EFFECTIVENESS OF INSTRUCTIONAL MATERIALS IN TEACHING MENSURATION

A

THESIS

BY

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

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LETTER OF CERTIFICATE

This is certified that Mr. Tejendra Luhar, a student of the academic year 2070/71 with the Exam Roll No. 281260, Campus Roll No.1509, Thesis Number 1091 and T.U Registration No. 9-2-327-723-2008 has completed his thesis under my supervisor, during the period prescribed by the rules and regulation of Tribhuvan University, Nepal. The thesis entitled **"Effectiveness of Instructional Materials in Teaching Mensuration"** embodies the result of his investigation, conducted during the period 2071/72 in the Department of Mathematics Education Central Department of Education University Campus Tribhuvan University Kirtipur, Kathmandu. I recommend and forward that his thesis be submitted for the evaluation to awarding the degree of Master of Education.

…… …….

(Mr. Lok Nath Bhattarai) (Assoc. Prof. Laxmi Narayan Yadav)

Supervisor Head

Date:-

LETTER OF APPROVAL

Thesis Submitted

By

Tejendra Luhar

Entitled

"Effectiveness of Instructional Materials in Teaching Mensuration" has been approved in partial fulfillment of the requirements of the degree of Master of Education.

Committee for the Viva-voce	**Signature**
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Pro. Dr. HariPrasad Upadhya (Member)	…….
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…….....

(Tejendra Luhar)

Date:-

ABSTRACT

The purpose of present study was to find out the effectiveness of the instruction materials in teaching mensuration at lower secondary level. The researcher selected just one school for his research purpose, it was shree Saraswati Secondary school, Kanchanpur district. The research was carried out for period of 14 days. The design of the research was experimental in nature with sample of 44 students of grade VIII. The quantitative data derived from pre- post test on experimental and control groups were analyzed applying t-test. The experimental group was taught by using different instructional materials and control group was without using instructional materials. Pre test was administered before the experimental started. The experimental runs for the duration of 14 days. After 14 days a post test was administered on both groups and the mean scores was calculated. The difference in mean achievement score are tested by using t- test at 0.05 level of significance.

Finally, the researcher concluded that the achievement of students of experimental group is better than the achievement of control group. The result showed that there is significant difference in achievement of experimental group over control group while using of instructional materials in teaching of mensuration at lower secondary level.

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Chapter-I

INTRODUCTION

Background of the Study

The word “Mathematics” has been taken from a Greek word “Mathema” which is derived from “Mathaein” means “to learn”. Mathematics is an essential part of civilization. It was organized together with the origin of human civilization so; the history of mathematics is the history of civilization. Mathematics understanding is essential for better living in modern scientific and technology changing society.

Mathematics is an interesting subject and can nurture creativity in life. However, students think that mathematics is an uninteresting and meaningless subject. Students feel afraid, worried and anxious to learn mathematics. Furthermore, students perceived that mathematics is a difficult subject due to lack of mathematics laboratory and unattractive teaching method that is not related to real life and real world problem (Ali et al., 2010; Cazzola, 2008). Moreover, many schools are more focused on their performance to achieve excellent examination results, especially in the public examination. As a result, students focus on the examination without understanding the concept of real mathematics. Previous research in mathematics shows that conventional strategy cannot enhance mathematical thinking skills (Ahmad et al., 2008) as nowadays, students like challenges in learning mathematics that emphasizes self-learning with available resources and help them to develop skills in various fields. However, they still need a teacher to facilitate them to identify what they need to know and learn in order to solve problems. Moreover, peers and computer-paper based cognitive tools (Schmidt et al., 2011) also play a significant role as a scaffold to facilitate meaningful and lifelong learning. Mathematics teacher should create a

learning environment that makes mathematics as an enjoyable subject that enhances students' thinking skills, brainstorming, as well as initiates more discussion and gives motivation. Students' perceptions towards mathematics as a subject that is not integrated and has no connection with real life can be changed by providing them with an authentic mathematical problem scenario, where this relationship between mathematical concepts and everyday life is often overlooked.

Instructional materials can be used to build new mathematical knowledge, to solve problems that arise in mathematics and in other contexts, to apply and adapt a variety of problem-solving strategies, and to monitor and reflect on the mathematical problem-solving processes. However, depicting complexity of thinking and learning processes in such environments offers challenges to researchers. A possible solution may be through multiple perspectives. On one exemplary problem this instructional method will be demonstrated in a technological context including then behaviors, dispositions and knowledge observed as a result of problem solving investigations in a technological context. These are discussed from three different perspectives-students', lecturers and researcher's offering a rich portrait of a problem solving mathematical activity in a technological context. Implications for mathematics instruction at the secondary and tertiary level were given at the end of report.

According to oxford dictionary "Mathematics is the science of number and space", Lock defines it as mathematics is a way to settle in the mind a habit of reasoning". Thus, the term "mathematics" has been interpreted and explained in various ways. It is the numerical and calculation part of man's life and knowledge. It is also defined as the science of abstract form.

To overcome the various problems on numerals, counting and calculation men themselves created and developed the important discipline called mathematics. The

word “Mathematics” has been derived from the ancient Greek word “Manthanein” which means “to learn”. This indicates that mathematics is taken as a process of learning and interpreting the natural phenomena of each individual. It has been explained in other ways such as it is he knowledge of numerical and calculation part of man’s life. Mathematics as we know it today is the science of number and their operations, interrelation and combination of space configuration and their structure, measurement etc.

The important of mathematics is ever increasing. What occupation a student will choose in the future, the understanding and mastery of mathematical concepts, skills and processes will essentially develop his efficiency. Understanding of mathematic is very essential for everyday life as well as for higher studies. In the field of science and applied science, Mathematics helps the students to understand and interpret the important aspects of living. Mathematics had been originated along with the origin of human civilization. No body can live without fundamental knowledge of mathematics. Mathematical structure is characterized by undefined terms, defined terms, axioms and rule of logics. Mathematics is an organized body of knowledge. It arose from the needs of organized societies of the people.

Every culture on earth has developed some mathematics. In some cases this mathematics has spread from on culture to another. Now there is one predominant international mathematics and this mathematics has quite a history. It has root in ancient Egypt and Babylonia, then grew rapidly in ancient Greece. Mathematics written in ancient Greek was translated into Latin and becomes the mathematics of Western Europe. Over a period of several hundred years, it become the mathematics of the world. Mathematics gives the logical foundation to investigate the unknown.

Mathematics continuous to grow at a phenomenal rate. There is no end in sight and the application of mathematics, in science becomes greater all the time.

Here the history of mathematics education has seen greater changes, not only in what is being taught but also in the manner of the teaching. There has been great variation in education. The opinion of the public and academic societies towards a predominantly. Mathematics or scientific education has for the most part has been very different to those held now. There are numerous questions which come immediately to mind what topics in mathematics have been taught and to what extent? What are the reasons for the changes that have taken places? How has mathematics been taught? Are the methods of today very different to those used centuries ago? Does materials effect on mathematics achievement? Do the independent variables like parent's education, socio-economic condition, gender, teaching method and teacher qualification etc. effect on achievement students?

Imagine a primitive tribe living by hunting and collecting the natural harvest of forest and field rudimentary forms of country is needed to communicate important to the tribe. This may be the animals in heard or the number of people in a hostile tribe. Also needed to measure of size, distant and time however crudely formulated they may be a certain primitive awareness of similarities of shapes must be present in effort to duplicate arrowheads and implements. It is also important to have some means of describing location involving both distance and direction. Thus even which later developed into mathematics is necessary. Moreover, this primitive tribe needs something of virtually all the greater branches of specialized mathematics.

