupils accounted for 13%, 22% and 12% respectively. Thus almost half of the errors occurred in the first three steps.

Marinas and Clements (1990) studied on grade seven students of Penang and found that over 90% of the initial errors made by the students were of the comprehension or transformation type.

Marahata (2000) studied on "A study on computational error on fraction by grade VI students in Chitwan district" aimed to identify the computational errors on fraction by grade VI students in operation of fractions, comparing the computational errors of grade VI students with respect to four basis operations. 78 government secondary school of district were classified into two strata. School in rural location and the school in urban location. Then three from each stratum were selected randomly. From each school 5 boys and 5 girls were selected randomly. After this process 60 students were identified and were included in the sample. Using diagnostic

text on introduction of fraction, addition of fraction, subtraction, multiplication and division of fraction.

The main findings were students generally commit more error in addition of fractions than in introduction of fraction, the mean error in multiplication of fraction is higher that introduction of fraction and errors are higher in division of fractions then introduction of fractions. There is no effect of sex to commit the error in areas of operation of fraction considered in this study.

Kafle (2006) studied on "Error analysis of proof of the theorem in geometry in grade X" for his thesis in Master's degree. The main objectives of this study were, to identify the errors, to classify the errors on the basis of recognized theory and to indicate possible causes of errors. The main findings of this study were, one fourth of the total errors were concerned on reading and comprehension skills together and students don't have sufficient experiences at prerequisites at lower levels to encounter formal study of geometry at secondary level

Bhatt (2009) studied on "A study on the error analysis on the problem solving of area of triangles and quadrilaterals". The main objectives of the study were, identify the errors committed by students in solving problem of area of triangles and quadrilaterals, compare the error committed by students in knowledge, skill and application and problem solving area of triangles and quadrilaterals and find the course of error committed by students in solving problem of area of triangles and quadrilateral.

On the basis of this study the researcher concludes that poor performance of students in the topic "Area of Triangles and Quadrilaterals" in different areas such as knowledge, skill and application and problems solving due to weak academic foundation of students, poor assessment system and promotion practices, heavily content driven curriculum, huge class size, lack of remedial teaching, inadequate teaching, poor learning of students as well as poor conception of geometrical knowledge, structure, inappropriate use of new technology and teaching aids in geometry.

The foregone review of related literature showed that the researchers are actually not grasping the Newman error analysis procedure. These researchers are

seems to be deviated toward comparative studies like gender wise comparison, region wise comparison, institute wise comparison (private and public). After studying these studies the researcher has tried his best to conduct this research strictly according to the objectives to the study and hopes to meet the objectives as far as possible.

Theoretical Framework

The following theoretical frameworks are helpful to analyze the error committed by pupils

Newman Error

The Australian educator M. Anne Newman (1977) also an Australian language educationist, developed a systematic procedure for analyzing errors in mid 1970s by students responding to write mathematical tasks. The finding of these studies has been sufficiently different from those, produced by other error analysis procedures, to attract considerable attention from both the international body of mathematics education researches and teachers of mathematics. Newman (1983) recommended the following ways to classify student's errors mathematical tasks. They are as follows:

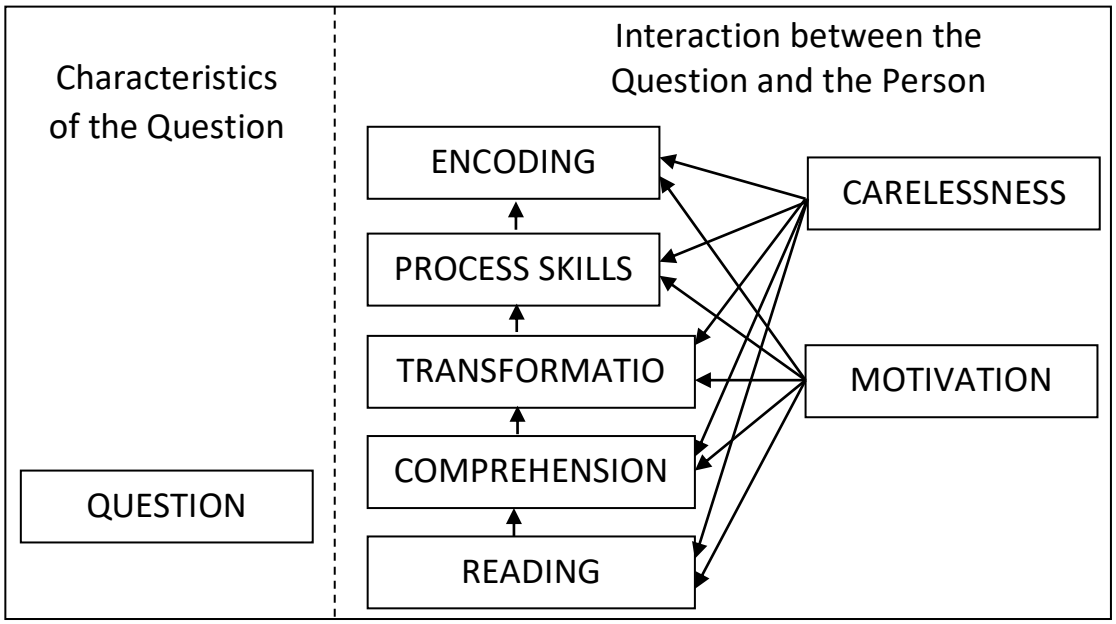


Figure 1: The Newman Hierarchy of error causes (from Clements,

According to Newman (1977, 1983), a person wishing to obtain a correct solution to a one-step world problem such as “The marked price of a book was $20. However, at a sale, 20% discount was given. How much discount was this?” must ultimately proceed according to the following hierarchy:

Read the problem; comprehend what is read; carry out a mental transformation from the words of the question to the selection of an appropriate mathematical strategy; apply the process skill demanded by the selected strategy; and encode the answer in an acceptable written form.

Newman used the word “hierarchy” because she reasoned that failure at any level of the above sequence prevents solvers from obtaining satisfactory solutions (unless by chance they arrive at correct solutions by faulty reasoning).

Clements (1980) illustrated the Newman technique with a diagram. According to Clements (1989, p4) errors due to the form of the question are essentially different from those in the other categories because the source of difficulty resides fundamentally in the question itself rather than in the interaction between the problem solver and the question. This distinction is represented in the figure by the category labeled "question form" being placed besides the five step hierarchy. Two other categories "carelessness" and "motivation" are also been shown as separate from the hierarchy because, as indicated, such errors can occur at any stage of the problem solving process. A careless error, for example, could be a reading error a comprehension error and so on. Similarly, who have read, comprehended and worked out an appropriate strategy for solving problem might decline to proceed further in the hierarchy because of lack of motivation. For example, a problem solver might exclaim; "what a trivial problem I can't be bothered doing it."

Chapter III

METHODS AND PROCEDURES

This chapter describes the detail of the procedure used in the study to analyze the errors committed by the students. In this part design of the study, population and sample of the study, tools, data collections procedures and data analysis procedure.

Design of the Study

This research was survey in nature. This study was based on descriptive research design. It was descriptive because it aims to describe the events or situation addressing the present activities of students. The researcher had used Newman techniques as the theoretical base of the study and on the basis of them, result were analyzed.

Population of the Study

Population of the study was focused to all the secondary students studying in grade X of Dhading district. The financial and time constraints under which the researcher worked, it was not possible him to select sample from each school of such large scattered population. Hence, the scope to this study was deliberately limited to the one private and two government schools inside Naubise, Thakre and Jeevanpur VDC of Dhading district.

Sample of the Study

From the population of only three schools of Dhading inside three VDC were selected for this study. Stratified random sampling method was used to select these schools. The aim of taking a sample was that the researcher himself lives in this local area and he could contribute more and more time for the study. The data for analysis of error committed by students was collected from students of grade X of these schools. One hundred twenty-eight students (64 boys and 64 girls) were taken for the written tests.

Tools of the Study

To analyze the errors committed by the students the researcher has developed a test item. The test item (questionnaire) included eight questions were taken out from grade X Mathematics text book. All the questions were selected from simultaneous linear equations and were in the form of word (verbal) problem.

Written Test

To analyze the error committed by the students, the researcher developed a test item. All questions included in test was prepared by researcher himself. Questions (Appendix D) were given for written test.

To test the reliability of the questions, test-retest method was used. Researcher divided all students in two groups (boys and girls) then questions were distributed for written test. Same questions were given for second test after 50 minutes of first test completion and both answer sheets were checked and identified errors. Finally, correlation coefficient of both group test were calculated using following formula

$$r = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{N\sum X^2 - (\sum X)^2}\sqrt{N\sum Y^2 - (\sum Y)^2}}$$

Where correlation coefficient r = 0.82 (high positive correlation)

Hence all the prepared questions were reliable for further test.

To test the validity of the questions, as the requirements of objective of research appropriate tools were selected where written test and interview guideline were taken to fulfill the purpose of the study.

Interview Guideline

Researcher also used the interview schedule for students to identify the causes of committed errors. Questions (Appendix C) were asked in interview. There were two types of incorrect responses; wrongly attempted and not attempted at all. The students with these two types of error were interviewed to determine whether there is "carelessness error" or "motivation error". If the carelessness and motivation error were not found. The errors were included in the respective type of error. If an

incorrect response is given to a question, then the error was classified according to where the first break down occurred in the attempt to get a solution.

Data Collection Procedures

After making the tools ready, the researcher visited each of the selected secondary school. At first, researcher described the purpose of test to the principal and grade X students of respective schools. All the students were taken for written test. All the test items included in the test paper was prepared by researcher himself as per objective of the research and the item were selected from simultaneous equations. After taking paper-pencil test, researcher checked the test paper in which the first mistake was taken as error and the errors following were neglected. Fifty students were interviewed by using Newman question for further result.

Data Analysis Procedure

After the written test had been administered the incorrect items (answers) were identified and analyzed to determine the types of error committed by the students where Newman error analysis techniques were used as theoretical base. Similarly, Clements techniques of error analysis were used as an interview guideline.

