

Chapter-I

INTRODUCTION

Background of the study

Mathematics, as we know of it today, is the science of numbers and their operations, interrelation and combination of space configuration and their structure, measurement etc. In the history of mathematics, Babylonian civilization, Greek civilization, Chinese, Hindu and Arabian have played vital roles in the development of mathematics and become an excitingly separate branch of knowledge or discipline in today's world.

From the very beginning of development of mathematics, the use of mensuration has become absolutely essential for solving the different problems of our daily life. As we have seen the initial emphasis of mathematics was on practical, arithmetic and mensuration. Mathematics as we know, today is the science of numbers and their operation, interrelation and combination of space configuration and their structure and measurement.

Mensuration is the branch of mathematics concerned with the shape of individual objects, spatial relationships among various objects and the properties of surrounding space. Mensuration is measurement of length, breadth, perimeter, area and volume of different geometrical objects. It is one of the oldest branches of mathematics having arisen in response to such practical problems as those found in surveying and its name is derived from Greek Words meaning "Earth Measurement".

Mathematics is a living subject, which seeks to understand patterns that permeate both the world around us and the mind within us. Although the language of mathematics is based on rules that must be learned, it is important for motivation that students move beyond rules to be able to express things in the language of

mathematics. This information suggests changes both in curricular content and instruction style. It involves renewed effort to focus on seeking solutions, not just memorizing procedures, and exploring patterns, not just memorizing formulas and formulating conjectures, not just doing exercise.

In the ancient Nepalese civilization, people used the mensuration for building solid and find our distance without knowing the formula rules. Development of mathematics education including mensuration were found before Vedas period. In Vedas period, Rig Vedas represented mathematics, including arithmetic, geometry and astronomy. Mensuration was taught in Gurukul, Pritikul education system in arithmetic mathematics.

After the modern area flourished, further progress in the field of mensuration has been comprehensively used. Since then the accuracy on the field of mensuration has quite a lot of use in the development of post modern mathematics.

In the context of Nepal when Rana came to power they established the Durbar School in Thapathali, Kathmandu and started to teach mathematics but there was not good planned programmed. Since 1971 A. D. mathematics has been taught as a compulsory subject for all classes in school. Besides compulsory mathematics, optional mathematics has also been offered to the willing students. Out of the total time for instruction in the school 30 percent is allotted to mathematics at the primary level 20 percent at lower secondary level 12 percent at secondary level.

In Nepal, the mathematics curriculum in the secondary level has fixed the content of Grade IX on area(carpeting, painting and plastering) and estimation op cost, pathways outside Rectangular square and Circular Area, Estimation of the cost of required Marbles, Bricks and other expense, Prism(surface area, Area of cross section and volume of cube and cuboids), Estimation of number of bricks required for

a wall and their costing related problems in mensuration chapter. Similarly the content of Grade X are problems on area of triangle (Right angled triangle, Equilateral triangle, Isosceles triangle and scalene triangle), behavioral problems on triangular surface, problems on triangular prism (total surface area, lateral surface area and volume related problems), problems related to total surface area, curved surface area and volume of cylinder, cone and a solid figure made of these (at most 2), problems on pyramid (Square base and Based on equilateral triangles only), total surface area and volume related problems.

Different educational reports Nepal National Educational Planning Commission (NNEPC, 1945), primary report of Royal Higher Educational Commission 1983, National Education Commission (NEC, 1992), National Higher Educational Commission curriculum. According to NEC, 1992 mathematics is taught as a basic subject. As we know, mensuration is one of the important topic in secondary level mathematics, the time allocated to teach this topic is 15 period each of forty five minutes duration of class 9 and 10. The knowledge of mensuration is essential for the students to solve their daily problems. The researcher regarding the importance of mensuration decided to undertake the study to analyze the errors students commit. Error analysis is a technique that teachers use as an educational diagnosis for analyzing clues to solve some of the severe learning problems of their students. It allows the teacher to pinpoint the computational mistakes being made by students and interpret the reasons for mistakes.

Further, the teacher can discover and analyze response to detect the learning difficulties through the intelligent use of inventory and diagnostic test along with personal interviews and also the plan the specific remedial measure to correct errors occurs in mathematics due to the poor mathematical background of the students, lack

of effective methods of teaching, the concept of mensuration cannot be visualized in secondary level, therefore students commit errors while solving the problems related to mensuration.

Statement of Problems

For years ago, when I was a secondary school teacher, I observed many students in my class struggling to cope with learning mensuration especially in problems. They had a good algebraic background and they could solve a problem using lengthy algebraic procedures that they came up with themselves but hesitated to solve a problem. I always tried to teach problems to motivate them. However, my attempts were not successful or rather failed to teach the problem effectively. At the same time I left my teaching and joined a University where I did not have further opportunity to pursue this area. So the problem of this study is to diagnose the errors committed by secondary level students when solving the problem. Especially this study finds the following questions.

What types of errors do students commit in mensuration?

Why do students commit such types of errors?

Does the error made by students in the Total Surface Area of square based pyramid and Equilateral triangle based pyramid differ?

Objectives of the Study

The objectives of this study will as follow:

To categorize the errors committed by the students of grade ten in solving the problem of mensuration.

To analyze the error committed by students in solving the problem of mensuration in mathematics.

To find out the causes of error in solving problems of mensuration in mathematics.

Significance of the Study

The purpose of error analysis is to identify the patterns of error or mistakes that students make in their work and understand why students make the error. When conducting an error analysis the teacher analyzed the student's mathematics problems and categorized the errors. Mensuration is a part of mathematics courses in each level of school mathematics. It is a subject which is locally useless but globally essential. Mensuration is being used in our daily life activities. This study has the following significance:

This study helps to find out the errors committed by the student and to choose the way of minimizing them.

This study helps in the improvement in the day to day classroom teaching.

It helps to find out the specific area where the student commits the error.

It helps the teacher to organize his/her experience and teaching strategies and adopt suitable methods to teach.

This study helps for students, parents, counselors, teachers, curriculum designer, textbooks, writers, researchers, coordinators and administrators.

Mensuration is important for motivation that students move beyond rules to be able to express things in the language of mathematics. This information suggests changes both in curricular content and instruction style. The knowledge of mensuration is essential for the students to solve their daily problems. The errors students commit error analysis is a technique that teachers use as an educational diagnosis for analyzing clues to solve some of the severe learning problems of their students.

Delimitation of the Study

The study was delimited under the following aspects.

This study was limited to the students of Grade X.

It was limited in Saptari district.

This study was concerned government school students and private school students.

The sample of the school was taken in two schools for this study.

The study was limited to the topic of mensuration.

Operational Definition of Terms

Error. The first mistake made by the student during the solution of the problem or error refers to the mistake which occurs regularly in the form of learner's performance.

Reading error. Inability of students to read the words in the question such that he/she can't grasp all the information given on the question.