With the introduction of the new mathematics the discovery method and the use of exploratory material make mathematics more meaningful. The general observation is that most of the schools of Nepal are still using the traditional method

characterized by mastery of subject matter through drill, repetition and memorization of study indicates that only 8 or 9 percentage of the school budget allocated for educational materials. Which included both stationary and instruction aids. This sum is absolutely inadequate for the provision of instructional materials in the school is extremely limited, without the use of necessary materials the teacher particularly remains unable to adopt modern inquiry.

Material that provide support for teacher need to be built into the programs .These materials should contain specific suggestions and illustrative examples of how the teacher can implement a standards –based mathematics program. Instruction should need following criteria. All component of the program are provided so that there is little or no need for teacher to identify gather or develop supplementary materials.

Mathematics is generally regarded is difficult subject. Studies have been done relating to the instructions materials and methods for the development of effective teaching learning situation. Aryals shows the situation in the following words “to some students mathematics is collections of meaningless symbols, to other rules and to still other tricks and jargon. To some mathematics is a queen red in the tooth and claws .The situation is created due to the lack of understanding of mathematics and suitable teaching learning process .In order to enhance understanding of the mathematical concept, mathematics more meaningful and understandable for the people of primary level as well as lower secondary level.

Agwagah (2000) had noted the mathematics teacher in most cases do not use instructional materials in their mathematics classroom, so most of the mathematics concepts are taught abstractly. This may be because some of the mathematics teachers believed that instructional materials to be used for teaching these mathematics

concepts are not in existence. Even when they are available, there is this complain of lack of money by the mathematics teacher. This maybe one of the factors responsible for students' continuous frailer in public mathematics examinations.

Piaget (1957) theory of concrete operational stage point out that the mathematics teacher should be conscious of the developmental level of the learner. This becomes very important because majority of the basic education level students are still at the concrete operational level.

Johnson speaks of the importance of materials in the following line "instructional materials are as essential for mathematics teacher as species as for the chef." They are necessary extra ingredients that makes teaching and learning mathematics pleasant satisfying experience models, pamphlets, films given that would be difficult to obtain in any other was.

With the introduction of the new mathematics the discovery method and the use of exploratory material make mathematics more meaningful. The general observation is that most of the schools of Nepal are still using the traditional method characterized by mastery of subject matter through drill, repetition and memorization of study indicates that only 8 or 9 percentage of the school budget were allocated for educational materials. Which included both stationary and instruction aids. This sum is absolutely inadequate for the provision of instructional materials in the school is extremely limited, without the use of necessary materials the teacher particularly remains unable to adopt modern inquiry.

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of the program are provided so that there is little or no need for teacher to identify gather or develop supplementary materials.

Amatya (1978) made a comparative study on the effectiveness of teaching mathematics with and without the use of instructions materials. He conclude that the achievement of student taught by using instructional materials is significantly higher than the achievement of the student taught without instructions materials.

Gagne (1963) defines learning as change in human disposition or capacity which can be related and which is not simply accessibly to the process of growth. Learning as the permanent change in behavior potential which occurs as a result of reinforce practice.

Singh (1975) in a study on the availability of instruction material pointed out that the degree of availability of materials is closely linked to the training and qualification of the teachers.

Bruner describes "A child makes three level of representation. The first level is the inactive level where the children manipulate material directly. The second level children then progress the iconic level, where children deals with mental images of objects but does not manipulate then directly. Finally children moves to the symbolic level, where children's are strictly manipulating and no longer mental images of objects

Panday (2042) did an experimental research work on" use of visual aids in teaching fraction". Development of teaching module for teaching in lower secondary level, selecting proper visual aids and see how effective the prepared models where teaching models with visual aids and a plain verbal exposition model where prepared.

His research showed that the teaching model with visuals aids was found to be more effective than the plain verbal exposition models.

Statement of the Problem

Mathematics is one of the important disciplines with broader application all over the world. Mathematics is the compulsory subject in our school education. Various kinds of researches were done in the different area of mathematics. The view of people towards mathematics is not positive till now, though many researches carried out in this area. Mathematics is still considered as a complex subject on the view of students and their parents. Most the students are failed in exam due to its cause it means it is a major issue in our educational society of Nepal. Some people consider mathematics as a complex subject that drive students not only from school but also from actual life. Most of the students failed in exam due that people thinking mathematics is hard subject, which is still a burning issue in mathematics teaching.

Education is one of the basic human rights. Education cannot establish as a right because of its expensiveness. The mathematics education of Nepal is facing many problems such as the lack of qualified and trained teachers, lack of good implementation of teaching methods and lack of teaching materials.

Most of the people believe that the teaching strategy is the main problem for higher rate in mathematics. Most of mathematic teaching technique applied in classroom are based on teacher centered method that makes the students passive and also the slow learner. Most of teacher still are applying the tradition approaches although they have pedagogical knowledge and are trained. In Nepal, the teaching and learning situation of mathematics is not satisfactory and large numbers of students

failed in mathematics. There are no sufficient teaching materials and appropriate teaching methods.

The present study focused on exploratory of extend of effectiveness of instructional materials in teaching mensuration at lower secondary level. In order to ascertain the effectiveness of the instructional materials in teaching of mensuration at lower secondary school, this study tries to answer the following researcher questions.

- Does the instructional materials for teaching mathematic are effective?
- Is there any significant difference between the achievement of students taught by using instructional materials and without using instructional materials?

Objectives of the Study

The objective of this study were a follows;

- To compare the achievement of students taught by using instructional materials and without using instructional materials.
- To find the effectiveness of instructional materials on teaching mensuration.

Significance of the Study

If we can taught mathematics by using instructional materials with PBL in teaching method, students were motivated toward mathematics and they get success in their future study. So the teaching of mathematics has concerned some factor like as teaching style, teaching strategies, teaching methods and using of instructional material. Teaching of mathematics becomes more meaningful by using proper materials. Mathematics is major subject in our educational system. It is taught from the elementary level to the higher level.

There are various areas of mathematical knowledge, but in our mathematics curricula selected topic are included. Mensuration is one of them and there is a general belief that an instructional materials also governs the achievement of students. We derived our study toward the impact of instructional materials over the achievement to mensuration teaching and learning process. This was the problem under our investigation. If it could be provided the effect in the achievement on mensuration teaching conclude the optional use of materials.

The objects of mathematics are the cultural products "facts, skill, concepts and principles". The exiting curriculum of mathematics is a reform oriented program. Reform brings some new contents more on teaching learning. So we have to suggest the effective approach or methods as well as materials for teaching through research. Instructional materials play an important role in making learning meaningful and help people to overcome their difficulties. Even though the wide range of its impact of materials on teaching and learning of mathematics has not been studied. Very few teachers are used them. Most of the mathematics teachers teach following traditional way, without the using of materials. There is a lack of adequate number of experimental studies related to teaching learning activities. So the problem of efficiency dropout and failures of students in school are considerably high in mathematics. These studies will have given an evidence of the effectiveness of instructional materials in teaching at lower secondary level. It is also tries to give an advice to use the materials during the teaching and learning. The significance of this study can be stated as follows;

- It would help the mathematics teachers to improve their teaching strategies.

- It helps to improve the mathematics result of lower secondary level students.

Hypothesis of the Study

Statistical Hypothesis

The statistical hypothesis formulated for this study were as follows:

$H_0: \mu_1 = \mu_2$ (Null Hypothesis)

$H_1: \mu_1 \neq \mu_2$ (Alternative Hypothesis)

Where μ_1 and $\mu_2$are the mean achievement score of the student taught by using instructional material for experimental groups and without using material for control groups.

Delimitation of the Study

This study was limited in following criteria

- This study was limited in one lower secondary school of Kanchanpur district.
- Only the public school student was included in this study.
- The researcher was taught only mensuration of grade VIII.