Chapter IV

ANALYSIS OF DATA AND INTERPRETATION OF RESULT

This is a survey research. Which is related to find the errors of study in solving simultaneous equations. The objectives of the study were to identify the errors committed by students, to analyze the errors committed by students in solving problems and to analyze the result with respect to gender. This study was based on descriptive research design because its aim was to describe the events or situation addressing the present activities of students. The researcher had used Newman technique of error analysis as the theoretical base of the study and on the basis of them result was analyzed.

To fulfill the requirements of the study, the researcher had used written test and interview guideline as a tool of the study. All the secondary level students in grade X of Dhading district was focused as population of the study. Three schools in Jeewanpur, Thakre and Naubise VDCs in Dhading were selected as the sample of the study.

After making the tools ready, the researcher visited each of the selected secondary school. All the students of class X were taken for written test. All the test items included in the test paper was prepared by researcher himself as per objective of the research and the items were selected from simultaneous equations. After taking paper-pencil test, researcher checked the test paper in which the first mistake was taken as error and the errors following were neglected. To analyze the collected data, Newman’s and Clement 'technique of error analysis were used as theoretical base.

The following table shows the distribution of errors on the basis of test items

Table: 4.1

Distribution of Errors on the Basis of Test Items

No.	Test Items	No. of Errors			Percent		
		Boys	Girls	Total	Boys	Girls	Total
1	A two digit number is 3 times the sum of its digits. The sum of the number formed by reversing its digits and 9 is equal to 3 times the original number. Find that number.	34	48	82	13.5	13.2	13.4
2	The sum of the ages of the father and son is 44 years. After 8 years, the age of the father will be twice as old as the age of the son. Find their present ages.	32	48	80	12.7	13.2	13
3	The ages of two girls are in the ration of 2:3. 6 years hence the ration of their ages will be 11:15. Find their present ages.	27	42	69	10.7	11.6	11.3
4	Three years ago, the sum of the ages of the father and his son was 54 years. 3 years later the father's age will be double of the son's age after 9 years. Find the present ages of the father and son.	51	50	101	20.3	13.8	16.5
5	The present ages of a father and his son are 40 years and 8 years respectively. How many years ago, the product of their ages was 105? Find it.	23	52	75	9.2	14.4	12.2
6	A number consists of two digits. The sum of its digits is 16. If 18 is subtracted from the number, the digits interchange their places. Find the number.	25	46	71	10	12.7	11.6
7	5 years ago a man's age was 5 times the age of his daughter's. 3 years hence, twice his age will be equal to 6 times his daughter's age. What are their present ages?	41	41	82	16.3	11.3	13.4
8	If 3 is added to the numerator of a fraction, the value of the fraction becomes 1. When 3 is added to the denominator of the fraction, the value of the fraction becomes 1/4. What is the value of the fraction? Find it.	18	35	53	7.2	9.7	8.6
Total		251	362	613	100	100	100

Table 4.1 shows that only 13.4 % of the total errors were concentrated in the first problem which was about the operation on two digit numbers. In this test item girls committed less error (13.2%) than boys (13.5%). In this problem, students committed less error in comparison of other test items. Second test item was about ages of father and son in which 13% of the errors concentrated. Boys committed 12.7% errors where girls committed 13.2% errors in this problem. Test item third was taken from girl's ages in ratio. In this problem, 11.3% of the total errors occurred. Boys and girls committed 10.7% and 11.6% errors respectively. Forth test item was about ages of father and son. In this problem, boys committed 20.3% and girls committed 13.8% of the total errors in aggregate of 16.5% error. Fifth test item was also related to father and son's ages. In this problem boys committed 9.2% error where girls committed 14.4% error. The average error was 12.2%. Sixth test item was related to two digit number. Here boys and girls committed 10% and 12.7% errors respectively and average error was 11.6%. Seventh test item was related to ages of a man and his daughter. In this problem, students committed 13.4% error where boys committed 16.3% errors and girls committed 11.3% errors. Test item eight was related to fraction. Comparatively less error errors were concentrated in this problem. Boys committed 7.2% and girls 9.7% errors in this problem. 8.6% of the total errors were concentrated in this problem.

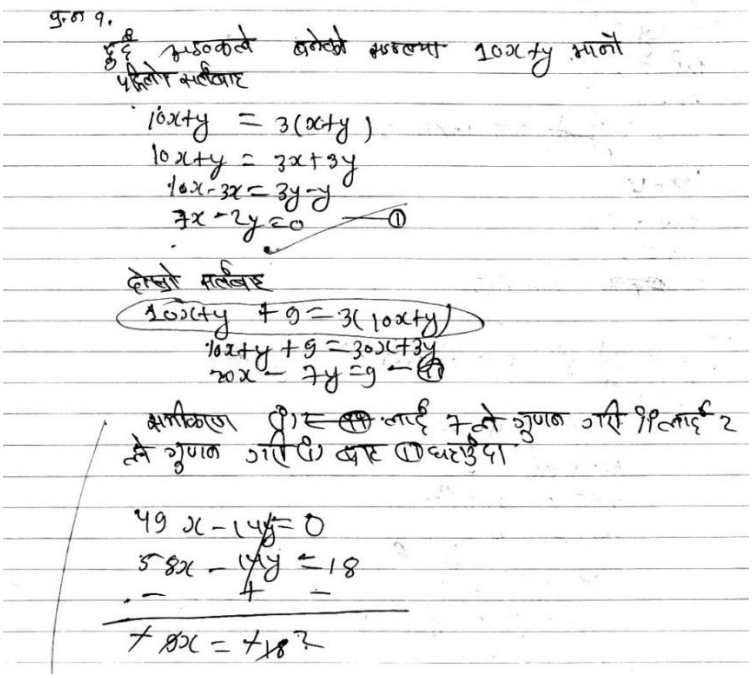
Analysis of First Test Item

When the researcher asked the question as, "A two digit number is 3 times the sum of its digits. The sum of the number formed by reversing its digits and 9 is equal to 3 times the original number. Find that number".

There were altogether eighty two errors in this test item. Out of these thirty four errors were committed by boys and forty eight errors were committed by girls. When this question was asked to read, three boys and one girl couldn't read the problem. The only one word that caused the problem was "reversing".

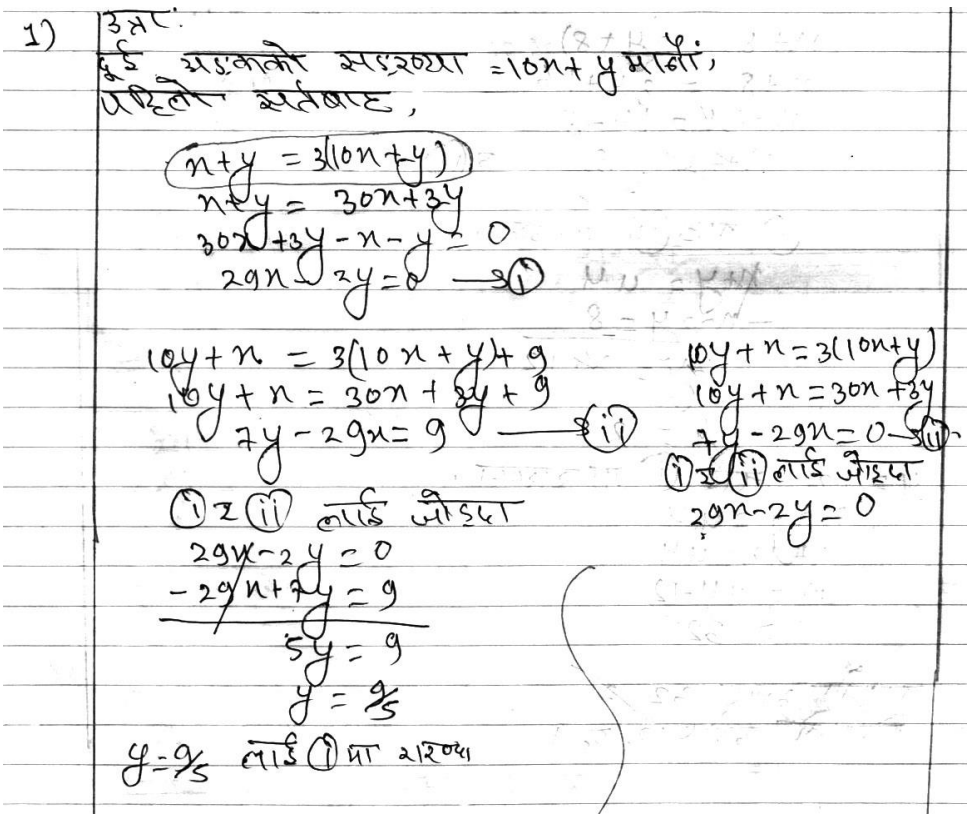
These students did not make the appropriate mathematical expression and solved as:

One of the boy of Bhuwaneshwori, solved like this:



For the solution of first question he understood the question but could not express the verbal problems into mathematical expression. So, it is taken as transformation error.

One of the girl of Bhuwaneshwori, solved like this:



In the solution of second question, she also made a mistake in transforming verbal problems into mathematical form, so it is also taken as transformation error.

The following table shows the distribution of errors of First Test Item.