Comprehension error. If the students could not grasp the overall meaning of the given problem, these types of error are classified as comprehension error.

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

Encoding error. If the students made the correct solution to the question but could not express the solution into acceptable written form, this type of error is an encoding error.

Knowledge. Knowledge is defined as the familiarity gained by experience or range of information in this research, the researcher has taken knowledge as a list of formulas used in mensuration that have set in the mind of learner knowledge is defined as the remembering of appropriate, previously learned information.

Skill and Application. A skill is defined as the ability to do something expertly and well. Application is defined as the use of previously learned information in new and concrete situations to solve problems that have single or best answers. The researcher understands skills as the application of formula in the series of operational procedures of the problem of mensuration.

Problem Solving. Problem solving is defined as the use of learned mathematical concepts, facts and principles to solve the problems. Problem solving in this research purely indicates the use of various mensuration skills by the student of grade X. Here the students must have to use more than one formula in a sole operation of mensuration.

School. Those institutions which perform the teaching and learning activities and other formal education are imparted. Thus school means the institution which was 10 areas where the data collection procedure was operated i.e. Shree Masi Lal Janta secondary school Kushha, and Bravebeart secondary school Karmeniya Saptari, Nepal.

Students. This research work uses the word students for those respondents who facilitated and participated in the data collection work from Shree MasiLalJanta secondary school and Bravebert secondary school.

Motivation Error. If the student declines to proceed further due to his/her psychological reason this type or error is classified as motivation error.

Carelessness Error. If the student commits error in a written test but corrects the error himself while interviewed. These types of error are classified as carelessness error.

No Solution. No solution means student has no written responses or if the student can't read and formulate the problem.

Word Problem. The problem (question/item) which is written in words in written test or verbal problem mentioned in test items.

Chapter-II

REVIEW OF RELATED LITERATURES

A literature review is the process of locating, reading and evaluation. The purpose is to develop some expertise in one area to see what new contributions can be made and to receive some ideas for developing a research design.

Review of literature is the important, essential and helpful part to perform the research task in a better perspective. It is a way to discover what research in the area of our problem has untouched. A critical review of the literature helps the researcher to develop, understand and insight into previous research work that related to the present study. For a particular research in providing direction in making the problem more realistic, precise, research able and meaningful. Having these advantages in mind, in this study the researchers reviewed the considerable related and relevant literature carried out by various researchers in the field of computational errors and disability in learning of students towards mathematics equally in mensuration. The major purpose present study is to find out the errors committed by the grade X students in mensuration on the process of studying various related literature, the error analysis, learning disability in mensuration and related subjects in Nepal and other countries have been carefully reviewed.

Empirical Review

Burekner (1968) analyzed the errors committed by the fifth and sixth grade in addition and subtraction of fraction. Seven errors were common to both operations. The type of errors in addition and subtraction of fraction in Burekner's study were lack of comprehension of process: reduction to lowest term, computational errors, wrong operation, partial operation, changing into common denominator, difficulty with improper fractions and borrowing difficulty.

Tindal and Marston (1990) suggested that the following list of errors that students commonly make in solving word problem as; difficulty in reading, inability to understand the language and vocabulary of the problem, difficulty in identifying the relevant and irrelevant information, difficulty in identifying the number of steps required to solve the problem and trouble in doing mathematical operations.

Engelhard (1977) not satisfied with Robert classification of error type conducted a study to extend Roberts efforts in identification and classification on computational error. He took an arithmetic text containing eight- four items among hundred students of grade third and sixth. The items identified as having incorrect responses were analyzed to understand student's approaches or misconceptions leading to those responses according to commonalties. These inferences were clustered to form error type. These procedures resulted in the identification of eight type of error. These were basic facts, in appropriate invention, grouping incorrect operation, defective, incomplete algorithm identifying errors.

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

Marahatha (2002) studied on "A Study on Computational Error in Fraction by Grade VI Students in Chitwan district". The main finding was: Students generally commit more errors in addition of fraction than in introduction of fraction. Thus the conclusion was derived from the result of the null hypothesis in which the error mean was higher in addition of fraction than in the introduction of fraction. The mean error occurring in 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 in areas of operation of fraction considered in this study.

Poudel (2002) concluded in the master degree thesis entitled; "The occurrence of errors while solving word problems in mathematics by the lower secondary pupils" that, there were 4.88% reading error , 6.37% comprehension errors, 52.44% transformation errors, 11.89% process skill errors and 24.42% encoding errors and boys committed less 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 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 a diagnostics test in which an equation was developed and 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 keys. T-test was used to compare the significant difference between two sample means. All the differences were tested at 0.05% level of significance.

Kafle (2006) studied error analysis of the proof of the theorem in Geometry in grade IX. The study revealed that students had committed numbers of errors in making proof of geometrical theorems. The student's committed errors from the beginning of the solutions to the deduction of the result. 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 difficulty in carrying out correct operations and did not follow correct procedures to carry out these operations accurately.

Adhikari (2007) studies on “An error analysis in Mensuration of Grade Nine students”. In this study he found the mathematics curriculum of secondary level in the content of Mensuration consists most of the exercise and problems are focused on problem solving skills. Grade nine students generally are low achievers and this could be the effect of error. Seriousness of the error as well as the concentration was found in problem solving, knowledge and skill and application respectively. Gender based analysis on errors showed that girl students were found significantly different in skill and application and problem solving. However, the average number of errors made by girls was higher.

KC (2008) analyzed on “An analysis of error committed by students of grade IX in geometrical transformation”. The study found that when four questions were asked then 168 errors were committed by the students. The error committed in drawing is analyzed without any theoretical base. Most of them couldn't draw even parallel line, perpendicular without any theoretical base. Most of them couldn't draw even parallel line perpendicular, angle measuring where little knowledge was sufficient, so they committed more errors. In verbal test item 8% errors were found in reading which is very low out of 401 errors being the problem in reading for grade IX student however very few errors were found in reading. More error was found in process and transformation. There were 26% errors found in transformation and process. Quantitatively, boys committed more error than girl from the gender point of view.

Panthi(2009) studies on “An error analysis in the equation of Grade VII students” aims to identify the error committed by students on problem solving , comparing the error with respect to gender. The study was an intuitionist research combined with interpretative in design. Newman error and hall errors on solutions of simple linear equation techniques were the theoretical basis of 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 by boys and 84 errors committed by girls, the analysis showed that 10.7% errors at reading level, 33.3% errors at comprehension level, 25.5% errors at transformation level, 17.6% errors at process skill errors and 13.7% encoding error, which conclude that students committed more error at comprehension level. s

Pangeni (2010) carried out a study on “A Study of Error Analysis Committed by Students of Grade X in solving Verbal Problems on Height and Distance”. The study was conducted in four schools (two public and two private) of Syangja District taking 40 students as a sample. The objectives of the study were to find the errors made by students of Grade X in solving verbal problems on height and to find out the causes of errors in solving verbal problems on height and distance. The tools used for data collection were problem solving test and interview schedule. The study found out the total number of errors committed by the students in solving verbal problems was 185. Out of 185 errors committed 15 from reading, 40 from comprehension, 47 from transformation, 45 from process and 38 from encoding. The researcher found out learning problems of the students so that the students committed errors were attach own meaning, incomplete or fuzzy thinking, mix-up the rules, salient teachers a conformist attitude and teachers talks and students listen. So to solve these problems

researchers have suggested using the teaching materials, teaching strategies, classroom management, participation of students, students encouragements.