Definitions of key Terms

Achievement

The achievement on this study is defined in terms of the score obtained by the learners.

Effectiveness

The effectiveness in this study is defined in terms of the magnitude of the score obtained by experimental and control group students in the mathematics achievement test.

Experimental Groups

The students who were taught by using instructional materials is considered as experimental group in this study.

Control Groups

The students who were taught by without using instructional materials is considered as control group in this study.

Instructional Materials

The manipulative materials such as model of rectangular, quadrilateral, cube, cuboids and triangles are considered as instructional materials in this study.

Students

This term is use for both boys and girls who studied on grade VIII of Shree Saraswati Higher Secondary School of Kanchanpur district.

Public School

Public schools are those schools which receive the government grant for the salary of teacher and other purpose

Chapter- II

REVIEW OF THE RELETED LITERATURES

This chapter reviews the related literature to compare the study which provides the strong knowledge about the related topic, number of books, research reports, papers and other booklet can be found that concerned with curriculum, teaching materials, methods and so on. Instructional materials play a vital role in an instructional program as learning is based primarily on sensory experience and teaching materials provide visual and sensory experiences for the students.

Research in any sector of skill wants a suitable studies with the works in which there are many research that have been done in the same area. The purpose of review of literature is to study upon the text and background of the study. There are so many books report and related studies reviewed in order to the presented problem of the study.

There are some studies about collecting in mathematics education in which some are published and some are unpublished in national and international level. So some related literature which were reviewed in this researcher are discussed as follows;

Empirical Literature

Shresth (1991) conducted a study entitled a study of sex difference in achievements in mathematics of ninth grade students on Gorkha district with the aim to investigate whether the sex influences the achievement in mathematics as well as to find out some possible reasons that might be responsible for the difference in the achievement. He prepared two set of tools, achievements test and questionnaire and administered them to two hundred eighteen students of five schools. He applied t- test

to conclude that boys devote more time than girls at home study hours for mathematics together with all subjects and boys favored mathematics more and felt less difficult than girls.

Bhusal (2000) conducted a study on the effectiveness of teaching geometry using discover and expository model in secondary level to find out whether discover model of teaching in geometry is more useful than expository to prove geometrical theorems as well as to compare the achievement between the groups of students taught by using discovery and expository model of teaching. Thirty students were sampled and divided in to two groups (experimental and control). They were exposed separately to discovery and expository models for teaching. The same topic parallelogram, are of triangle and quadrilateral was taught for three weeks, the t-test was applied and concluded that discovery model of teaching was better than the expository model of teaching in Geometry.

Baral (2005) conducted a research on effectiveness of instructional materials in teaching geometry in primary level to find out whether the instructional materials are effective to develop geometrically concept. A pre- test post- test non equivalent group design was adopted for the purpose of the study. Forty students of two schools were selected as experimental and control groups. Both groups were taught by the researcher himself on the topic geometry with and without teaching aids for twenty day. The t- test was applied arid conclusion was that the achievements of the students' taught with instructional materials was better than the achievement of the students taught without using instructional materials.

Gautam (2005) conducted a research on effectiveness of instructional materials in teaching mensuration at secondary level to find out whether teaching materials are effective to develop the concept and to estimate the surface area and

volume of cone, prism and pyramid. A pre test and post test least equivalent group design was adopted for the purpose of the study. Seventy six students of two school were selected as experimental and control group. Both groups were taught by the researcher himself on unit mensuration with and without teaching aids for fifteen days. The t- test was applied and conclusion was that the achievement of the students taught with instructional materials was better than the achievement of the students taught without using instructional materials.

Poudel (2005) in his study of all learning strategies of mathematics concepts of out of school children pointed out different mathematical concepts were constructed in different situation as they were engaged in household works, farm works, labor works and the interaction between the members of family and society. He further note that, they acquired mathematical concepts through experience, practice and scaffolding. It was also found that they learned by observing other's work, by hearing from the other and by repeating them.

Shaibu and Usman (2006) studied on involvement of students in the teaching and learning process which means a departure from the traditional methods of teaching is another means of ensuring active learning in science and mathematics. The call for a departure from traditional methods of teaching with its attendant poor performance indices has been sounded by researchers.

Thapa (2006) conducted a study on "Impact of instructional materials in teaching mathematics at primary level schools of Lamjung district." With the aim of investigate the impact of instructional materials in teaching mathematics at primary level. He selected ten secondary schools randomly for Lamjung district. Researcher compared the result of class five between the school using instructional materials and schools not using instructional materials. He used mean, standard deviation and

variance to compare their results. Finally researcher found the achievements of school teaching with instructional materials was higher than the achievement of school teaching without using instructional materials.

Hereeg and Hereeg (2010) conducted study on two groups of students. One group used applets only, whilst the other used the instructional materials and applets. The Study tested how to incorporate computer-based learning to reduce the working process of numerical integration. The result of this study showed that the materials experimental group gained more knowledge and skills than the control. This study also suggested that materials use is helpful for students who face difficulty in solving mathematical problems.

Calhour C. Callier and Harold H. Learch write, "Teacher are becoming increasingly aware that many children need to see, to feel or touch, to talk as well as to hear or listen in order to developed meaning and understanding. In addition familiar printed materials; chalkboard and the paper pad, available in any number fin readily available any number of instructional aids such an manipulative materials, charts, audiovisual aids, models, games and other devices to help each individual develop clear mental pictures of truths of mathematics."

Engen writes; "Mathematics instances of the symbolic integration of various sensory experiences which are essential to formation of concept can be readily given. The child in his early work in elementary school has many experiences with the actions with taking 2\3 of some physical objects."

Theoretical Literature

There are many learning theories are developed in instructional materials. Schoen (2003) described this instructional approach: As students attempt to solve rich

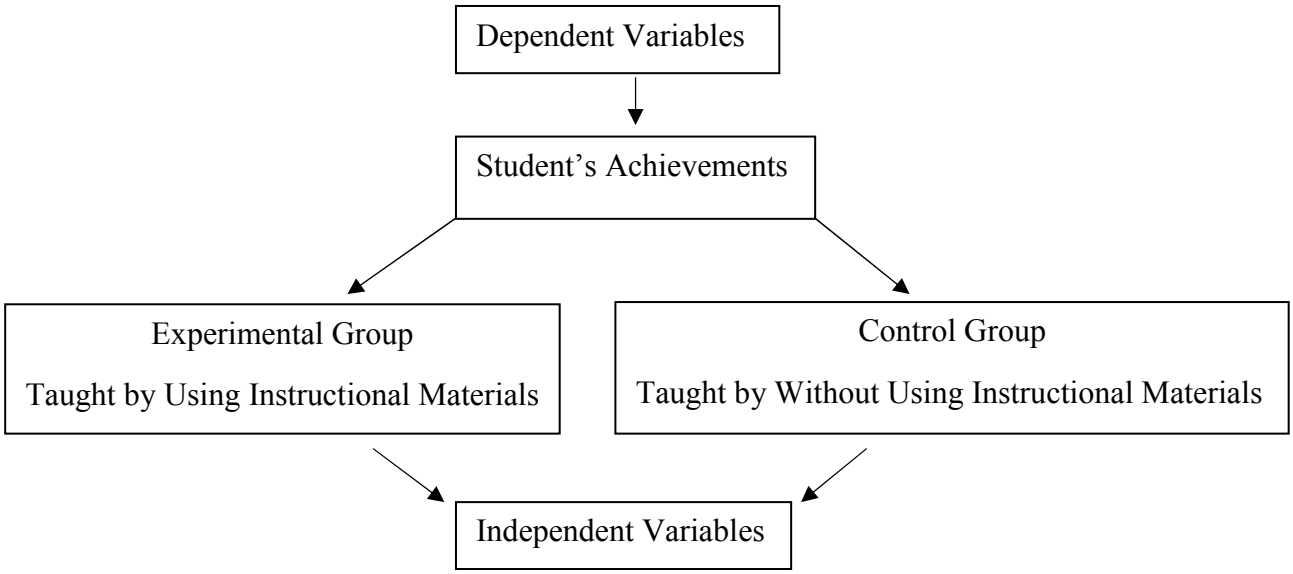
problem tasks, they come to understand the mathematical concepts and methods involved, become more adept at mathematical problem solving, and develop mathematical habits of mind that are useful ways to think about any mathematical situation.