Table 4.2

Distribution of Errors of First Test Item

S.No.	Types of Error	No. of Errors			Percentage		
		Boys	Girls	Total	Boys	Girls	Total
1	Reading Errors	3	1	4	8.8	2.1	4.9
2	Comprehension Errors	4	6	10	11.8	12.5	12.2
3	Transformation Errors	12	15	27	35.3	31.2	32.9
4	Process Skill Errors	3	7	10	8.8	14.6	12.2
5	Encoding Errors	2	12	14	5.9	25	17.1
6	Motivation Errors	3	4	7	8.8	8.3	8.5
7	Carelessness Errors	7	3	10	20.6	6.3	12.2
Total		34	48	82	100	100	100

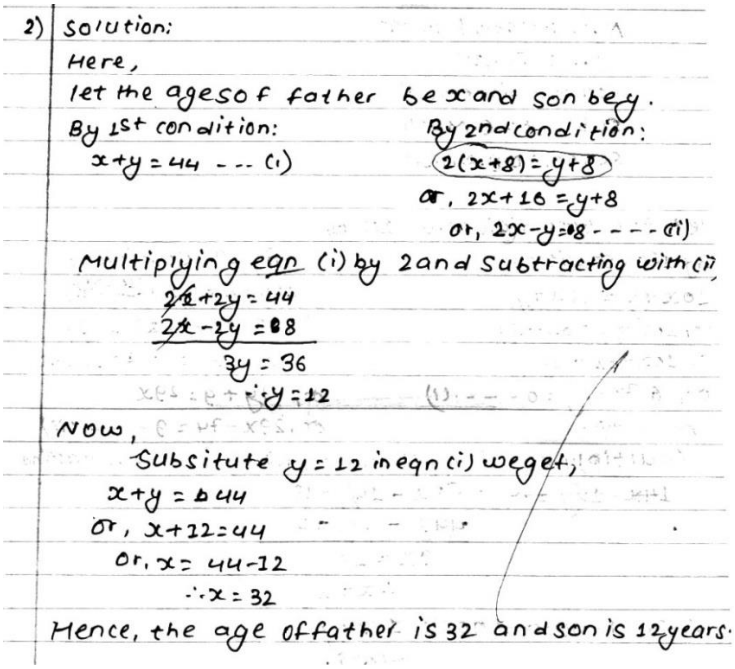
Table 4.2 show that, there was 4.9% reading error. Ten students read the problem, but couldn't understand what is given and what is to find from this problem. There were fourteen (17.1%) encoding errors which were committed by boys and girls. Similarly, there were twenty seven students (32.9%) who could not make the appropriate mathematical expression. Out of these twenty seven errors, twelve errors were committed by boys and fifteen errors were committed by girls.

Analysis of Second Test Item

When the researcher asked the question as, "The sum of the ages of the father and son is 44 years. After 8 years, the age of the father will be twice as old as the age of the son. Find their present ages".

There were eighty one errors in this test item. Thirty three errors were committed by boys and forty eight errors were committed by girls. Most of the errors (30.8%) were concentrated in encoding step.When asked to read the problem, six girls and five boys couldn't read the question properly. But they corrected themselves when interviewed. When askedto solve the problem, they themselves did it as:-

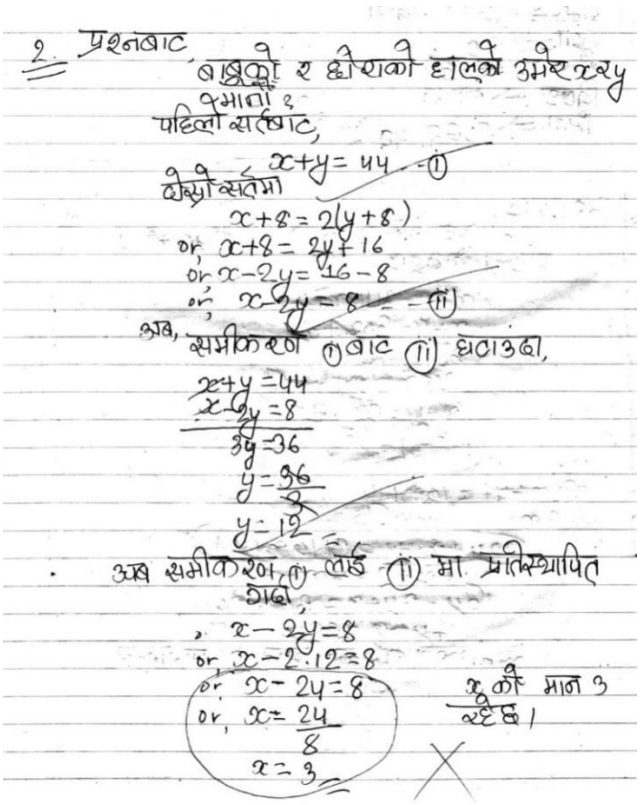
One of the boy of Dhunibeshi, solved like this:



2) Solution:
Here,
let the ages of father be x and son be y.
By 1st condition:
$x+y=44$ --- (i)
By 2nd condition:
$2(x+8)=y+8$
or, $2x+16=y+8$
or, $2x-y=-8$ --- (ii)
Multiplying eqn (i) by 2 and subtracting with (ii)
$2x+2y=44$
$2x-y=-8$
$3y=36$
$\therefore y=12$
Now,
Subsitute $y=12$ in eqn (i) we get,
$x+y=44$
or, $x+12=44$
or, $x=44-12$
$\therefore x=32$
Hence, the age of father is 32 and son is 12 years.

For the solution of second question, he could not grasp over all information from the question. So, it is taken as comprehension error.

One of the girl of Mahankaleswori, solved like this:



2. प्रश्नबाट
बाबुको र छोराको हालको उमेर x र y मानौं ।
पहिलो सर्तबाट,
$x+y=44$ --- (i)
दोस्रो सर्तमा
$x+8=2(y+8)$
or, $x+8=2y+16$
or, $x-2y=16-8$
or, $x-2y=8$ --- (ii)
अब, समीकरण (i) बाट (ii) घटाउदा,
$x+y=44$
$x-2y=8$
$3y=36$
$y=\frac{36}{3}$
$y=12$
अब समीकरण (i) लाई (ii) मा प्रतिस्थापित गर्दा,
$x-2y=8$
or, $x-2\cdot12=8$
or, $x-24=8$
or, $x=\frac{24}{8}$
$x=3$
x को मान 3 हुँदा ।

In above solution, she was able to identify the operation but did not know the procedure to carry out this operation correctly. So, it is taken as process skill error.

The following table shows the distribution of errors of second test item

Table: 4.3

Distribution of Errors of Second Test Item

S.No.	Types of Error	No. of Errors			Percentage		
		Boys	Girls	Total	Boys	Girls	Total
1	Reading Errors	5	6	11	15.2	12.5	13.5
2	Comprehension Errors	5	3	8	15.2	6.3	9.9
3	Transformation Errors	8	7	15	24.2	14.6	18.5
4	Process Skill Errors	4	4	8	12.1	8.3	9.9
5	Encoding Errors	7	18	25	21.2	37.5	30.8
6	Motivation Errors	0	4	4	0	8.3	4.9
7	Carelessness Errors	4	6	10	12.1	12.5	12.3
Total		33	48	81	100	100	100

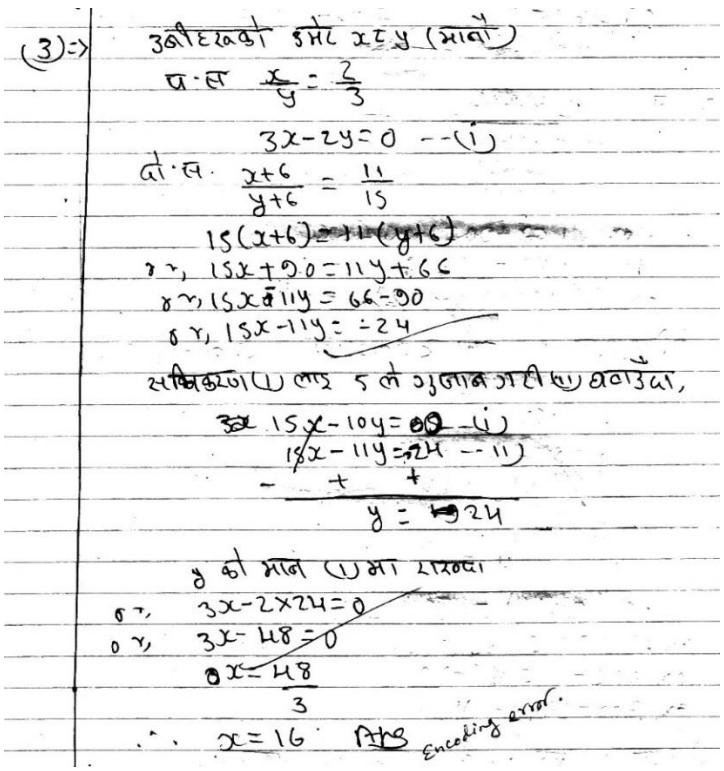
Table 4.3 shows that, there was eleven (13.5%) reading error. (9.9%) comprehension errors of which five were committed by boys and three errors were committed by girls. They could not understand what is to find, they were confused. Similarly, there were fifteen (18.5%) transformation errors, eight (9.9%) process skill errors. Four motivation errors of girls also found. Ten carelessness error found whereas four committed by boys and six by girls.

From this table it is found that most of the students are confused where to multiply by 2 with age of father or son because ‘age of father will be twice as old as the age of son’ was given in question. So they confused to transform question in mathematical expression.

Analysis of Third Test Item

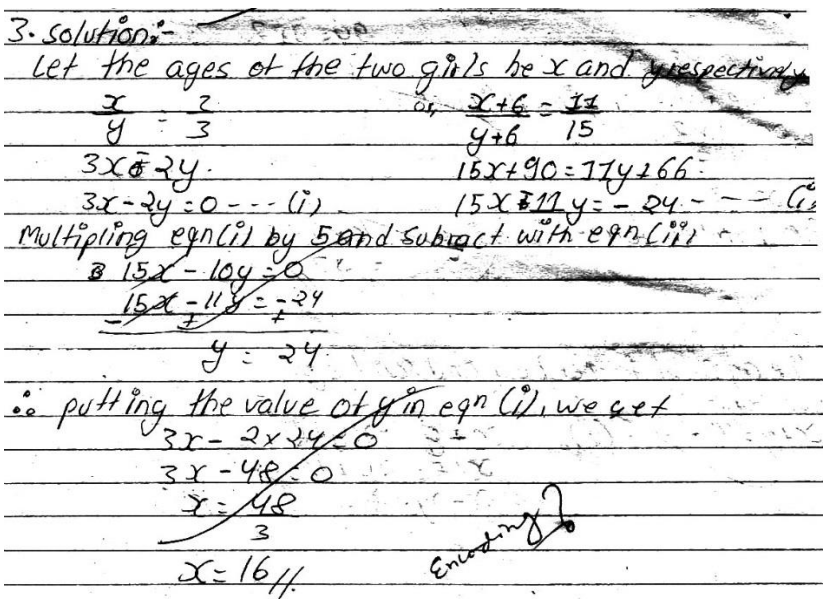
When the researcher asked the question as, "The ages of two girls are in the ration of 2:3. 6 years hence the ration of their ages will be 11:15. Find their present ages".