Nepali (2014) studied “errors committed by grade VII students geometry learning” with aim to identify the error committed by students in angle construction, compare the error with respect to gender of grade VII students in angle construction and analyze the error made by students according to Newman Hierarchy of error analysis in solving problem of angle construction.

This study was based on the grade VII students of the Tinthana VDC, Kathmandu district. Only one public school Shree Bisnudevi Secondary School, Tinthana Kathmandu district was selected for the study and a purposive sampling method was asked to select that school. The pencil-paper test was administered to a sample of 30 students. The test item included eight questions. The researcher had the Newman is theory of error analysis as the theoretical base of this study. The researcher used percentages to compare errors committed by the students.

The finding of the survey were, there were total 177 errors committed by the students out of 177 errors, 16 were reading errors, 48 were comprehension error, 43 were transformation errors, 39 were process skill errors and 31 were encoding errors, 9% errors were at reading level, 27% errors were at comprehensive level. Similarly, transformation error, process skill error and encoding error were 24%, 22%, and 18% respectively. Students committed more error of comprehension level, out of total error committed, 50.28% errors committed by boys and 49.72% errors were committed by girls.

After reviewing the above mentioned research report, so many mensuration related research thesis, journal, article etc. Many things have arisen in my mind. Before expressing my personal feeling, I want to express some findings studied by

Livingstone and Bork (1990) into the difference in actual teaching between novice and expert teachers; they observe that novice teachers “had little knowledge of student’s misconceptions. Their schemata was adequate for their own understanding, but was insufficiently developed to enable them to be responsible and expert teachers armed with knowledge of errors to be made by pupils.

Although, mensuration is one of the most useful important branch of mathematics for school education. Mensuration includes an enormous range of ideas and can be viewed in many different ways. School mathematics curriculum of Nepal has given emphasis on mensuration learning from the beginning of schooling. But, when mathematics curriculum in school level faces a dilemma when it comes to mensuration. This problem is not new and it has been taken into consideration for many years. The mistakes of the students made in the answer copies show that the learning of mensuration is considered as a rote process rather than making it meaningful.

So, I would like to say that although mensuration is a natural vehicle for developing intuition, creativity and a spirit of inquiry. We can see so many problems exist in teaching and learning mensuration. So, to overcome this problem, so many researches were conducted and this work is still continuous. Previous research reveals that students do more errors in comprehension and transformation level. So, the teacher must give the clear concept about the mensuration shapes and their properties.

Theoretical Review

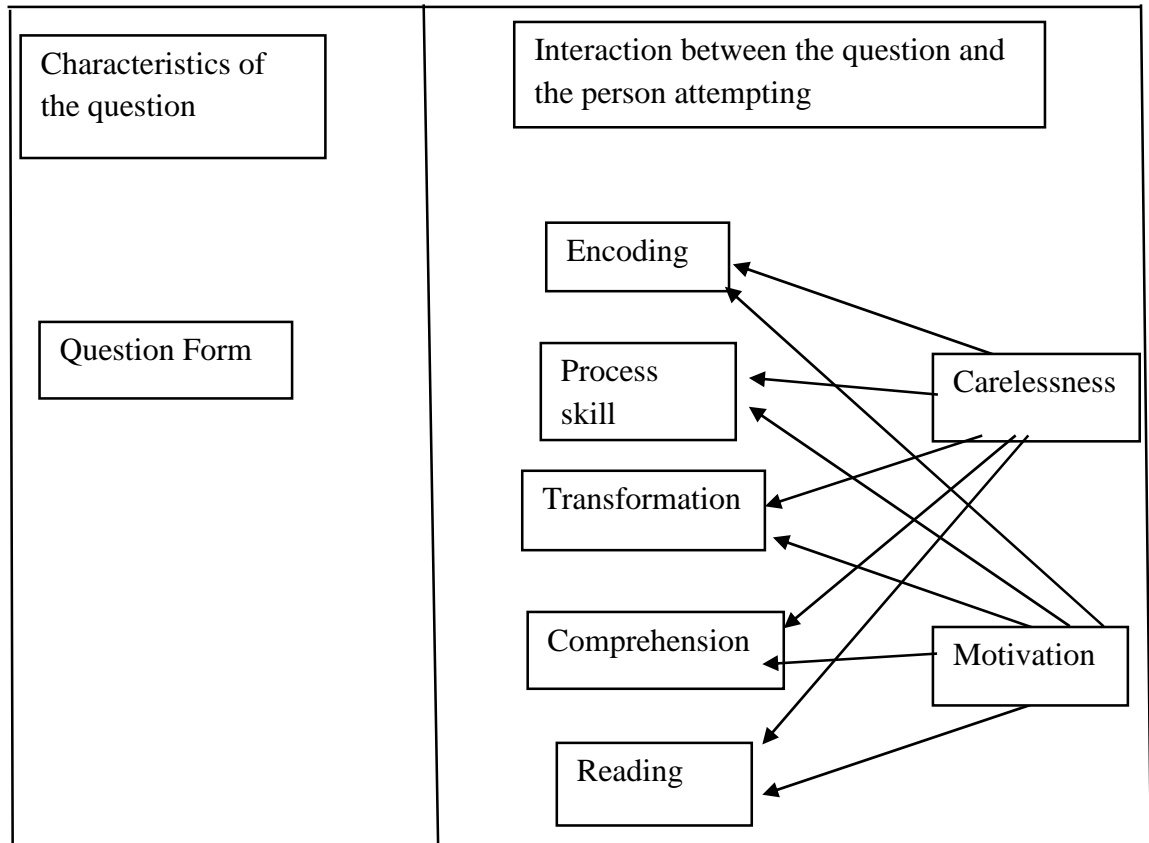
Theoretical basis of study plays a vital role in the field of research because it helps research to describe different concepts considered in research and to prepare research design. Some of the related theoretical literature is reviewed below.

Newman (1977) an Australian language educator who in the mid-(1970s), developed systematic procedure for analyzing errors made by students responding to written mathematics tasks. Since 1977 a steady stream 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 tests. 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 problem, this must ultimately the following hierarchy: read the problem, comprehend what is used, carry out 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 a diagram. According to Clements (1980, p.4) 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 shown as separate form of hierarchy because as indicated, such error can occur at any stage of the problem solving process. A careless error, for example, could be reading error, comprehension errors and so on. Similarly, who have read, comprehended and worked out an appropriate strategy for solving a 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 bother doing it”.