Open problems are attractive because of their nature; they allow students with the opportunities to generate several approaches and/or different correct solutions placing very little constraints on the students' methods, to share and discuss their thinking, and to make decisions and justify them. Its effective use can foster higher-order thinking and promote development of mathematical habits of mind. According to Cuoco, Goldenberg and Mark (1996), habits of mind are the ways of thinking that are there to allow students to develop a myriad of approaches and strategies that can be applicable in situations varying from challenges in school to those in life. Some of the habits of mind they discuss include but are not limited to looking for patterns, exploring, communicating, augmenting, conjecturing, refuting, and generalizing. The habits are there to enlighten students about the creation of mathematics, and most importantly to help them learn the way mathematicians think about mathematics. Consequently, students' engagement in these habits helps to develop and increase their ability to determining on their own how to think mathematically. Open problems differ in their nature: the starting situation, the goal situation or the problem solving approach can be open. Thus, with each type of problem students have the opportunity to show their creativity and engage in different mathematical habits of mind. In this paper I focus on problem on strategy-open problems. As the name says, the start and the goal situation are exactly given, however, the task allows for many approaches to achieve the goals situation. Such problems are suitable for mathematics teaching at

different levels of mathematics education, and can be therefore posed multiple times allowing the use of different mathematics and heuristics (Pehkonen, 2001).

Conceptual Framework of the Study

This study is focused to effectiveness of instructional materials in teaching mensuration. I adapt a conceptual framework of the study as present below.



The above framework illustrates the achievements of student's dependent on using instructional materials and without using instructional materials. Effectiveness of instructional materials gives a positive impact in teaching mensuration.

Chapter-III

METHODS AND PROCEDURES

The general aim of this study was to investigate the effectiveness of instructional materials on teaching of 'Mensuration' at lower secondary level mathematics course. The method employed by the researcher in this study was of the experimental study design. This chapter describes the design of the study. It gives the description of the study in research design, population and sampling, data collection, procedure and analysis. In this chapter preparation of the test items, procedure of analyzing the data is presented in detail.

Design of the Study

Research design is the most important part in research. So it is heart of the study. In this study experimental design was adopted to answer the formulated research question. So quantitative technique was used to analyze data. According to Best and Khan (2006) Experimental research describes certain variables are carefully controlled or manipulated. The focus on variable relationships. As defined here, deliberate manipulation was always a part of the experimental method. The study was experimental type having two groups, experimental and control groups. Experimental group was taught by using instructional materials and control group was taught by using usual materials like chalk, board and duster. Pre test and post test equivalent group design was adopted in this study. This design may be diagrammed as shown below:

Table-1

Design of the Study

Group	Pretest	Treatment	Posttest
Experimental (E)	O_1	Taught by using materials (X_1)	O_2
Control (C)	O_3	_	O_4

This was an experimental study. Two groups of students were selected for the purpose of this study. In this design, O_1 and O_3 was represented the pre-test for experimental group and control group, while O_2 and O_4represents the post-test for experimental groups and control groups respectively. X_1 is the treatment for experimental groups. Experimental group was completed post- test after being exposed to one of the teaching methods. Control group was completed post- test after being exposed to one of the teaching methods.

Population of the Study

The population of the study consisted of all the public school students of grade VIII students of Kanchanpur in academic year 2072 B.S.

Sample of the Study

This is an experimental research. Researcher chose one school Shree Saraswati Higher Secondary School as sample school and all students of grade VIII were participated in this study. All the students of grade VIII divided into two groups i.e. group ‘A’ and group ‘B’. Both groups have 22/22 students.

Independent, Dependent and Control Variables

Variables are the conditions or characteristics that the experimental manipulates, controls or observes. The independent variables are the conditions or characteristics that the experimenter manipulates or controls in his or her attempt to ascertain their relationship to observed phenomena. The dependent variables are conditions or characteristics that appear, disappear or change as the experimenter introduces, removes or changes dependent variables.

Teaching materials, school characteristics, different characteristics of teacher, students in two groups, subject matter of two groups are the non-experimental variables. To ensure the equivalency of the experimental and control group the mean, variance, standard deviation of two groups was calculated on the basis of their marks on their first terminal examination and ratio of two groups was calculated. At last t-test was applied to ensure whether there was significance difference between two groups.

Data Collection Tools

Achievement test paper consisting of subjective (very short, short and longs) type questions prepared by the researcher was the main tools used in collecting data for this study. The researcher developed test on the basic of prescribed curriculum and text book of grade VIII on the topics of mensuration. The test consists of knowledge level questions, understanding level questions, skill level question and problem solving questions. Researcher was intend to compare the student's motivation and their achievement in mathematics between the experimental and control groups.

Achievement test

The pre-achievement test was determined the achievement level of students in both groups. This test was consist of some questions to be solved. The post-achievement test was contain some questions that have a slightly different with the question in the pre-achievement test, but the questions was in the same structure. Post- achievement test was used to measure the students' achievement after using instructional materials.

Questionnaire

Research made an open –form questions in which the subject was encouraged to answer in his or her own words at some length. After the treatment period, the research conducted questions with individuals, six students: three from each groups, one who had the highest post test scores in their group, another who had average score and third one who had lowest scores. The questions answer was conducted after post test so that they would no influence its results. The questions asked to each responds are given in the appendix 7.

Validity and Reliability

The content validity of the tools and instructional materials was established and approved by mathematics experts as well as school subject teachers and thesis supervisor. For this purpose researcher administered the test among 22 students of grade VIII of Saraswati Secondry School Kanchanpur district. The reliability of the tools and instructional materials was established by using split-half reliability method. The split half reliability of the test was found 0.79. It indicates that the test reliable collect the data.

Scoring the Data

For the scoring of the data researcher was made different level and types of questions. Each type of question varied according to difficulty level. Knowledge level question demands simple information carry 1 marks, the comprehensive level question demands the both the information and skill carry 2 marks and each whereas the application type of question are higher level which demands knowledge as well as comprehensive level of 4 marks.

Data Collection Procedure

The experimental and control groups were taught by researcher himself 45 minutes per group every day. The experimental group was taught by using instructional materials where as the control group was taught by without using instructional materials. At the end of instruction period, the achievement test was administered to both groups' students. The answer sheets was collected and scored by the researcher and then the scores was tabulated for the analysis. For qualitative part the researcher asked some questions to teacher and students about use of instructional materials and without use of instructional materials in teaching mensuration.

Data Analysis Procedure

The collected data were analyzed and interpreted by using statistical devices/test by giving critical appraisal using the following procedures. Data were collected from various based on the data collection tools as well as procedure stated at the beginning of this chapter. In this study, the collected data was analyzed by using descriptive and inferential statistical analysis methods as follows;

- Mean, Standard deviation and Variance were calculated in both groups with their obtain marks in the test.

- T-test was used at 0.05 level of significance to find whether the difference of means statistically significant or not.
- The appropriate test of the significance difference between two independent means, t-value was found N_1+N_2- 2 degree of freedom, by using the t- distribution table.
- The data obtained from questionnaire for student's teacher were analyzed descriptively.