Some examples of encoding error are illustrated here:
One of the girl of Mahankaleswori, solved like this:



For the solution of third question, she worked out the solution to the problems but did not express the answer acceptable written form. So, it is taken as encoding error.

One of the boy of Dhunibesi, solved like this:



He also did same mistake, worked out the solution to the problems but did not express the solution in acceptable written form. So, it is taken as encoding error.

The following table shows the distribution of error of third test item.

Table: 4.4

Distribution of Errors of Third Test Item

S.No.	Types of Error	No. of Errors			Percentage		
		Boys	Girls	Total	Boys	Girls	Total
1	Reading Errors	0	1	1	0	2.4	1.4
2	Comprehension Errors	0	0	0	0	0	0
3	Transformation Errors	6	3	9	22.2	7.1	13
4	Process Skill Errors	4	17	21	14.8	40.5	30.4
5	Encoding Errors	9	16	25	33.3	38	36.2
6	Motivation Errors	3	3	6	11.1	7.1	8.7
7	Carelessness Errors	5	2	7	18.5	4.8	10.1
Total		27	42	69	100	100	100

Table 4.4 show that, sixty nine errors were concentrated in this test item. Twenty seven errors were committed by boys and forty two errors were committed by girls. Only one error (1.4%) was reading error, whereas maximum errors were concentrated in encoding error. There were twenty five errors (36.2%) in the encoding step of error analysis hierarchy.

When asked to read the problem, one girl could not read the ration 11:15. She read it as eleven fifteen. Nine (13%) students could not make the mathematical expression. Twenty five errors (36.2%) were encoding error. Similarly six (8.7%) were concentrated in motivation errors and seven (10.1%) carelessness errors. Maximum errors were encoding error. Twenty five (36.2%) errors were concentrated in this step. Students could not complete operation accurately.

From this table it can be concluded that; on solving verbal problems in Simultaneous Equation most of the errors occurred in encoding step. Therefore to solve such problems this step must be considered as vital step and students and teachers must focus on this step.

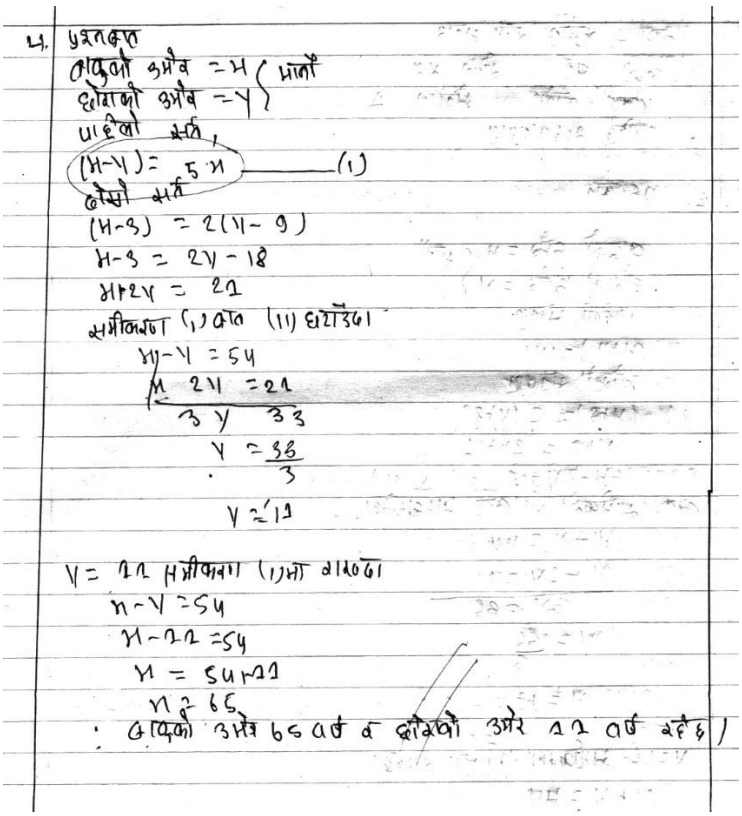
Analysis of Fourth Test Item

When researcher asked the question as, "Three years ago, the sum of the ages of the father and his son was 54 years. 3 years later the father’s age will be double of the son’s age after 9 years. Find the present ages of the father and son".

One hundred one errors were concentrated in this test item. Out of these errors fifty one errors were committed by boys and fifty errors were committed by girls.

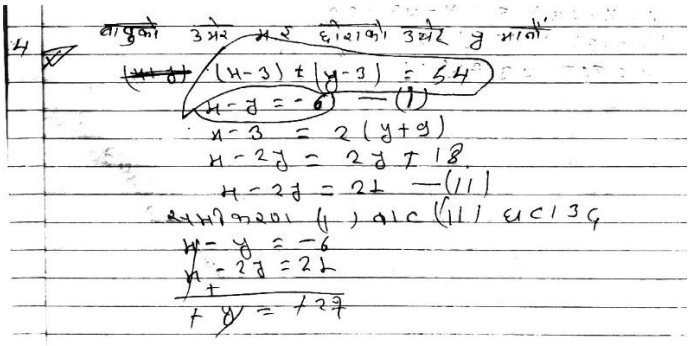
Some examples of this type of errors are illustrate here:

One of the boy of Mahankaleswori, solved like this:



For the solution of fourth problem, he couldn't grasp the overall meaning of the words and therefore could not proceed correctly. So, it is taken as comprehension error.

One of the girl of Bhuwaneshwori, solved like this:



In this problem, she understood what the question was asking about but could not transform sentences into mathematical form. So, it is taken as transformation error.

The following table shows the distribution of errors of forth test item

Table 4.5

Distribution of Errors of Forth Test Item

S.No.	Types of Error	No. of Errors			Percentage		
		Boys	Girls	Total	Boys	Girls	Total
1	Reading Errors	3	2	5	5.9	4	4.9
2	Comprehension Errors	3	2	5	5.9	4	4.9
3	Transformation Errors	26	12	38	50.9	24	37.6
4	Process Skill Errors	12	15	27	23.5	30	26.7
5	Encoding Errors	3	12	15	5.9	24	14.8
6	Motivation Errors	1	1	2	1.9	2	1.9
7	Carelessness Errors	3	6	9	5.9	12	8.9
Total		51	50	101	100	100	100

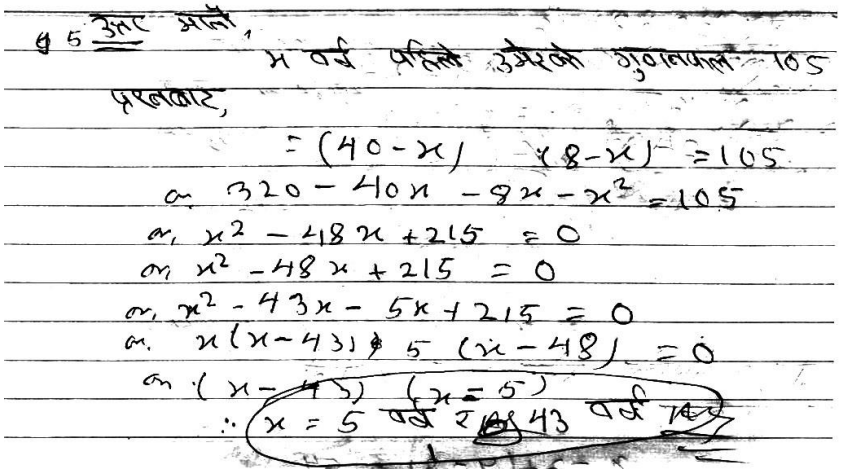
Only five errors (4.9%) was reading error. Similarly, five (4.9%) errors were comprehension errors, thirty eight (37.6%) were transformation errors, twenty seven (26.7%) process skill errors and nine (8.9%) carelessness errors.

This table shows that 37.6% errors are concentrated in transformation and 26.7% errors are concentrated in process skill errors. Therefore, these step must be kept in mind by the students and teachers on solving verbal problems of simultaneous equation.

Analysis of Fifth Test Item

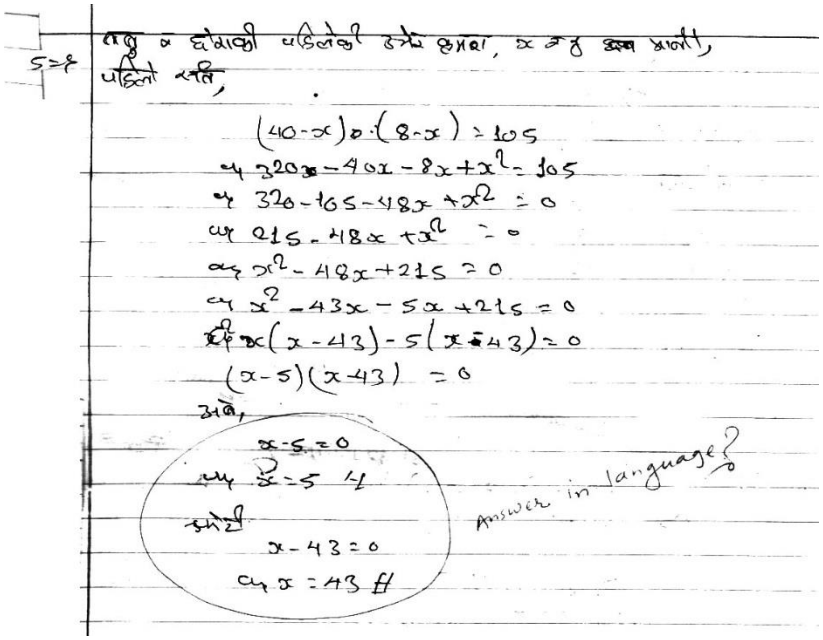
When the researcher asked the question as, "The present ages of a father and his son are 40 years and 8 years respectively. How many years ago, the product of their ages was 105? Find it."