Figure: 1

Chart Showing Theoretical Framework



Source: (Newman, 1983), the Newman hierarchy of error cause

Newman has presented a hierarchy of errors committed by the students which are intricately related with each other. 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.

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 consequences 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 are related to each other, one leads another error. All types of errors are caused by the motivation and carelessness as shown in above figure 1.

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

Newman (1983) recommended that the following “questions” or a request be used in an interview which is carried out in order to classify student’s errors on written mathematical tasks.

Classification	Typical Questions	Errors
Reading	Please read the question to me (If you don’t know a word or number, leave it out.)	Do not recognize key words or symbols

Comprehension	a) (Point to a word or symbol) what does this word/symbol mean? b) Tell me what the question is asking you to do. (What do you mean when you say ...?)	Can read the problems well but cannot comprehend the meaning of the words, symbols or question.
Transformation	Tell or show me how you start to find an answer to this question.	Cannot transform sentences into mathematical forms.
Processing skills	Show me how you get the answer. Tell me what you are doing as your work.(Let student work on a piece of paper.)	Can choose an appropriate operation but cannot complete the operation accurately.
Encoding ability	Write down the answer to the question.	Can perform the correct operations but writes the answer incorrectly.

Reading error

An error would be classified as a reading error if a student could not read a key word in the mathematical written problem to the extent that this prevented the student proceeding further along an appropriate problem solving path. To recognize the reading error of the students the researcher can ask the students; please read and the question “find the area of the equilateral triangle having length of one side is 5cm. “If students do not recognize the equilateral triangle and “length” is known as reading error.

Comprehension error

If the students can't grasp the overall meaning of the given problem this type error is classified as comprehension error. To understand the comprehension error, the researcher can ask the students by pointing word, what does this word "area" mean? If the students are able to read the problem well but cannot comprehend the meaning of the word 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 mathematics form that is transformation error.

Process error

An error was classified as a 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 choose an appropriate operation but cannot complete the operation accurately, that is processing error.

Encoding error

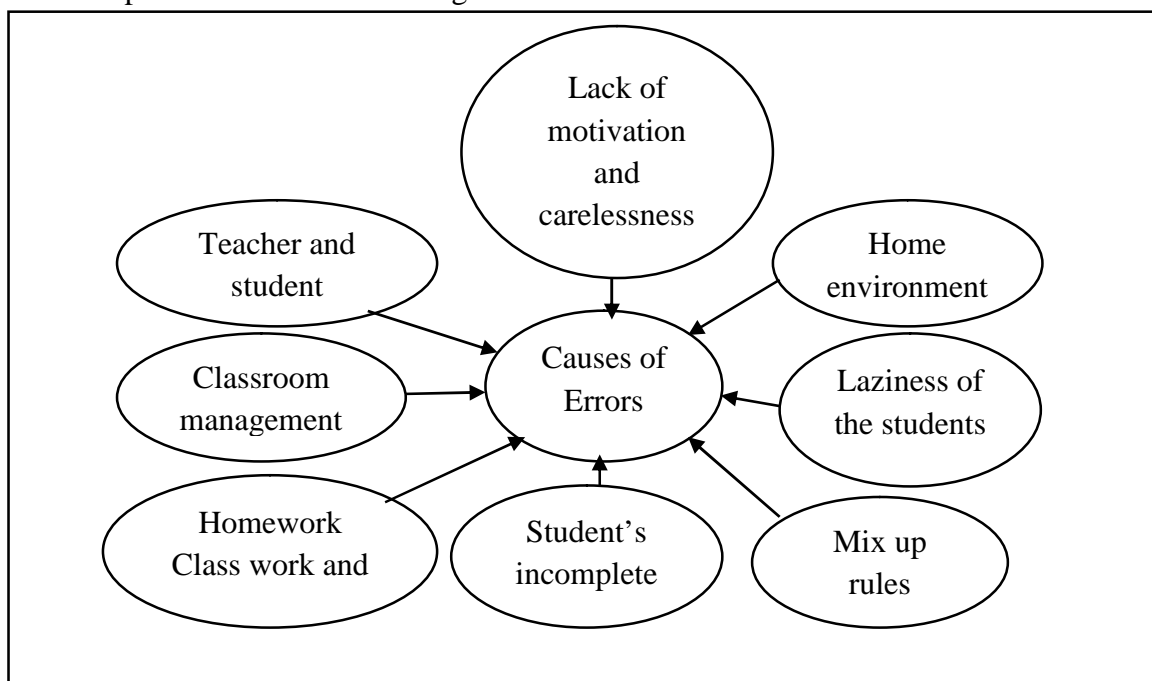
If the students make the solution to the question but can't express this solution into acceptable written form this type of error is classified as encoding error. To know the encoding ability of the students are asked to write down the question to the

question and the students can perform the correct operation but write the answer incorrectly that is known as encoding error.

Chart: 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 problems in mensuration. The research has applied Newman’s errors analysis technique to find out the types and frequencies of errors committed by the students while solving verbal problems in mensuration and causes of those errors.

Conceptual framework Figure No. 2



(Source: Pangani, 2010)

Students generally commit errors in solving verbal problem due to the different reason like 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 components or cause to committee error. If the students have lack of motivation and

carelessness in the class they involve incomplete thinking and less motivation arouses laziness of the students. Similarly the home environment has a crucial role in committing errors. If the home environment is not good, students do not do homework and are not well prepared 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

METHODS AND PROCEDURES

In this chapter the design of study, sampling procedures for the data collection, source of data collection, tools for research and data analysis and interpretation are described.

Design of the Study

This is a survey research which is descriptive in nature. It was descriptive because it aims to describe the events of the situation addressing the present activities of students. The researcher used Newman techniques as the theoretical base of study and on the basics of them, results were analyzed.

Population of the Study

Population of the study was focused on all the secondary students studying in grade X Saptari district. The financial and time constraints under which the researcher was working, it wasn't possible for him to select samples from each school of such a large scattered population. Hence, the scope to this study was deliberately limited to the one private and one public school inside Shree Masi Lal Janta secondary school Kushha, and Bravebert secondary school karmeniya of Saptari district.

Sample of the Study

From the population only two schools of Saptari district inside two municipalities were selected for this study. In the sample there were 40 students were from both community school and private school. They were selected by the help of their regular mathematics teacher. A 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.

Tools of the Study

For investigating the error committed by the students, the researcher developed a test item. The test (questionnaire) included twelve questions that were selected from grade X Mathematics textbook. All the questions were selected from solving the problem of mensuration in mathematics.