Chapter-IV

ANALYSIS AND INTERPRETATION OF DATA

This is an experimental research. The main focus of this study is to explore the effectiveness of the use of instructional materials with PBL in teaching "mensuration" at lower secondary level. The min parameter to explore the effectiveness of teaching materials is performance/achievement of the students. For this purpose, achievement of lower secondary level students is collected. The statistical analysis of the obtained data has been presented in this chapter. The data of the achievement test scores are analyzed under the following heading.

- Comparison of mean achievement scores of control group and experimental group for pretest data.
- Comparison of mean achievement scores of control group and experimental group for posttest data
- .Comparative bar graph showing mean achievement scores of control group and experimental group for the pretest and posttest.
- Analysis of students perception on teaching and activities in the classroom.

Comparison of Achievement Scores of Control and Experimental Group for Pretest Data

The pretest scores of students of experimental and control group are presented in Appendix 1 and the summary of statistical calculation for both groups on the pretest in presented in the following Table.

Table- 2

Mean, Standard Deviation and C.V of Pre-Test Result

Group	N	Mean	S.D	C.V	t-value	Level of significance
Experimental	22	10.14	4.68	0.46	0.16	0.05
Control	22	9.91	4.84	0.49		

Table -2 presents the mean, S.D and coefficients of variance and t- value of the score obtained by the students of experimental and control groups in pre-test. This shows that mean score of experimental group was 10.14 and the mean score of control group was 9.91 also the standard deviation of experimental group was 4.68 and the standard deviation of the control group was 4.84. The calculated t- value in the test is 0.16 which is less than the corresponding tabulated value (1.96) at 0.05 level of significance with degree of freedom 42 (n_1+n_2-2). Therefore, the null hypothesis $\mu_1= \mu_2$ was accepted. Hence there is no significant difference between students achievement in mensuration.

At this stage both the means and standard deviation of the experimental and control group were nearly equal. Since coefficient variance differs by 0.03 between two groups. So the groups are homogeneous.

Comparison of Achievement Scores of Control and Experimental Group for Posttest Data

The posttest scores of students of experimental and control group are presented in Appendix 2 and the summary of statistical calculation for both groups i.e. Experimental and control group on the post test is presented in the following Table

Table- 3

Mean, Standard Deviation and C.V of Post-Test Result

Group	N	Mean	S.D	C.V	t-value	Level of significance
Experimental	22	14.91	2.84	0.19	2.72	0.05
Control	22	12.14	3.86	0.32		

The table -3 presented that there were 22 sample students in both the experimental and control groups. The mean score obtained by experimental group students was 14.91 with stranded deviation of2.84 similarly the mean score of control group students was 12.14 with stranded deviation of 3.86. The coefficient of variation of experimental group was found to be less than the coefficient of variation of control group. For the first hand inference it seems that the different was really significant. The experimental group seems to be more consistent than the control group. Therefore the mean score of experimental group is higher than the mean score of control group. To test whether the materials produce the better result or not, t-test was employed. The calculated t- value was 2.72 on 5% level of significance at degree of freedom. This shows that calculated t- value is greater than the tabulated t- value ($t_{0.025,\ 42}$ =1.96). It indicates that there is significant difference between the mean

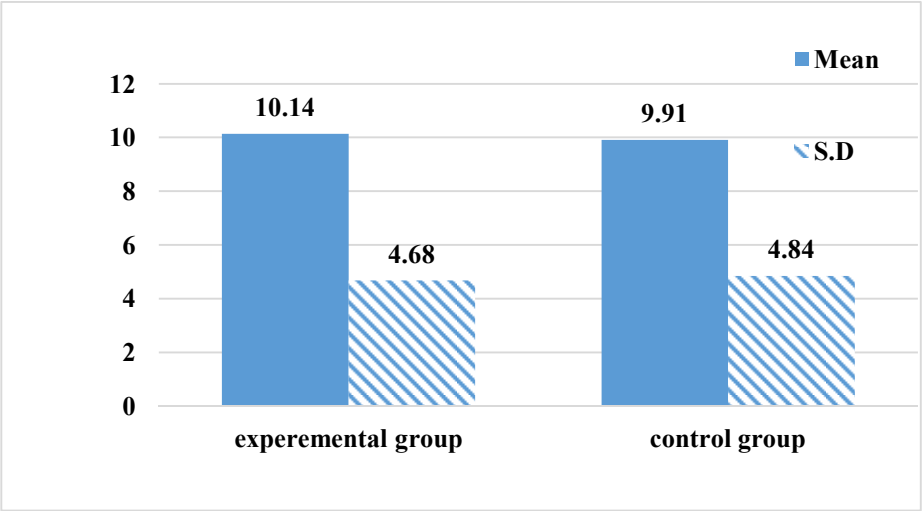
achievement score of experimental group and control group. Hence the null hypothesis was rejected and the alternative hypothesis was accepted. Therefore the researcher concluded that the student's achievement scores who were taught by using materials was found significantly better than that of student who was taught by conventional method. Hence the researcher can concluded that the students under the using of materials perform better result than the student under conventional method and using instructional materials in teaching of mathematics is more effective than the traditional way of teaching mathematics in lower secondary level.

Comparative Bar Graph Showing Mean Achievement Scores of Experimental and Control Group for Pretest and Post test result

In addition to the advance statistics, data are presented in visual from to understand these result/differences more effectively. So, the investigator presented the data diagrammatically through bar graph. The graph indicates the scores of the students which are given below.

Figure- 1

Comparative Bar Diagram of Mean and S.D of Pre-test Result

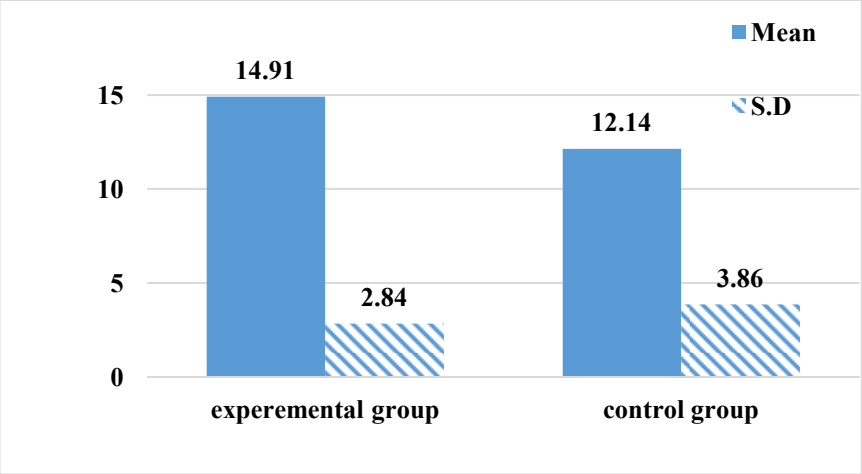


Discussion Based on Figure- 1

The mean and S.D score obtained by the students of experimental and control group in the pretest have been shown in figure-1. The figure shows that the mean score and S.D of experimental group are 10.14 and 4.68 respectively. Similarly, the mean scores and S.D of control group are 9.91 and 4.84 respectively. The difference between two mean was 0.23, this shows that the both groups experimental and control are nearly equal. Which indicate that there is no significance between mean and standard deviation obtained from achievement scores in mensuration of both groups.

Figure- 2

Comparative Bar Diagram of Mean and S.D of Post test Result



Discussion Based on Figure-2

The mean and S.D scores obtained by students of experimental and control group in the posttest are presented in figure-2. The mean scores of experimental group is 14.91and the mean score of the control group is 12.14 similarly the S.D of experimental group is 2.84 and the S.D of control group is 3.86. The difference between two means scores of experimental and control group is 2.77 that is positive. But the difference between two S.D scores of experimental and control group is -1.02.