One of the girl of Bhuwaneshwori, solved like this:



For the solution of fifth problem, she correctly worked out the solution o the problems but did not express the answer in acceptable written form. So, it is taken as encoding error.

One of the boy of Mahankaleswori, solved like this:



For the solution of fifth problem he correctly worked out the solution to the problems but did not express the answer in acceptable written form. So, it is taken as encoding error.

The following table shows the distribution of fifth test item

Table 4.6

Distribution of Errors of Fifth Test Item

S.No.	Types of Error	No. of Errors			Percentage		
		Boys	Girls	Total	Boys	Girls	Total
1	Reading Errors	1	1	2	4.3	1.9	2.7
2	Comprehension Errors	4	3	7	17.4	5.7	9.3
3	Transformation Errors	5	19	24	21.7	36.5	32
4	Process Skill Errors	3	6	9	13	11.5	12
5	Encoding Errors	8	19	27	34.8	36.5	36
6	Motivation Errors	1	1	2	4.3	1.9	2.7
7	Carelessness Errors	1	3	4	4.3	5.7	5.3
Total		23	52	75	100	100	100

Table 4.6 shows that, seventy five errors were counted in this test item. Boys and girls committed twenty three and fifty two errors respectively. Almost all students when asked to read the question, they did it, but maximum number of students felt difficulty in understanding the concept of time that should be increased or decreased from present time with ago and after.

There were two (2.7%) reading errors. Seven students (9.3%) couldn't comprehend the question. Twenty four (32%) students did transformation error. Nine students (12%) committed errors in process skill which were committed by three boys and six girls. The maximum errors committed by students is encoding error. Twenty seven (36%) students committed encoding error which were committed by eight boys and nineteen girls. Only two students committed motivation errors and four (5.3%) students committed carelessness errors.

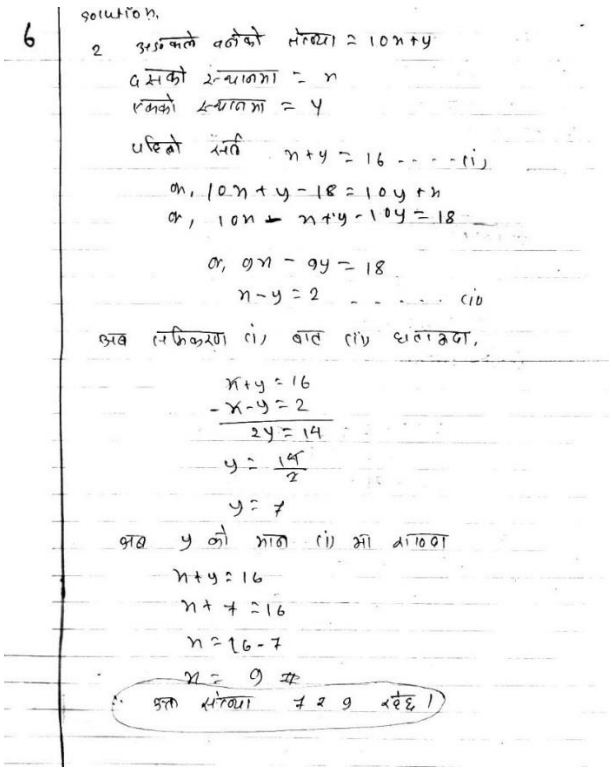
This table shows that there are about 68% transformation and encoding errors. On solving verbal problems of simultaneous equations. Students tried to transform the problem into mathematical form but were unable to transform. So the teachers must focus on this step in teaching verbal problems and way of transforming verbal problems into mathematical form.

Analysis of Sixth Test Item

When researcher asked the question as, "A number consists of two digits. The sum of its digits is 16. If 18 is subtracted from the number, the digits interchange their places. Find the number".

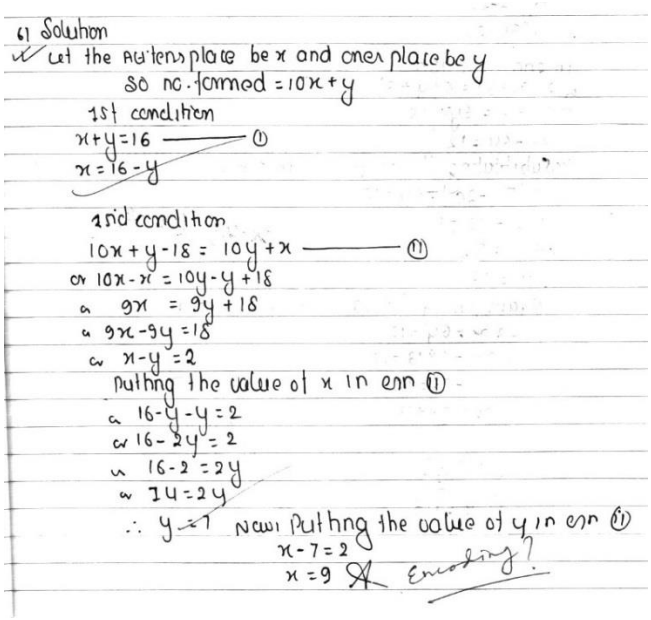
This problem was related to two digits number. They were quite interested to solve this problem. Total eighty eight errors were counted in this test item. Maximum number of errors was encoding errors. Five students, two boys and three girls, felt difficulty in reading. The word which caused the problem was “consists”. They did not understand the meaning of this word and couldn’t pronunciate this word accurately. Five (5.7%) students knew what’s to find but they did not know what is given. Therefore, these errors were counted as comprehension error. Some examples are given here:

One of the boy of Mahankaleswori, solved like this:



For the solution of sixth problem, he also did similar mistake, correctly worked out the solution to the problem but did not express the answer in acceptable written form. So, it is taken as encoding error.

One of the girl of Dhunibeshi, solved like this:



She also did similar type of mistake, correctly worked out the solution to the problems but did not express the answer in acceptable written form, she just calculated values of x and y not required number. So, it is taken as encoding error.

The following table shows the distribution of errors of sixth test item

Table 4.7

Distribution of Errors of Sixth Test Item

S.No.	Types of Error	No. of Errors			Percentage		
		Boys	Girls	Total	Boys	Girls	Total
1	Reading Errors	2	3	5	5.7	5.7	5.7
2	Comprehension Errors	2	3	5	5.7	5.7	5.7
3	Transformation Errors	7	18	25	20	33.9	28.4
4	Process Skill Errors	2	6	8	5.7	11.3	9
5	Encoding Errors	14	17	31	40	32	35.2
6	Motivation Errors	0	2	2	0	3.8	2.3
7	Carelessness Errors	8	4	12	22.8	7.5	13.6
Total		35	53	88	100	100	100

Table 4.7 shows that, twenty five students (28.4%) who read and comprehended the problem were failed to make accurate expression and eight students (9%) could not proceed the solution accurately.

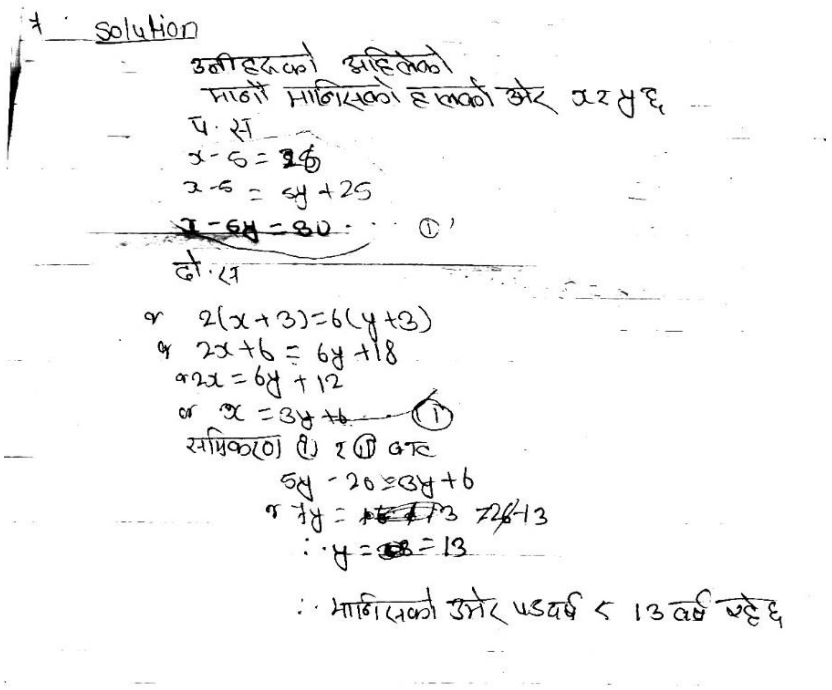
This table again shows most troublesome steps on solving verbal problem are transformation and encoding type. Students who are willing to solve such problems must be careful in the key words. They must try to transform the problem in their own language but never try to attach their own fuzzy thinking.

Analysis of Seventh Test Item

When the researcher asked the question as, "5 years ago a man's age was 5 times the age of his daughter's. 3 years hence, twice his age will be equal to 6 times his daughter's age. What are their present ages?"