Written Test (Subjective Test)

For investigating the error committed by the students, the researcher developed a test item. All questions included in the test were prepared by the researcher himself. Questions were given for written test and interview schedule used. The written test is widely used test to evaluate the students' achievement; formally it helps to examine the knowledge of students acquired from the certain content. Written test is a set of questions which are prepared by researcher from the related content in which the students were given the responses.

Reliability of Test

For checking the reliability of the questions, test-retest method was used. Researcher was divided all students so questions were distributed for the written test. Same questions were given for test after 1 hour 30 minutes the answer sheets were checked and identified errors. Hence all the prepared questions were relieved for further tests.

Validity of Test

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

Interview Guideline

Researchers also use the interview schedule for students to identify the causes of committed errors. Questions were asked in the 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 error and motivation error shall not be found then 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 breakdown occurred in the attempt to get a solution.

Procedure of Data Collection

To collect the data the selected schools were visited and the administrator was requested for cooperation with the help of a mathematics teacher. The test was administered in two schools. The first test was taken to students as a problem solving test where the students were solved the verbal problem in the answer sheet. Identification of error was a 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, an interview was conducted to identify those errors. Next, to fulfill the second objectives of the study, another interview was conducted by using an interview schedule on a multi sample of students. Classes were also observed by the researcher in order to fulfill the objectives.

Data Analysis Procedure

After collecting data the students were provided with tests to find out the mistake in their answer sheet. Interview was conducted to find out the error which will be difficult to find out by answer sheet. Interview was conducted on sample of students and mathematics teachers of the sample school to find the causes of errors were 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 students as described by Newman techniques. These five categories were 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 of illustration and responses of the teacher and students.

Chapter-IV

ANALYSIS AND INTERPRETATION

This is a survey study related to the error analysis in mensuration of grade X students. The objectives of this study were to categorize the errors committed by the students of grade ten in solving problems of mensuration, to analyze the error committed by students in solving problems of mensuration in mathematics, to find out the causes of error in solving problems of mensuration in mathematics. For this purpose the student of grade X was selected from one public school and one private school used to be selected as a sample. In the sample there were 40 students. They were selected by the help of their regular mathematics teacher. The main tools for the collection of data were the test items. The validity and reliability of the test items pilot survey was conducted on the sample before examination question. Then the test was taken and identification of error. Errors found in the answer sheet item were classified according to Newman's technique of error analyzed and interpreted in different subtopics are as follows.

Analysis of Data According to Newman Theory

The following table shows the frequency of error according to Newman hierarchy of error. Table 4.1 shows the error in five categories along with total number of errors and their percentage. This table shows all the seven hundred forty six (746) errors found in different categories.

Table No. 4.1 Analysis of data according to Newman Frequency of Error in mensuration at question number I to XII

S.N. Name of errors	Question number												Total	%
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
Reading error	2	7	6	4	6	2	9	3	4	5	11	10	69	9.24%
Comprehension error	10	12	20	14	18	16	20	25	14	8	12	14	183	24.53%
Transformation error	8	14	18	14	23	12	16	21	22	10	14	13	185	24.79%
Process skill error	7	24	14	15	20	14	24	10	12	15	16	10	181	24.26%
Encoding error	8	10	18	14	7	8	12	9	6	8	10	18	128	17.15%
	35	67	76	61	74	52	81	68	58	46	63	65	746	

Table 4.1 shows that there were altogether 746 errors. Among there are five types of errors that can be identified from the said interviews. These are errors in reading, comprehension, transformation, process skill and encoding.

Out of total 746 errors found, 9.24% were reading errors, 24.53% were comprehension errors, 24.79% were transformation errors, 24.26% were process skill errors and 17.15% were encoding errors.

Identification of Error

The observable error in problem solving in mensuration could be categorized under the following headings. Some errors done by students and are listed below.

Reading Error

This type of error is committed by the students at the time of reading key words or symbols used in written problems. An error is defined as a reading error if the students hadn't been able to read the question that is called reading error. While conducting test item, 69 items were committed reading error so that students were not understand the question for solve.

Comprehension Error

An error was classified as comprehension error if the students had been able to read all the words in the questions but not able grasped the overall meaning of the words and therefore was not able to proceed along an appropriate problem solving path. If the students read the question but he/s unable to write the given conditions of the question.

The researcher provides the question to the student i. e. a cone has its height 15cm and slant height 17cm. If it is filled with ice-cream in such an upper part the hemi-sphere finds the volume the ice-cream. Then one student has solved this problem as follows.

Solⁿ :- शीलाकी अर्धव्यास (r) = 15cm ← Comprehension Error.
 शीलाकी उचाई (h) = 17cm ←
 अर्ध - शीलाकी अर्धव्यास (r) = 15cm
 शीला वस्तुकी आयतन (V) = $\frac{1}{3} \pi r^2 h$
 $= \frac{1}{3} \times \frac{22}{7} \times 15 \times 15 \times 17$
 $= 4,107.14 \text{ cm}^3$
 अर्ध - शीलाकी आयतन (V) = $\frac{2}{3} \pi r^3$

From the above way of problem solving, the researcher had analyzed the students are totally unable to comprehend the mathematical problems about cones and hemi-sphere. Due to the lack of comprehension in the meaning of the diameter,

radius, real height of the cone slant height of the cone etc, students failed to solve the problem correctly.

While conducting test items, 41 items were committed, 183 items were committed comprehension errors so that students were not able to proceed along as appropriate problem solving path.

Transformation Error

An error is classified as a transformation error, if the students understand what the questions wanted him/her to find out but become unable to make appropriate strategy to solve the problem. The researcher has described transformation error, when the student could not write the condition. What is to be solved and appropriate methods of the given problem?

The researcher gave a question "find the area of an equilateral triangle whose side is 4cm". Then one student solved this problem as follows.

Solⁿ :-
 समबाहु त्रिभुजको भुजा 1cm = 4cm
 समबाहु त्रिभुजको क्षेत्रफल (A) = ?
 समबाहु त्रिभुजको क्षेत्रफल (A) = $\frac{1}{2} a^2$
 $= \frac{1}{2} (4\text{cm})^2$
 $=$ → Transformation error.
 $=$

Looking at the solution, the researcher has analyzed that the students had identified the problem but unable to make a strategy to solve the problem. Here the students started to solve the problem but not success because he/she did not identify the way of a suitable solving method.

While conducting test items, 185 items were committed transformation error so that students were not able to make appropriate strategy to solve the problem.

Process Skill Error

An error is classified as a process skill error if the student identifies an appropriate operation or sequence of operations, but does not know the procedure necessary to carry out these operations accurately. The researcher has described process skill error as. If the students were unable to solve the problem with the required process.

The researcher gave a question "the ratio of the radius of the base to the height of a cylinder is 2:3 if its volume is 12936 cm^3 , find the height of the cylinder".

The one student had solved this problem as follows.