This indicates that experimental group had better result than control group. Therefore, from figure 2, we can concluded that the use of instructional materials in teaching of mathematics have great impact than without using of material in lower secondary level.

Analysis of the Effectiveness of instructional Materials in Teaching Mensuration

For this research, researcher selected 44 students and separated into two homogeneous groups, one was experimental group and another was control group. In experimental period, researcher wrote class note after teaching every day on both groups. The researcher had found that his teaching was effective by the analysis of that class note of experimental group, because every students of experimental group were curious and interested to read this topic seriously and all students of that group were not making noise and also, they told to me teach regularly and to call me time to time to teach. Also, researcher requests the class teacher to observe his class and take feedback from the teacher and he gave positive response about teaching or experimental and performance. In experiment period, subject teacher and students had given thanks to me for teaching while teaching experimental group students. The researcher concluded that it is possible due to the instructional materials. Similarly, the researcher had found that his teaching was no effective as much as experimental group by analysis of result of data, class observation, class activity and class note of control group because students of control group were not serious and interpreted to read this topic seriously and also students neglect me and teacher. Hence the researcher found that there was significant effectiveness of instructional materials in teaching mensuration.

In the experimental group researcher found students regular in classroom and working in the group. The teacher and students had engaged their time to interest,

sharing information each other openly by which they learn in the better way while solving their mathematical problem. Students were found more active, interested and to take part in the interaction. In the control group students were only passive listener and read parrotly get the change to interaction. Thus from the above, it seen that confidence of students increase in instructional materials.

Analysis of the Response Given by Teacher and Students about Instructional Materials in Teaching Mensuration

In qualitative information to interviews were taken from the selected students and mathematics teacher to derive qualitative information. Then researcher asked some question and collected the answer which is given below;

Researcher: What type of effect did you find from the class conducted by using instruction materials?

Subject Teacher: Student become active in teaching activities. They were interested in subject matter.

Researcher: What type of difference did you find in teaching between using instructional materials and without using instructional materials?

Student 'a': Teaching with instructional materials is easy to understand than teaching without using instructional materials.

Student 'b': I feel that learning remains long in memory by using instructional materials.

Student 'c': Instructional materials helps students to understand subject matter.

The answer of the above questions shows that the use of instructional materials in teaching mensuration is effective than without using instructional materials.

During experimental period researcher also found that every students of experimental group were curious and interested to learn mensuration seriously. Instructional materials helps students to understand mensuration. Its basic terms and estimation of mensuration teaching manfully. It is makes the teaching interesting and funny so students are motivate. Hence the researcher found that there was significant effectiveness of instructional materials in teaching mensuration.

Chapter-V

SUMMARY, FINDINGS, CONCLUSION AND RECOMMENDATIONS

As stated in the introduction, the purpose of this study was to test the effectiveness of instructional materials in teaching in mensuration at lower secondary level. In this chapter summary, finding, conclusion and recommendations for further study have been presented under the following headings.

Summary of the Study

Since mathematics as the science of abstract form and its importance is ever increasing. Mathematics is generally regarded as a difficult subject. Mathematics took place as a compulsory subject from elementary level, as its relation with a different disciple. Most of the people think mathematics is difficult subject. There are different areas on mathematics.

Mathematics learning achievement of students directly affected by some independent variables. It may be teaching methods textbook, parents' education, instructional materials, socioeconomic condition, school, teacher qualification, etc. This research directly motive to see the affect of independent variables i.e. instructional materials over dependent variables i.e. students achievement on the topics mensuration.

The researcher kept all independent variables as silent except materials. The main question over this researcher were to see, is there a effectiveness of instructional materials on teaching of mensuration? Does achievement differ significantly when instructional materials are used? Over these researcher questions, this study has been done Kanchanpur district, a period of two and half week, and the units of mensuration on grade VIII. The desired objectives of this researcher study were; to identify the

effectiveness of instructional materials on teaching mensuration and to compare the achievement between the uses of material sand without materials.

This study was given an evidence of the effectiveness of instructional materials in teaching mathematics. The study was experimental, in order to conduct the experimental study on the effectiveness of instructional materials in teaching mensuration at lower secondary level, the researcher developed a teaching module and taught by student of experimental group were taught by using instructional materials and the students of control group were taught by conventional teaching method. At the end of teaching a standardized achievement test was administrated on both the group. The pretest posttest control, equivalent group design were adopted for the purpose of the study. Mean, S.D and variance were calculated in both groups with their obtain marks. t-test was used 0.05 level of significance to find whether the different of mean statistically significant. The scores obtained by the students in the test was analyzes and thus had the following finding.

Finding of the Study

On the basis of the analysis of the scores obtained by those students, the researcher found that the mean achievement scores of students taught by using instructional materials is higher than the mean achievement scores of students taught by without using instruction materials. The finding of the study are as follows;

- Statistically the difference between the mean scores was significant. Thus the researcher concluded that the use of instructional materials was effective in teaching mensuration at lower secondary level.

- From the result of this study it can be concluded that the instructional materials helps to understand the mensuration concepts clear to the students rather than traditional methods of teaching.
- Use of instructional materials is effective in mensuration teaching and help to develops students self-confidence while solving the problems
- The mean and standard deviation of experimental group students in pre test were 10.14 and 4.68 respectively.
- The mean and standard deviation of control group students in pre test were 9.91 and 4.84 respectively
- The mean and standard deviation of experimental group students in post test were 14.91 and 2.84 respectively.
- The mean and standard deviation of control group students in post test were 12.14 and 3.86 respectively

Conclusion of the Study

On the basis of the analysis of the data obtained from the achievement test, which has been describe in chapter IV, it was found that the mean score of the students of experimental group was greater than the mean scores of the students of control group. Using instructional materials gives a positive impact in teaching, as well as learning mathematics. Many researchers and teachers stated that instructional materials are a solution in learning by understanding the concepts and application in real life. Students are involved in in-depth learning to construct the conceptual of knowledge. The researcher also concluded that the instructional materials method develop self-confidence while solving problem of students. From the result of this study, it can be concluded that the instructional materials method help to

understanding the mensuration and performance in achievement test over traditional or regular method.

Recommendation for Educational Implication

On the basis of finding of this study some measure have been recommendation for the improvement of the teaching situation in lower secondary classes as given below;

- Mostly the math teacher should try to use available materials in teaching mathematics
- The mathematics teacher should be encouraged to use instructional materials in teaching mathematics.
- Training programmer should priority the using of materials.
- Teacher should develop to mensuration ideas and concepts.

Recommendation for Further Study

- The largest researcher studies must be designed and carried out in order to investigate the effectiveness of using materials in sample in various school of different parts of Nepal.
- Similar empirical study may be suggested to conduct at different levels of school.
- It may be interesting to replicate this study in different subject and different classes

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Appendix-1

Teaching Episode

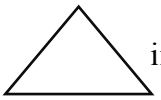
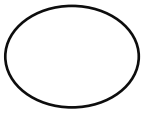
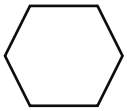
Teaching Episod-1

Objectives:

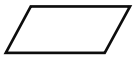
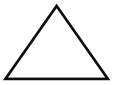
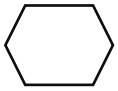
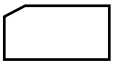
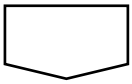
– Find out the right figure of given below;

1) Introducing Task:

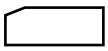
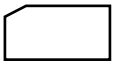
– Ask them to find the right figure of triangle in the given.

i.  ii.  iii.  iv. 