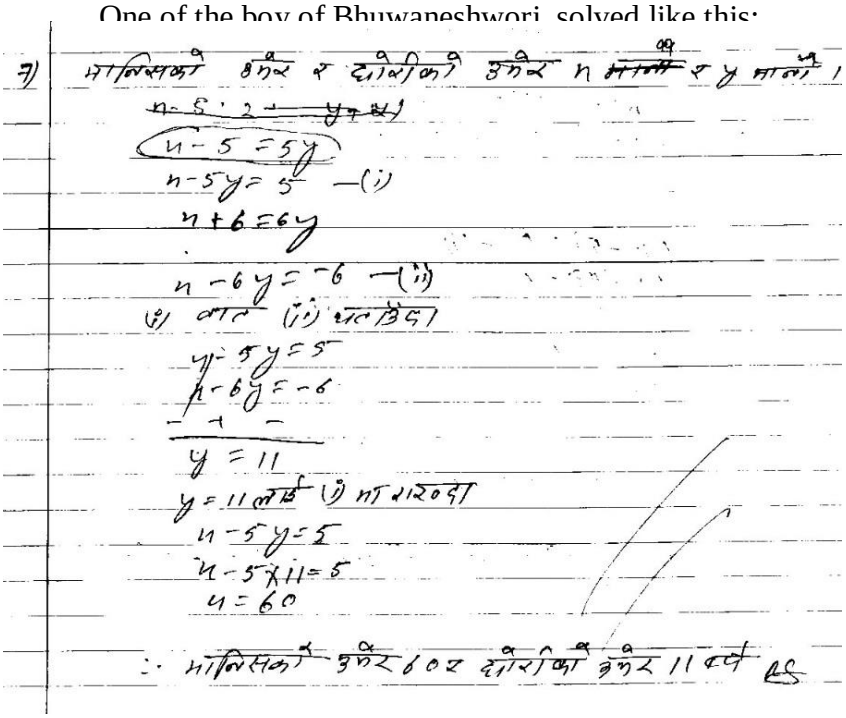
This test item was related to the age of a man and his daughter. Here nearly equal numbers of errors were committed by boys and girls. Eighty one errors were counted in this test item. Boys committed forty one errors whereas girls committed forty errors. Only three boys couldn't read the question. There was no reading error for girls in this test item. Some of the students, without making appropriate expression, tried to solve the problem and committed errors as follows:

One of the girl of Mahankaleswori, solved like this:



For the solutionof seventh problem she identified the operation but did not proceed to carry out this operation correctly. So, it is taken as process skill error.

One of the boy of Bhuwaneshwori solved like this:



In this problem, he understood the problem what the question was asking but could not transform the sentence into mathematical form. So, it is taken as transformation error.

The following table shows the distribution of errors of seventh test item

Table 4.8

Distribution of Errors of Seventh Test Item

S.No.	Types of Error	No. of Errors			Percentage		
		Boys	Girls	Total	Boys	Girls	Total
1	Reading Errors	3	0	3	7.3	0	3.7
2	Comprehension Errors	3	3	6	7.3	7.5	7.4
3	Transformation Errors	9	4	13	21.9	10	16
4	Process Skill Errors	18	17	35	43.9	42.5	43.2
5	Encoding Errors	4	11	15	9.7	27.5	18.5
6	Motivation Errors	0	0	0	0	0	0
7	Carelessness Errors	4	5	9	9.7	12.5	11.1
Total		41	40	81	100	100	100

Table 4.8 shows that, thirteen students (16%) couldn't transform the question into mathematical form. Many to them were successful as well. But nine (11.1%) students made mistake due to carelessness where four boys and five girls were found unwilling to solve the problem.

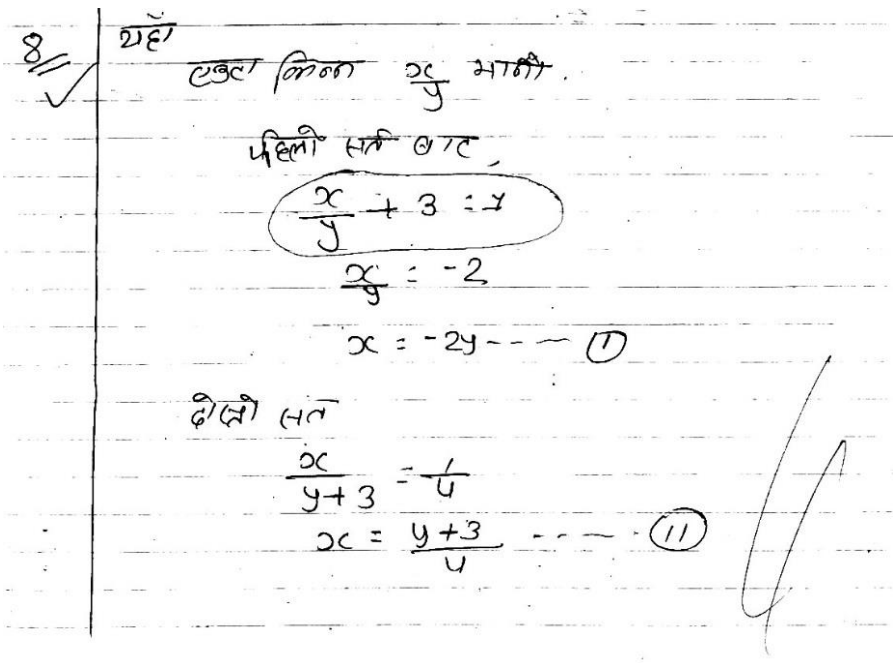
This table shows that students trying to solve verbal problem of simultaneous equation understand the problem easily but could not find out an appropriate mental solution and become failed to proceed further. Motivation errors and carelessness error found in this problem were seen due to anxiety of students toward the problem.

Analysis of Eighth Test Item

When the researcher asked the problem as "If 3 is added to the numerator of a fraction, the value of the fraction becomes 1. When 3 is added to the denominator of the fraction, the value of the fraction becomes 1/4. What is the value of the fraction? Find it".

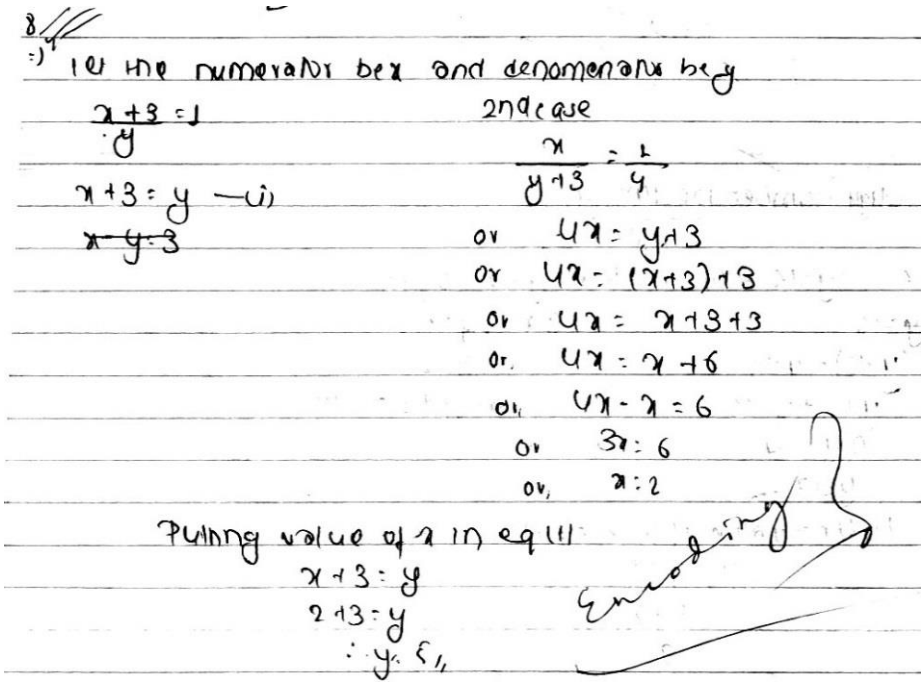
There were fifty three errors in this test item which were mostly related to process skill and encoding error type. Some comprehension and encoding errors committed by the students are given below:

One of the boy of Mahankaleswori, solved like this:



For the solution of eighth problem, he was unable to grasp overleaping of question. So, could not select appropriate procedure to carry out correct solution. So, it is taken as comprehension error.

One of the girl of Dhunibeshi, solved like this:



In this solution she correctly carried out the solution to the problem but could not express the answer into acceptable written form. So, it is taken as encoding error.

The following table shows the distribution of errors of eighth test item

Table 4.9

Distribution of Errors of Eighth Test Item

S.No.	Types of Error	No. of Errors			Percentage		
		Boys	Girls	Total	Boys	Girls	Total
1	Reading Errors	2	2	4	11.1	5.7	7.5
2	Comprehension Errors	1	4	5	5.5	11.4	9.4
3	Transformation Errors	5	1	6	27.8	2.8	11.3
4	Process Skill Errors	3	13	16	16.7	37.1	30.2
5	Encoding Errors	1	11	12	5.5	31.4	22.6
6	Motivation Errors	3	1	4	16.7	2.8	7.5
7	Carelessness Errors	3	3	6	16.7	8.6	11.3
Total		18	35	53	100	100	100

Table 4.9 shows that, there were sixteen (30.2%) process skill errors and twelve (22.6%) encoding errors. Those students who read the problem couldn't grasp the aggregate meaning of the question. Six (11.3%) transformation errors, four (7.5%) motivation and six (11.3%) carelessness errors were also found in this test item.

This table shows that more errors are concentrated in process skill and encoding steps. If the students become failed in these steps, they obviously failed the

further steps of solution. This is the reason for less percentage of errors in the higher steps of error analysis hierarchy.

Table: 4.10

Distribution of Errors on the Basis on Newman's Five (Plus Two) Error Hierarchy

S. No	Types of Error	No. of errors			Percentage		
		Boys	Girls	Total	Boys	Girls	Total
1	Reading Errors	16	16	32	6.4	4.4	5.2
2	Comprehension Errors	20	24	44	7.9	6.6	7.2
3	Transformation Errors	76	79	155	30.3	21.8	25.3
4	Process Skill Errors	49	82	131	19.5	22.6	21.4
5	Encoding Errors	48	113	161	19.1	31.2	26.3
6	Motivation Errors	9	16	25	3.6	4.4	4.1
7	Carelessness Errors	33	32	65	13.1	8.8	10.6
Total		251	362	613	100	100	100

This table also shows that there are altogether 613 errors of which 251 errors were committed by boys and 362 errors were committed by girls. It is concluded from this table that there is significant difference in the number of errors committed by the boys and girls.

The following table shows the distribution of errors on the basis of Newman's five (plus two) error hierarchy.

Table 4.10 shows the errors in seven categories along with total number of errors and their percentage. This table shows all the 613 errors in different categories.

Table 4.10 shows that lowest percentage of errors was concentrated in motivation error whereas highest percentage of errors was concentrated on encoding error. This indicates that students of grade X commit less error due to motivation. They always try to solve the problem but they didn't encode answer in acceptable written form.