Solⁿ: - माना,

बेलनाकी अर्धव्यास र उचाई $2k$ र $3k$ हुन।

बेलनाकी आयतन $(V) = 12936 \text{ cm}^3$

बेलनाकी आयतन $(V) = \pi r^2 h$

or, $12936 \text{ cm}^3 = \frac{22}{7} (2k)^2 \cdot 3k$

or, $12936 \text{ cm}^3 = \frac{22}{7} (2k \cdot 2k \cdot 3k)$ → process skill error

or, $k^2 = \frac{12936 \times 7}{264} \text{ cm}^3$

or, $k = \sqrt{343} \text{ cm}^3$

Looking at the solution, the researcher has analyzed that the students had identified the correct way of solving the given problem but the student failed to precede further step. The students solved the problem accurately but failed in the process of multiply condition.

While conducting test items, 181 items were committed process skill errors so that students were not able to solve the problem with the required process.

Encoding error

An error classified as an encoding error if the student can perform the correct operation but failed to write the answer in an acceptable written form i.e. unable to use appropriate sign letters in appropriate place and do not write the correct answer. The researcher gave a question "Find the volume of a pyramid if its base area is $49m^2$ and height is 12m. Then one student had solved this problem as follows.

Soln:-
 पिरामिडकी आधारकी क्षेत्रफल (A) = $49 m^2$
 पिरामिडकी उचाई (h) = $12 m$
 पिरामिडकी आयतन (V) = ?
 पिरामिडकी आयतन (V) = $\frac{1}{3} A h$
 $= \frac{1}{3} \times 49 \times 12$
 $= \frac{588}{3}$
 $= 196 m^2$ → Encoding error

Looking at the solution, the researcher has analyzed that the student had performed the correct way but failed to write the correct given number and answer in an acceptable written form. Thus according to Newman, it was an encoding error.

While conducting test items, 128 items were committed encoding errors so that students were not able to use the appropriate place and did not write correct answers.

Causes of Error committed by Students

The data collection program was conducted on students through interviews. The interview program was performed on the basis of interview guide lines to find the causes of errors. Interview guidelines were provided to the sample student who

committed maximum error in the area of an equilateral triangle .Most of the students were interested due to the researcher's request to interact during the interview. The questions were asked about the possible causes of error in problems solving in mensuration. They need to give the answer that what are the possible causes that forced you to dislike mensuration.

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 a question to read. Only 9.24% of errors were committed by the students in the test item.

Causes of reading errors were given below:

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

Less important is given in reading questions in the classroom, by the mathematics teacher. Lack of knowledge to recognize the symbols which are used in mathematics.

Reading errors occur due to the unclear voice of respondents.

In conclusion, hesitation, poor background of language, knowledge of technical terms, symbols and voice are the responsible causes of reading errors. Teachers need to encourage the students; teachers should pay special attention to the language.

Causes of Comprehension Error

The error was kept under the comprehension error when students were unable to receive what the question asked. It was found out through the answer sheet and interview. Students committed 183 errors out of 746. It was about 24.53%.

Causes of comprehension error were given below:

Some students perform the comprehension error due to the lack of prerequisite knowledge.

Students have difficulty in comprehension due to lack of knowledge of technical terms in mathematics.

Some students perform comprehension errors due to the bad relation with the mathematics teacher.

Lack of classroom management and noise.

Tension at home is also one of the causes of comprehension error.

Partial attention to the teacher's explanation.

Students only listen in class but do not participate in discussion.

In conclusion, after studying the above statements presented by the different mathematics teachers the researcher drew that comprehension error occurred due to monotonous environment, own meaning, lack of knowledge of technical terms, lack of attention to the teacher's explanation.

Causes of Transformation Error

An error was classified as a transformation error if the students had understood what the question was 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. Large numbers of errors were committed by the students in this level i.e. 185 out of 746 which is about 24.79%.

Causes of Transformation error were given below:

Students commit transformation errors due to the lack of concept and meaning of the mathematical words.

Students commit transformation errors because teachers focus on the calculation but do not give emphasis or do not explain about the question properly.

Students commit transformation errors because of a lack of prerequisite knowledge of their previous classes.

Transformation error occurred due to being unable to identify the correct operation to solve the problem.

Lack of classroom discussion.

In conclusion, transformation errors are occurred due to incomplete explanation, clarifying the problem, lack of mathematical concept skill and more emphasis on calculation part on mathematics.

Causes of process skill error

An error was classified as a process when a student was unable to identify the correct operation and did not know the procedures to carry out these operations accurately. In mensuration problem solving test students were committed 181 errors Out of 746. It was about 24.26%. It was found out through the answer sheet of the test.

Causes of process skill error were below:

Lack of teaching materials in mensuration problems.

Lack of practice to solve mensuration problems at home and classroom.

Lack of mathematical skills which are essential to solve the mensuration problem.

In conclusion, from the study of above statements the researcher found that process skill error occurs due to mix-up of rules, lack of thinking alternative, not listening to the teacher explanation properly, and less practicing the problem.

Causes of Encoding Error

An error was classified as encoding if the students correctly worked the solution to the problem but could not express the solution in an acceptable written form. In the test students committed 128 errors out of 746. It was about 17.15%. It was found out through the answer sheet of the problem solving test.

Causes of encoding error were given below:

Encoding error occurred due to carelessness of students.

Sometimes limitations of time in test

Lack of homework and class work checking.

In conclusion, encoding error occurs due to carelessness, importance is given to finding the answer and less importance to arranging the procedure.

Chapter-V

SUMMARY, FINDINGS, CONCLUSION & RECOMMENDATIONS

This chapter deals with the summary, finding, conclusion and recommendations concerning the analysis of error of mensuration in grade X. This chapter is divided into four sections: summary, finding, conclusion and recommendations of the study.

Summary and Findings

The study was aimed at fulfilling three objectives. They were to categorize the errors committed by the students of grade ten in solving problems of mensuration, to analyze the error committed by students in solving problems of mensuration in mathematics, to find out the cause of error in solving problems of mensuration in mathematics. The sample in this study consisted of 40 students from one public school and one private school of Saptari District. The schools were purposely selected. Newman technique of error analysis and observation was adopted as the theoretical base of this study. Test consisted of twelve questions. Errors from the test were analyzed by applying Newman technique of error analysis. Error collected from the answer sheets. From the mensuration 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 a 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 students were 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 accusatory then process error was committed there. An error was classified as an encoding error of the solution in an acceptable written form. The errors in each of five problems were classified and later the errors in total were tabulated.

The main findings of this study are following:

The total number of errors committed by the students in reading error 69 in comprehension error was 183 in transformation error 185 in process skill error 181 in encoding error 128 these errors were tabulated by checking answer sheets and using Newman's technique.

Students did not have even the general concept of mensuration. So, many errors were found while solving the problem of mensuration.

Students thought that the mensuration chapter was more difficult than other chapters.

In the test, least errors were found in reading and most of the errors found in reading and most of the errors found in transformation and process.