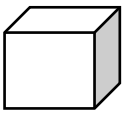
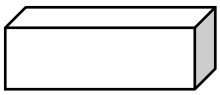
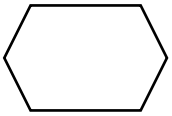
– Ask them to find the right figure of quadrilateral in the given.

i.  ii.  iii.  iv.  v 

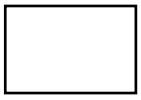
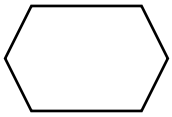
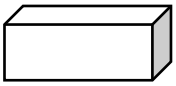
– Choose right figure of parallelogram from the given figures.

i  ii  iii  iv 

– Ask them to find the right figure of cube among the given.

i  ii  iii 

– Ask them to find the right figure of cuboids from in the given figure.

i  ii  iii  iv 

Teaching Episod-2

Area of Triangle

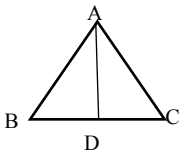
1) Objectives:

At the end of this class will be able to:

- Find the area of triangle

2) Teaching Learning Activities

- First teacher asks to the students about triangle and area of triangle formula then students can't tell fact meaning of triangle.
- Teacher gives the clear concepts of triangle.
- After that derive the formula of area of triangle.



Which formula can we apply the area of triangle

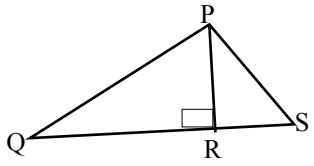
Area= 1/2(base ×height)

- Teacher to derive the formula of equilateral triangle

i.e. Area = $\frac{\sqrt{3}}{4}$ a^2 where, a= side of triangle

3) Extended task:

Find out the area of the given triangle



Where QS= 9 cm and PR= 4 cm

4) Summarizing (Reflection)

- To identify the height and base line of the triangle.
- Area= 1/2(base ×height)

Teaching Episod-3

Area of Quadrilateral

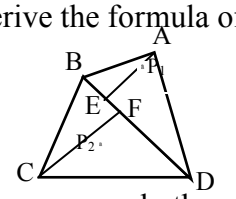
1) Objectives:

At the end of this class will be able to:

- Find the area of quadrilateral

2) Teaching Learning Activities

- First teacher asks to the students about quadrilateral and area of quadrilateral formula then students can't tell fact meaning of quadrilateral.
- Teacher gives the clear concepts of quadrilateral.
- After that derive the formula of area of quadrilateral.



Which formula can we apply the area of triangle

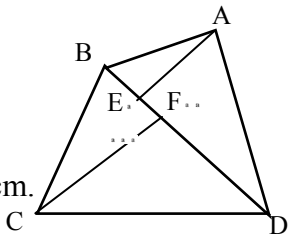
Area= $\frac{1}{2}$ BD (P_1+ P_2)

Where BD is diagonal of quadrilateral P_1 and P_2 are perpendicular of diagonal of BD

3) Extended task:

Find out the area of the given Quadrilateral

Where BD = 11 cm, AE= 4 cm and CF=5 cm.



4) Summarizing (Reflection)

- They can categorize the different type of quadrilateral.
- The sum of the angle of quadrilateral is 360^0

Teaching Episod-4

Area of Parallelogram

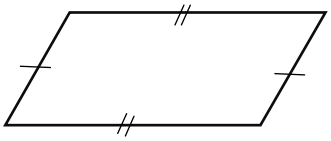
1) Objectives:

At the end of this class will be able to:

- Find the area of parallelogram

2) Teaching Learning Activities

- First we make ready to the students concentration and motivate them in learning today topic.
- First teacher asks to the students about parallelogram and area of parallelogram formula then students can't tell fact meaning of parallelogram.
- Teacher gives the clear concepts of parallelogram.
- After that derive the formula of area of parallelogram.

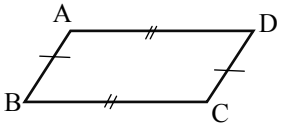


Which formula can we apply the area of parallelogram

Area= base ×height

3) Extended task:

Find out the area of the given parallelogram



Where BC = 5 cm and AB= 3 cm

4) Summarizing (Reflection)

- To identify the height and the base line of the parallelogram.
- Area of parallelogram= base ×height.

Teaching Episod-5

Volume and Area of Cube

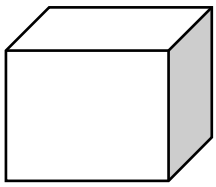
1) Objectives:

   At the end of this class will be able to:

   - Find the area of cube.

2) Teaching Learning Activities

   - First teacher asks to the students about cube and after that teacher will discuss about cube.
   - Teacher gives the clear concepts of cube.
   - Definition of cube is a solid figure that has six identical square faces.
   - After that derive the formula of area of cube.



a

   Which formula can we apply the area of cube

   Area= $6a^2$ where 'a' is side of cube

3) Extended task:

   - Cube of which area is 72 cm^2, find the length of each side of the cube.
   - Find area of cube if length is 3.5 cm.

4) Summarizing (Reflection)

   - Area of cube=$6a^2$
   - They can find the area of cube.

Teaching Episod-6

Volume and Area of Cube

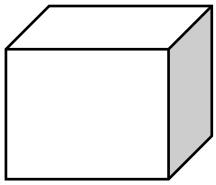
1) Objectives:

At the end of this class will be able to:

- Find the volume of cube.

2) Teaching Learning Activities

- First teacher captures the students looking towards him/her and ask what they have learnt about cube in previous class.
- The teacher asks to the students about cube and after that teacher will discuss about cube.
- Teacher gives the clear concepts of cube.
- Definition of cube is a solid figure that has six identical square faces.
- After that derive the formula of volume of cube.



a

Which formula can we apply the volume of cube is

Volume = $a \times a \times a = a^3$

Where 'a' is side of cube

3) Extended task:

- Find of cube if length is 5 cm.

4) Summarizing (Reflection)

- Volume of cube=a^3
- They can find the volume of cube.

Teaching Episod-7

Volume and Area of Cuboids

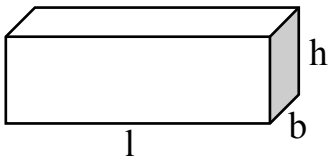
1) Objectives:

At the end of this class will be able to:

- Find the area of cuboids.

2) Teaching Learning Activities

- First we make ready to learn for all the students looking towards the board.
- The teacher asks to the students about cuboids and after that teacher will discuss about cuboids.
- Teacher gives the clear concepts of cuboid.
- Definition of cuboids is a box- shaped solid figure bounded by six rectangular faces. The opposite faces are congruent and parallel.
- After that derive the formula of area cuboids.



Which formula can we apply the area cuboids is

$$\text{Area} = 2(l \times b) + 2(b \times h) + 2(l \times h) \text{ square unit}$$

3) Extended task:

- Find of are of cuboids whose length 14 cm, breath 5 cm and height 9 cm.

4) Summarizing (Reflection)

- Area of cuboids $= 2(l \times b) + 2(b \times h) + 2(l \times h)$ square unit
- They can calculate the area of cuboids.

Teaching Episod-8

Volume and Area of Cuboids

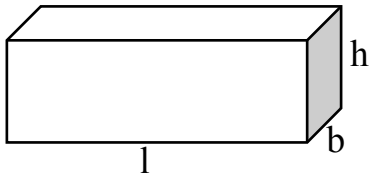
1) Objectives:

At the end of this class will be able to:

- Find the volume of cuboids.

2) Teaching Learning Activities

- First teacher captures the students looking towards him/her and ask what they have learnt about cuboids in previous class
- The teacher asks to the students about cuboids and after that teacher will discuss about cuboids.
- Teacher gives the clear concepts of cuboids.
- Definition of cuboids is a box- shaped solid figure bounded by six rectangular faces. The opposite faces are congruent and parallel.
- After that derive the formula of volume of cuboids.