There were 5.2% reading error. This error was found due to poor background in language. 7.2% errors were comprehension error and 25.3% errors were transformation error. This indicated that most of the students can't transform the verbal problems into mathematical expression. These two levels of error were found most troublesome steps in solving verbal problem. There was 21.4% process skill error. This shows that less percentage of error is concentrated in process skills error in

solving verbal problem of simultaneous equation. Similarly, 26.3% encoding errors, 4.1% motivation errors, 10.6% carelessness errors were found in the study. This table also shows the comparison of number of errors and their percentage between in errors committed by boys and girls.

Causes of Error

The researcher also found some learning problems of students due to which they commit errors.

- **Attach own meaning**

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

- **Incomplete of fuzzy thinking**

  Sometimes the students pay only partial attention to the teacher's explanation as a result of boredom, tiredness or monotonous tone of teacher. Consequently, they can recollect only part of explanation and then try to patch it up with their own logic, which may be faulty.

- **Mix-up the rules**

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

- **Salient teachers**

  In attempt to make things easy for the students some teachers give incomplete explanation by focusing on salient feature that illustrate only some of the features of the concept.

- **A conformist attitude**

  Since students are often trained to follow instruction meticulously, seldom supported by conceptual justification, they do not think of alternatives and uncomfortable with them.

- **Teacher talks and students listen**

  When teacher teaches, the students just listen the explanation and to not participate in the discussion. The teachers must involve the students in the teaching and learning process to do better in solving verbal problems. The teachers should give the orientation that provide sufficient guidance to solve the problem and should give the opportunity to do the problem students themselves.

Chapter V
SUMMARY, FINDINGS, AND CONCLUSION

This chapter deals with the result of the study "Error Analysis of Students on Solving Problems of Simultaneous Equations". This chapter is divided into four sections. Summary, findings, conclusion and the recommendations.

Summary

Simultaneous equation plays a vital role in an individual to solve daily life problems. Realizing its importance, Simultaneous Equation is included as an important component of Mathematics up to secondary level. But in the teaching experience of researcher, student feel more difficulty in doing Simultaneous Equation, especially in solving verbal problems, than any other topics of Mathematics. Keeping this in mind, the researcher decided to find out the types of error committed by the students on solving verbal problems on Simultaneous Equation so that some remedial solutions can be drawn to minimize the errors. For this purpose the researcher selected the students of the grade X.

The sample for the study consisted of one hundred twenty-eight students from three different schools of Dhading. The sample schools were Shree Mahankaleshwori Higher Secondary School, Thakre01, Shree Bhuwaneshori Secondary School, Jeewanpur and Dhunibeshi English Boarding Higher Secondary School, Naubise. These schools were selected for the convenience of the researcher. A test of eight verbal problems from grade X was administrated to all the 128 sample students. All the test items were related to Simultaneous Equation. The collection of data or the information was done in two phases. The first phase the data were collected from answer sheets and errors were identified. In second phase in-depth interviews with each students was done to conform the errors which were seen in the answer sheets. Newman technique of error analysis was adopted as the theoretical base of study.

The identified errors were classified into seven categories as described by Newman and Clements frequency of each type of error were tabulated, the seven categories of errors were reading error, comprehension error, transformation error, process skill error, encoding error, motivation error and carelessness error. An error was classified as reading error, if the student couldn't recognize the key word of the

written problem. An error was classified as comprehension error, if the student couldn't grasp the overall meaning of the verbal problem. An error was classified as transformation error, if the student couldn't transform the sentences into mathematical forms. An error was classified as process skill error, if the student could choose the appropriate operation but couldn't complete accurately. An error was classified as encoding error, if the student couldn't write down the answer in acceptable written form. An error was classified as motivation error, if the student did not want to respond the problem at any level of hierarchy. An error was classified as carelessness error, if the student obtained correct answer in second attempt during interview i.e. if the student could spot his /her own mistakes.

Findings

After classifying the errors into seven categories, distribution of these errors into different eight test items were classified in the tables and analyzed. The following are the findings of the study:

- Total number of errors committed by the students was 613. Out of these errors 251 were committed by boys and 362 were committed by girls.
- 5.2% of the total errors were concentrated in reading level.
- 7.2% errors were concentrated in comprehension level.
- 25.3% errors were concentrated in transformation level.
- 21.4% errors were concentrated in process skill level.
- 26.3% errors were concentrated in encoding level.
- 4.1% errors were concentrated in motivation errors.
- 10.6% errors were concentrated in carelessness errors.
- Students attach their own meanings to the confused words of the problem.
- Incomplete thinking is one of the major problems in understanding of verbal problem.
- A conformist attitude restricts the students from alternative ways of solving problems.
- Using salient features by the teachers on teaching verbal problems restrict the students from complete understanding of the verbal problem.
- No indigenous ways of solving verbal problem were found.

Discussion

From the study it is found that total number of errors committed by the students was 613 out of these errors 251 were committed by boys and 362 were committed by girls. Whereas students committed maximum errors (26.3%) in encoding level because most of the students forgot to write the answer in acceptable written form they just calculated the value of variables x and y only not the value of number (10x+y). Students committed 25.3% errors in transformation level because they adopted wrong operation to transform the words in mathematical forms. Next concentration of errors was on process skill level where students committed 21.41% errors because they could not find out an appropriate mental solution and became failed to proceed further. Similarly, next concentration of error was on carelessness level where students committed 10.6% errors because of their overconfidence, nervousness and lack of practice for written test. Students committed 7.2% errors in comprehension level because they attached their own meaning to key words rather than word's mathematical meaning. Similarly, next concentration of error was on reading level where students committed 5.2% errors due to poor background in language, grammatical structure and lack of practices. Students committed 4.1% errors in motivation level. Due to lack of motivation, health problem, tiredness and lack of preparation for the test.

Conclusion

Simultaneous equation takes a major part in Algebra of Mathematics in school level. Most of the exercises in Simultaneous equations are found in the verbal problems. The main objective of the study was to identify the types of error committed by students of grade X. According to the objectives of the study, the data and information were collected and analyzed.

From the study it is concluded that; the students commit errors from the beginning (reading level) to the deduction of the result (encoding level), the concentration of errors were seen on encoding level. Where the students committed 26.3% errors. The result shows that the maximum number of students they solved the problem correctly but forgot to write the answer in acceptable written form. Next

concentration of errors was on transformation level. Where the students committed 25.3% errors. This shows that those students who have understood the problem are failed to make appropriate mathematical form or expression. Similarly next concentration of was on process skill level. Where the students committed 21.4% errors. This shows that students were able to choose appropriate mathematical expression but did not know the procedure to carry out the solution.

Recommendations for educational implications

On the basis of above result and conclusion the following recommendations are made for educational implications:

- Most of the errors are committed by students because of poor background in language. Teachers should pay special attention to the language and techniques to understand it. Mathematical concepts should be explained in detail using simple language with illustration.
- Teachers should adopt appropriate strategies to minimize the errors committed by the students.
- Teachers should encourage students to solve the verbal problems themselves.
- Teachers should be concentrated on how to make the verbal problem understandable.
- Teachers can use Newman error analysis hierarchy to teach verbal problems efficiently.

Recommendation for further study

The present study generates some questions, which need to be verified.

- What are the measures of minimizing errors committed by the students in solving verbal problem?
- How and why the students commit errors in solving verbal problems?
- How the result of analysis be used in classroom teaching learning activities?

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Appendix- A

Errors Committed by Boys in Different Test Items

SN	Name of Students	Name of Schools	Question No							
			1	2	3	4	5	6	7	8
1	ManojRai	Dhunibeshi	R	-	-	T	-	E	-	-
2	SaileshSubedi	Dhunibeshi	-	-	-	T	-	-	-	P
3	BijayPandey	Dhunibeshi	-	Co	-	T	-	-	E	P
4	AmritThapa	Dhunibeshi	-	E	Co	-	-	-	-	Ca
5	Sunil Regmi	Dhunibeshi	-	-	-	Co	-	M	-	Co
6	SujanAcharya	Dhunibeshi	-	T	-	T	-	-	P	M
7	DipeshShrestha	Dhunibeshi	-	-	-	T	E	-	-	M
8	RajkumarRokka	Dhunibeshi	-	-	-	T	-	-	Ca	-
9	Milan Bhattarai	Dhunibeshi	-	-	-	T	-	-	R	-
10	SirishPathak	Dhunibeshi	Co	-	-	T	-	-	-	-
11	SachinKapri	Dhunibeshi	-	-	-	-	E	Co	-	-
12	Deshbhakta KC	Dhunibeshi	-	-	-	P	E	-	P	-
13	IshanThapa	Dhunibeshi	-	-	P	E	-	E	E	-
14	Dinesh Basnet	Dhunibeshi	E	-	E	T	-	-	E	E
15	AnkitChalise	Dhunibeshi	-	-	-	P	E	-	-	M
16	NabinShrestha	Mahankaleshwori	-	-	-	-	-	-	-	-
17	Rajesh Thapa	Mahankaleshwori	-	-	-	-	E	-	-	-
18	UpendraAdhikari	Mahankaleshwori	-	-	-	-	-	-	-	-
19	Rajesh Bhandari	Mahankaleshwori	-	P	-	T	-	-	-	E
20	NabinKunwar	Mahankaleshwori	-	T	E	T	-	-	T	-
21	Mohammad Tahipmiya	Mahankaleshwori	-	-	E	E	E	P	P	-
22	Ashok Balami	Mahankaleshwori	-	-	-	-	E	-	-	T
23	SandipKarki	Mahankaleshwori	T	-	P	P	-	E	P	-
24	BishnuTamang	Mahankaleshwori	-	-	-	-	-	-	-	-
25	SagarTamang	Mahankaleshwori	-	Co	-	P	-	P	R	T
26	SushilKhatri	Mahankaleshwori	T	-	P	P	-	-	P	-
27	RoshanChapagain	Mahankaleshwori	-	-	-	T	-	-	P	-
28	SanjibTamang	Mahankaleshwori	Ca	-	-	T	-	-	P	-
29	Susan Acharya	Mahankaleshwori	T	-	P	P	-	E	T	-
30	Sabin Tamang	Mahankaleshwori	-	-	-	P	E	-	-	T
31	AnitMagar	Mahankaleshwori	-	Co	-	-	R	-	-	T
32	Chandra Kumar Gurung	Mahankaleshwori	T	-	P	P	-	E	P	M
33	SudershanSubedi	Mahankaleshwori	-	Co	-	-	-	P	-	-
34	SarojThapa	Mahankaleshwori	-	-	-	-	-	Ca	-	-
35	JenishAcharya	Mahankaleshwori	-	T	Co	-	P	T	P	-
36	SumanBhujel	Mahankaleshwori	Co	T	-	T	T	E	P	-
37	PrabinAdhikari	Mahankaleshwori	-	-	E	T	-	-	Ca	R
38	DipeshTamang	Mahankaleshwori	M	P	-	T	E	-	T	-
39	UmeshBaskota	Mahankaleshwori	T	-	E	-	T	-	-	-
40	BishalAcharya	Mahankaleshwori	T	-	E	-	T	-	-	-
41	Sabin Acharya	Bhuwaneshwori	P	-	-	T	-	-	P	P
42	Krishna PdAdhikari	Bhuwaneshwori	-	E	T	-	T	Co	P	-
43	Aryan Acharya	Bhuwaneshwori	Ca	-	-	T	E	-	T	-