Transformation and process part is more important in problem solving so that students commit more errors in problem solving, then skill and application and knowledge.

Most of the errors were committed by the students because of poor background in concept and mensuration formula.

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

Teachers and students thought that mensuration is one of the difficult chapters.

Lack of instructional materials, the teacher was not teaching effectiveness.

Using salient features by the teachers on teaching mensuration restricts the students from complete understanding the problem.

Conclusion

Mensuration is a most important topic of compulsory mathematics. It is applied mathematics. Most of the errors are committed by the students. The main objectives of the study were to categorize the errors committed by the students of grade ten in solving problem of mensuration, to analyze the error committed by students in solving problem of mensuration in mathematics, to find out the causes of error in solving problems of mensuration in mathematics. According to the objectives of the study the data were collected and analyzed.

From the study, it is concluded that the students committed errors in comparison and are more than reading. Similarly, the students committed error comparison transformation is more than comprehension and the students committed error process skill is more than encoding.

Recommendation for Educational Implication

On the basis of findings and conclusion the following recommendations for educational implication are made:

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

Students become puzzled when a new chapter approaches them at secondary level. So, any topic should be introduced from a lower level.

Most of the errors are committed by the students because of poor background in concept. Mathematical concepts should be explained in detail by using simple language with illustration.

Compare the problems due to understanding the relative of the problem.

Before starting the problem solving, the teacher must prove the formula by inductive method.

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

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

Opportunity should be given to the students to express the question in their own words after reading.

The teacher should try to find out the reason about committing the errors

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

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

Recommendations for further Study

The result and conclusion of the study generates some other questions which need to be verified.

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

How the errors committed by students can be minimized?

What will be the impact of individualized instruction in reducing the error committed by students?

What would be the result of error analysis at a lower and higher level?

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Appendix-A**Test Questionnaire**

Class:-X

Time:1hrs30min

Sub: - comp. Mathematics

Full marks:40

Attempt all the questions:**Group-A****4×1=4**

1. Write the Heron's formula to find the area of triangle if all sides are given of a triangle.
2. What will be the volume of a cone if the cone has base area 'y' sq. unit and height 'x' unit?
3. Find the area of an equilateral triangle whose side is 4cm.
4. Find the volume of a squared pyramid if its base area is $49m^2$ and height is 12m.

Group-B**4×4=16**

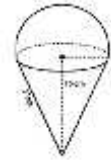
5. If the volume of a prism of height three times of the sides of its squared is $375cm^3$, find its total surface area.
6. The ratio of the radius of the base to the height of a cylinder is 2:3 if its volume is $12936cm^3$, find the height of the cylinder.
7. The volume of a triangular prism is $960cm^2$. If the height of the triangle prism is 20cm and measures of its triangle base sides are 10cm, 10cm and xcm respectively, find the cross-section area, lateral surface area and total surface area of the triangular prism.
8. The total surface area of a cone is $704cm^2$. If the sum of its slant height and the radius of its base is 32cm. Find the slant height of the cone.
9. Find the volume of a triangle prism having length 30cm and measure of triangle base sides are 6cm, 25cm and 29cm respectively.

10. A square based pyramid has length of base 15cm and slant height 18cm. Find the total surface area.

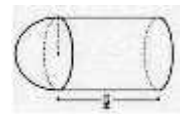
Group-C

2×5=10

11. A cone has its height 15cm and slant height 17cm. If it is filled up with ice-cream in such a way that its upper part is hemi-sphere find the volume of the ice-cream.



12. Composed of a cylinder with hemi-sphere at one end. If the total surface area and length of the solid are 770cm^2 and 14cm respectively. Find the length of the cylinder only.



Appendix-B

S.N.	Name of the students	question Numbers											
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	Abhishek K. Chaudhary	Ce	Re	Re	Te	Pse	Re	Ee	Ce	Pse	Ee	Re	Te
2	Preti Chaudhary	Pse	Ce	Ce	Re	Ce	Pse	Ce	Te	Ee	Re	Ce	Pse
3	Neha Chaudhary	Re	Te	Te	Te	Te	Ee	Re	Pse	Pse	Te	Te	Pse
4	Rajesh Kumar Sah	Ee	Re	Re	Ce	Re	Pse	Pse	Re	Ee	Ee	Re	Te
5	Salendra Kumar Sada	Te	Ce	Ce	Pse	Ce	Ee	Ee	Pse	Re	Re	Ce	Re
6	Om Narayan Chaudhary	Ce	Te	Ce	Te	Te	Pse	Pse	Te	Ce	Te	Re	Pse
7	Subhod Sah	-	Re	Re	Re	Re	Ee	Ce	Ce	Te	Pse	Ce	Ce
8	Retesh Chaudhary	Ee	Te	Te	Te	Ce	Ce	Pse	Re	Te	Ee	Te	Ee
9	Pinki Paswan	Pse	Ce	Ce	Pse	Te	Ee	Re	Ce	Ce	Pse	Re	Ce
10	Karishma sah	Re	Re	Re	Ce	Re	Ce	Pse	Ce	Re	Re	Ce	Re
11	Monika Chaudhary	Ee	Te	Te	Te	Ce	Pse	Ee	Te	Te	Ee	Te	Ce
12	Arjun Chaudhary	Te	Te	Ce	Ce	Te	Ee	Pse	Re	Ce	Pse	Re	Re
13	Anjuli Chaudhary	-	Ce	Re	Te	Re	Ce	Ee	Ce	Te	Pse	Ce	Ce
14	Madhu Kumar Paswan	Ce	Te	Te	Re	Ce	Pse	Ce	Te	Te	Ee	Te	Re
15	Mo. Adam Rain	Pse	Re	Ce	Ce	Te	Ee	Re	Pse	Pse	Pse	Re	Ce
16	Aarti Kumar Paswan	Te	Ce	Ree	Ee	Te	Ce	Ce	Te	Ee	Ee	Ce	Pse
17	Karan KumarPaswan	Pse	Te	Ee	Ce	Re	Pse	Pse	Ee	Pse	Re	Te	Ee
18	Anjuli Kumar Chaudhary	Ce	Pse	Ce	Pse	Te	Ee	Re	Te	Ce	Pse	Re	Pse
19	Laxmi Kumar Chaudhary	Ee	Pse	Te	Ee	Ce	Pse	Pse	Ce	Pse	Ee	Ce	Re
20	Raj Kumar Chaudhary	Te	Re	Ce	Ce	Pse	Ce	Pse	Te	Te	Pse	Pse	Te
21	Sunjay Kumar Caudhary	Pse	Pse	Te	Ee	Te	Ce	Pse	Te	Pse	Ce	Ee	Ce
22	Ramita Kumar Caudhary	Ce	Ee	Pse	Pse	Te	Te	Pse	Ee	Te	Re	Te	Ee
23	Radhe krishan Caudhary	-	Pse	Te	Te	Ce	Pse	Ce	Pse	Te	Pse	Ee	Te
24	Parash Kumar Chaudhry	Pse	Ee	Ee	Ce	Te	Ce	Te	Ce	Te	Ce	Pse	Ee
25	Niraj Kumar Ram	Ce	Pse	Te	Pse	Pse	Te	Pse	Ee	Ce	Te	Te	Te
26	Rupesh Kumar Chaudhary	Ee	Pse	Ee	Te	Te	Pse	Re	Ce	Te	Pse	Re	Re
27	priyanka Ram	Ce	Ee	Te	Ee	Te	Ce	Te	Ce	Te	Ce	Pse	Ce