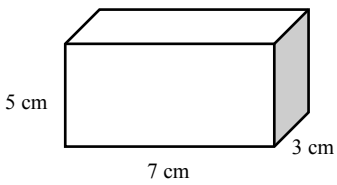


Which formula can we apply the volume of cuboids is

Volume = l× b× h

3) Extended task:

– find the volume of given figure



- find the volume of given cuboids

  i. l=4m, b=1/2m, h=3m

  ii. l=8m, b=7m, h=2m

4) .Summarizing (Reflection)

- They can calculate the volume of cuboids.
- To identify the length, height and breath of the cuboids.
- Volume of cuboids = l×b×h

Apendix-2

Pretest and Posttest Questions

Mensuration

नाम- कक्षा- रोल्नं-

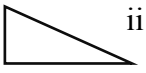
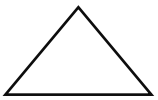
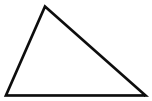
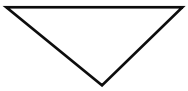
विषय- समय- मिति-

विद्यालय-

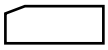
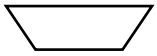
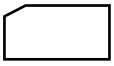
समुह क

१ सवै भन्दा मिल्दो उत्तरमा यस्तो () चिन्ह लगाऊ ।

क) तल दिएको चित्रमा कुन चाँही समबाहु त्रिभुज हो । १

i  ii  iii  iv 

ख) तल दिएको चित्रमा कुन चाँही समानान्तर चतुर्भज हो । १

i  ii  iii  iv 

ग) समानान्तर चतुर्भजको क्षेत्रफल निकाल्ने सुत्र कुन हो । १

i क्षेत्रफल= २ (लम्बाइ×चौडाइ)

ii क्षेत्रफल= १/२ (लम्बाइ×चौडाइ)

iii क्षेत्रफल= लम्बाइ×चौडाइ

iv क्षेत्रफल= लम्बाइ × चौडाइ × उचाइ

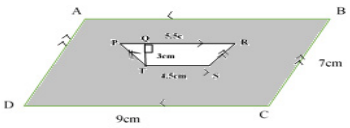
२ आधारको लम्बाई ३२ से.मी र उचाई १२ से.मी भएको त्रिभुजको क्षेत्रफल कति हुन्छ । १

३ एउटा भुजा ५ से.मी भएको समबाहु त्रिभुजको क्षेत्रफल कति हुन्छ ? १

४ एउटा किनारा १० से.मी भएको घनको पुरा सतहको क्षेत्रफल निकाल ? १

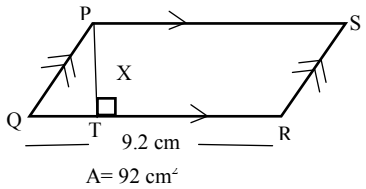
समुह ख

५ तलको चित्रमा छाया पारेको भागको क्षेत्रफल पत्ता लगाऊ ? २



DC=9 cm, BC=7cm, SR=4.5 cm, PR=5.5 cm, QT=3 cm

६ तलको चित्रमा X को मानपत्ता लगाऊ ? २



७) एउटा १० से.मी लम्बाइ, ८ से.मी चौडाइ र ३ से.मी उचाइ भएको उक्त बाकसको आयतन कति होला ? २

समुह ग

२×४= ८

८) २४० फिट लम्बाइ र १८० फिट चौडाई भएको आयतकार खेतको बिचमा १६ फिट किनारा भएको एउटा वर्गाकार पोखरी छ भने पोखरी बाहेकको खेतको क्षेत्रफल कति होला ?

९) २८ से.मी लम्बाइ र २० से.मी चौडाइ भएको बाकसको आयतन ३३६० घन से.मी भए उक्त बाकसको उचाइ कति होला ?

Appendix-3

The pretest result of experimental and control groups students

Pre test result		
Pair	Experimental	Control
1	18	19
2	14	13
3	16	15
4	9	17
5	13	12
6	15	9
7	5	7
8	18	14
9	15	11
10	8	15
11	14	17
12	11	8
13	7	5
14	5	1
15	9	4
16	4	7
17	7	10
18	2	6
19	13	9
20	8	11
21	8	3
22	4	5
Sum	223	218

Appendix-4

The posttest result of experimental and control groups students

Post test result		
Pair	Experimental	Control
1	20	19
2	18	16
3	16	14
4	17	17
5	19	15
6	14	10
7	17	18
8	19	12
9	15	11
10	13	15
11	14	17
12	11	13
13	12	5
14	16	13
15	15	9
16	17	12
17	13	10
18	12	6
19	13	9
20	14	8
21	8	7
22	15	11
Sum	328	267

Appendix– 5

Experimental(X)	Control(Y)	XY	X^2	Y^2
20	19	380	400	361
18	16	288	324	256
16	14	224	256	196
17	17	289	289	289
19	15	285	361	225
14	10	140	196	100
17	18	306	289	324
19	12	228	361	144
15	11	165	225	121
13	15	195	169	225
14	17	238	196	289
11	13	143	121	169
12	5	60	144	25
16	13	208	256	169
15	9	135	225	81
17	12	204	289	144
13	10	130	169	100
12	6	72	144	36
13	9	117	169	81
14	8	112	196	64
8	7	56	64	49
15	11	165	225	121
$\Sigma X=328$	$\Sigma Y=267$	$\Sigma XY=4140$	$\Sigma X^2=5068$	$\Sigma Y^2=3569$
$(\Sigma X)^2=$ 107584	$(\Sigma Y)^2=$ 71289	$22*\Sigma XY=$ 91080	$22*\Sigma X^2=$ 111496	$22*\Sigma Y^2=$ 78518

$$r_{xy}= \frac{N\Sigma XY-\Sigma X\Sigma Y}{\sqrt{(N\Sigma X^2-(\Sigma X)^2)(N\Sigma Y^2-(\Sigma Y)^2)}}$$

$$=\frac{22\times4140-328\times267}{\sqrt{22\times5068-107584)(22\times3569-71289}}$$

$= 0.658$

$= 0.66$

Reliability of whole test $(r_{tt}) = \frac{2\times r_{xy}}{1+ r_{xy}}$

$$= \frac{2\times0.66}{1+0.66}$$

$= 0.79$

Apendix-6

Statistical Formula used for Data Analysis

1. Mean($\bar{X}$) = $\frac{\Sigma X}{N}$

2. Standard Deviation(S.D)(σ)=$\frac{\sqrt{(\Sigma(X-\bar{X})}}{N}$

3. Coefficient variation(CV)= $\frac{\sigma}{\bar{X}}$

4. $$t = \frac{X_1 - X_2}{\sqrt{\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}}}$$

   where

   X_1 = Mean of first sample

   X_2=Mean of second sample

   N_1=No. of students in first sample

   N_2= No. of students in second sample

   σ_1= Variance of first sample

   σ_2=Variance of second sample

   CV= coefficient of variation

   Degree of freedom= N_1+N_2-2

5. Pearson's correlation coefficient

$$r_{xy} = \frac{N\Sigma XY - \Sigma X \Sigma Y}{\sqrt{(N\Sigma X^2 - (\Sigma X)^2)(N\Sigma Y^2 - (\Sigma Y)^2)}}$$

   Where

   X and Yare paired scores

   N= Number of paired scores

6. Reliability of whole test (r_{tt}) = $\frac{2 \times r_{xy}}{1 + r_{xy}}$

Appendix-7

QUESTIONNARE FOR STUDENTS

1. You are understood using instructional material in teaching mensuration?
2. What type of method you like teaching in class room?
3. Did you find in different between using instructional materials and without using instructional materials?
4. Do you interest learning mensuration?
5. How do you feel in classroom teaching mensuration topic?