44	Ranjan Shah	Bhuwaneshwori	T	P	T	-	T	Co	P	T
45	Krishna BikramBaskota	Bhuwaneshwori	-	T	P	E	T	-	-	Ca
46	Saroj Lama	Bhuwaneshwori	-	E	-	T	T	E	-	-
47	BikramRegmi	Bhuwaneshwori	-	P	M	T	-	E	P	-
48	Chandra Kumar Jirel	Bhuwaneshwori	P	-	-	T	P	-	P	M
49	Mahesh Khadka	Bhuwaneshwori	-	P	-	T	-	-	T	-
50	Rishi Regmi	Bhuwaneshwori	T	-	T	-	-	E	-	Co
51	PradipGajurel	Bhuwaneshwori	-	-	T	T	-	-	-	-
52	HariomGajurel	Bhuwaneshwori	R	-	-	E	E	T	-	T
53	KiranAcharya	Bhuwaneshwori	-	-	T	Co	T	T	P	-
54	DevrajChapagain	Bhuwaneshwori	P	P	T	P	-	-	P	-
55	BishalBhujel	Bhuwaneshwori	-	-	R	-	-	-	P	-
56	SarojBhatta	Bhuwaneshwori	T	-	Co	-	-	Ca	-	-
57	SujanRanaMagar	Bhuwaneshwori	-	Co	-	-	T	-	P	-
58	RoshanKhanal	Bhuwaneshwori	T	-	P	P	E	-	P	-
59	Dinesh Khatiwada	Bhuwaneshwori	T	-	-	-	E	-	T	-

Note:

R = Reading Error

Co = Comprehension Error

T = Transformation Error

P = Process Skill Error

E = Encoding Error

M = Motivation Error

Ca = Carelessness Error

Appendix – B

Errors Committed by Girls in Different Test Items

SN	Name of Students	Name of Schools	Question No							
			1	2	3	4	5	6	7	8
1	Sabina Khatri	Mahankaleshori HSS	T	P	P	P	T	-	P	P
2	Shanti Tamang	MHSS	P	T	E	-	T	T	-	-
3	SusmaTamang	MHSS	-	-	P	P	-	T	T	-
4	SirjanaGurung	MHSS	T	-	P	-	T	T	Co	-
5	AaratiThapa	MHSS	-	-	-	-	-	-	-	T
6	SabitaSubedi	MHSS	-	-	-	-	-	-	-	-
7	RakshyaRegmi	MHSS	-	-	-	-	-	-	-	-
8	SharmilaThapa	MHSS	E	-	P	-	T	E	-	-
9	SangitaMahat	MHSS	-	-	-	-	T	P	P	-
10	SudhaSubedi	MHSS	-	-	T	E	-	-	P	P
11	GomaThapa	MHSS	-	-	-	-	-	-	-	-
12	SangitaTamang	MHSS	-	-	-	-	-	-	-	E
13	SangitaThapa	MHSS	-	-	-	-	-	-	T	-
14	SapanaKarki	MHSS	-	-	-	-	-	E	E	E
15	Swostika Nepal	MHSS	-	-	E	P	-	-	P	E
16	Mina Khatri	MHSS	T	T	P	P	E	-	P	-
17	BimalaKhatri	MHSS	-	-	P	P	-	T	P	-
18	BimalaSubedi	MHSS	-	E	P	-	-	-	P	-
19	SanitaTamang	MHSS	P	-	-	E	E	E	-	E
20	Sabina Thapa	MHSS	-	-	-	-	-	-	-	-
21	SumeeKhadka	MHSS	-	-	-	-	-	-	-	-
22	RupaDangol	MHSS	-	-	T	-	T	-	P	-
23	SamjhanaTamang	MHSS	-	-	P	-	E	-	-	-
24	DipaAdhikari	MHSS	P	T	-	-	T	T	-	-
25	SangitaKhatiwada	MHSS	-	-	-	P	-	-	P	-
26	Ashmita Lama	Dhunibeshi HSS	T	-	-	P	-	-	P	-
27	RanjanaThapa	Dhunibeshi HSS	P	-	-	-	T	-	-	T
28	Anita Alemagar	Dhunibeshi HSS	-	-	T	T	T	P	-	-
29	SrijanaTamang	Dhunibeshi HSS	-	-	T	-	T	T	-	-
30	GomaBhujel	Dhunibeshi HSS	-	-	P	-	T	-	Co	-
31	Sabina Gurung	Dhunibeshi HSS	-	-	P	-	T	-	T	-
32	AasthaKharel	Dhunibeshi HSS	-	E	E	E	E	-	E	-
33	Monika Shrestha	Dhunibeshi HSS	-	-	-	-	E	-	-	-
34	SajinaSubedi	Dhunibeshi HSS	-	-	-	-	E	-	-	-
35	Nima Lama	Dhunibeshi HSS	-	E	E	-	E	E	E	E
36	SadikshyaUprety	Dhunibeshi HSS	-	E	E	E	E	-	-	E
37	SharmilaBista	Dhunibeshi HSS	-	E	E	-	E	-	-	-
38	AaratiBidari	Dhunibeshi HSS	-	-	E	-	-	-	-	-
39	Anisha Lama	Dhunibeshi HSS	-	-	-	-	E	-	-	-
40	PoojaBasnet	Dhunibeshi HSS	-	E	E	E	E	-	-	-
41	BindaRupakheti	Buwaneshwori	-	-	-	-	-	-	P	-
42	KalpanaRegmi	Buwaneshwori	T	P	P	T	T	P	P	E

43	BismitaGajurel	Buwaneshwori	-	P	P	P	T	T	-	P
44	ShreejanaSubedi	Buwaneshwori	-	-	P	T	T	Co	-	P
45	RabitaBhujel	Buwaneshwori	T	-	-	-	-	-	-	-
46	AnjuRupakheti	Buwaneshwori	-	-	-	-	E	-	P	-
47	DipaGajurel	Buwaneshwori	T	P	P	P	T	T	-	P
48	PabitraKunwar	Buwaneshwori	-	-	P	T	T	T	P	P
49	Pinki Shah	Buwaneshwori	-	T	P	P	-	T	P	P
50	Anita Gajurel	Buwaneshwori	T	-	-	T	T	T	P	-
51	BinitaAcharya	Buwaneshwori	T	-	-	T	T	Co	-	-
52	KarunaRegmi	Buwaneshwori	T	P	-	P	T	Co	-	-
53	Sumitra Shrestha	Buwaneshwori	-	-	-	P	-	-	-	-
54	JamunaAcharya	Buwaneshwori	P	E	-	T	P	-	P	P
55	ApsharaSigdel	Buwaneshwori	-	-	-	T	-	-	-	P
56	RojinaShrestha	Buwaneshwori	P	E	-	-	P	-	T	P
57	AnishaHamal	Buwaneshwori	P	E	-	E	E	E	-	T
58	PunamBhujel	Buwaneshwori	-	-	-	T	P	T	T	P
59	AsmitaBhujel	Buwaneshwori	E	-	-	P	E	-	-	-
60	RejinaRegmi	Buwaneshwori	T	-	P	T	P	Co	E	E
61	Rinki Shah	Buwaneshwori	T	T	-	T	Co	-	-	P
62	SanumayaJirel	Buwaneshwori	T	-	-	P	E	-	-	P
63	Shrmila Lama	Buwaneshwori	T	-	E	-	E	P	-	P

Note:

R = Reading Error

Co = Comprehension Error

T = Transformation Error

P = Process Skill Error

E = Encoding Error

M = Motivation Error

Ca = Carelessness Error

Appendix C

- Please read the question for me. (Reading)
- Tell me what is asked you to do?(Comprehension)
- Tell me method you can use to find the answer.(Transformation)
- Show me how you worked out the answer to the question.(Process Skill)
- Now tell me your answer to the question.(Encoding)

Appendix D

- A two digit number is 3 times the sum of its digits. The sum of the number formed by reversing its digits and 9 is equal to 3 times the original number. Find that number.
- The sum of the ages of the father and son is 44 years. After 8 years, the age of the father will be twice as old as the age of the son. Find their present ages.
- The ages of two girls are in the ration of 2:3. 6 years hence the ration of their ages will be 11:15. Find their present ages.
- Three years ago, the sum of the ages of the father and his son was 54 years. 3 years later the father's age will be double of the son's age after 9 years. Find the present ages of the father and son.
- The present ages of a father and his son are 40 years and 8 years respectively. How many years ago, the product of their ages was 105? Find it.
- A number consists of two digits. The sum of its digits is 16. If 18 is subtracted from the number, the digits interchange their places. Find the number.
- 5years ago a man's age was 5 times the age of his daughter's. 3 years hence, twice his age will be equal to 6 times his daughter's age. What are their present ages?
- If 3 is added to the numerator of a fraction, the value of the fraction becomes 1. When 3 is added to the denominator of the fraction, the value of the fraction becomes 1/4. What is the value of the fraction? Find it.