28	<i>Shiv Kumar Mandal</i>	<i>Te</i>	<i>Pse</i>	<i>Pse</i>	<i>Pse</i>	<i>Pse</i>	<i>Ce</i>	<i>Te</i>	<i>Ee</i>	<i>Ce</i>	<i>Te</i>	<i>Ce</i>	<i>Ee</i>
29	<i>Ramesh Kumar Caudhary</i>	<i>Ce</i>	<i>Pse</i>	<i>Te</i>	<i>Te</i>	<i>Te</i>	<i>Te</i>	<i>Ce</i>	<i>Ce</i>	<i>Re</i>	<i>Ce</i>	<i>Re</i>	<i>Te</i>
30	<i>Bimala Kumari Biswakarma</i>	<i>Ee</i>	<i>Re</i>	<i>Te</i>	<i>Ce</i>	<i>Ce</i>	<i>Ce</i>	<i>Te</i>	<i>Ee</i>	<i>Te</i>	<i>Pse</i>	<i>Ee</i>	<i>Te</i>
31	<i>Krishana Kumar Sah</i>	<i>Te</i>	<i>Pse</i>	<i>Pse</i>	<i>Ce</i>	<i>Te</i>	<i>Te</i>	<i>Pse</i>	<i>Ce</i>	<i>Te</i>	<i>Te</i>	<i>Ce</i>	<i>Ce</i>
32	<i>Nirauta Kumari Chaudhary</i>	<i>Ce</i>	<i>Te</i>	<i>Ce</i>	<i>Pse</i>	<i>Pse</i>	<i>Pse</i>	<i>Te</i>	<i>Ee</i>	<i>Ce</i>	<i>Ce</i>	<i>Re</i>	<i>Te</i>
33	<i>Priya Kumari Chaudhary</i>	-	<i>Pse</i>	<i>Pse</i>	<i>Te</i>	<i>Te</i>	<i>Ce</i>	<i>Pse</i>	<i>Ce</i>	<i>Te</i>	<i>Pse</i>	<i>Pse</i>	<i>Ce</i>
34	<i>Ashoka Nand Yadab</i>	<i>Te</i>	<i>Ce</i>	<i>Ce</i>	<i>Ce</i>	<i>Pse</i>	<i>Te</i>	<i>Te</i>	<i>Ce</i>	<i>Te</i>	<i>Pse</i>	<i>Re</i>	<i>Ee</i>
35	<i>Manisha Kumar Takur</i>	<i>Ee</i>	<i>Pse</i>	<i>Ee</i>	<i>Pse</i>	<i>Te</i>	<i>Ce</i>	<i>Pse</i>	<i>Ee</i>	<i>Ce</i>	<i>Ce</i>	<i>Ce</i>	<i>Te</i>
36	<i>Durga Nand Paswan</i>	<i>Pse</i>	<i>Te</i>	<i>Pse</i>	<i>Ce</i>	<i>Pse</i>	<i>Ce</i>	<i>Te</i>	<i>Ce</i>	<i>Te</i>	<i>Pse</i>	<i>Ee</i>	<i>Ce</i>
37	<i>dipika Chaudhary</i>	<i>Ce</i>	<i>Pse</i>	<i>Ee</i>	<i>Te</i>	<i>Te</i>	<i>Ce</i>	<i>Pse</i>	<i>Ce</i>	<i>Ce</i>	<i>Ce</i>	<i>Te</i>	<i>Te</i>
38	<i>Dhirendra Kumar Kamat</i>	-	<i>Ee</i>	<i>Ce</i>	<i>Ce</i>	<i>Pse</i>	<i>Te</i>	<i>Ee</i>	<i>Ce</i>	<i>Te</i>	<i>Pse</i>	<i>Ee</i>	<i>Ce</i>
39	<i>Binita Kumar Chaudhary</i>	<i>Te</i>	<i>Pse</i>	<i>Ee</i>	<i>Te</i>	<i>Te</i>	<i>Ce</i>	<i>Pse</i>	<i>Te</i>	<i>Ce</i>	<i>Ce</i>	<i>Pse</i>	<i>Pse</i>
40	<i>BumikaKumariChaudhary</i>	<i>Ee</i>	<i>Ce</i>	<i>Ee</i>	<i>Pse</i>	<i>Ce</i>	<i>Pse</i>	<i>Te</i>	<i>Ce</i>	<i>Ce</i>	<i>Pse</i>	<i>Ee</i>	<i>Ce</i>

Note:

Re=Reading error

Ce=Comprehension

Te= Transformation error

Pse=Process skill error

Ee=Encoding error

Sample of Teachers for Interview

S.N.	Name of the Teachers
1.	Amit Kumar Chaudhary
2.	Rajesh Kumar Chaudhary
3.	Gaury Narayan Chaudhary
4.	KashiLalChaudhary

Appendix-C

Interview questions for finding the error related to Newman procedure of error analysis.

-) Please read the question to me. (Reading)
-) Tell me what the question is asking you to do. (Comprehension)
-) Tell me a method you can use to find an answer to the question. (Transformation)
-) Show me how you worked out the question. Explain to me what you are doing as doing as you do it.(Process Skill)
-) Now write down your answer to the question.(Encoding)

Appendix-D

Interview Guidelines for Students

Related to the Teacher

-) Behavior of teacher in classroom
-) Relation with other teacher and student
-) Teaching style
-) Effort of teacher to teach content

Related to Students

-) Attendance in classroom
-) Participation in mathematical programmed in or outside school even classroom
-) Like or unlike subjects
-) Interest in mathematics as well as mathematics related subjects
-) Relation with teacher (especially with mathematics teacher)
-) Peer group relation
-) Future plan
-) View towards mathematics (Discuss will be carried out deeply as possible)
-) What pressured to hate mathematics? (Searching their view)

Related to School Environmental Condition

-) Physical facilities (desk ,bench, black etc)
-) Library conditions
-) Latrine situation
-) Instructional martial

Related to Teaching process and materials

-) Teaching method frequently used by teacher (students center/ teacher center)
-) Material (using condition) and so

Related to family Background

-) Family's educational status
-) Family's economical conditions
-) Role of parents (support/negligence/natural)
-) Home environment (educational environment)