EFFECTIVENESS OF INSTRUCTIONAL MATERIALS IN TEACHING MENSURATION

A

THESIS

BY

KHIL NATH GAUTAM

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A

Thesis

By

Khil Nath Gautam

Entitled

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

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2) Prof. Dr. Hari Prasad Upadhyay (Member)	.....
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Letter of Certificate

This is to certify that **Mr. Khil Nath Gautam** a student of academic year 063/65 with campus Roll No. 314, Thesis No. 816, Exam Roll No. 280789 and T. U. Registration No. 42900-95 has completed this thesis under my supervision for 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 of 2015 at Department of Mathematics Education, University Campus, Kirtipur, Kathmandu. I recommend and forward this thesis for evaluation as the partial requirements to award the degree of Master of Education.

.....	.....
Mr. Dipak Mainali	Mr. Laxmi Narayan Yadav
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Khil Nath Gautam

ABSTRACT

There are many problems in the field of teaching and learning process. Most of the teachers and students think that mathematics is a complicated subject for teaching and learning. In mathematics teaching teachers face many problems to give clear concepts to the students. It is clear that use of instructional materials make teaching learning process easier. Instructional materials assist pupil to enhance their memories. Usually, pupils can remember concrete materials in longer periods rather than abstract facts. With the help of teaching aids teacher do not need much to explain the certain concept by using many words. Using teaching aids teacher can save a lot of time because it is no longer required to write notes on the boards for the pupils to copy. So the teacher plans to study the effectiveness of instructional materials in teaching mensuration of primary level.

This study focused on the effects of instructional materials on performance of pupils taught by using instructional materials and without using instructional materials. Total 55 students were selected from grade-v students of Saraswati Higher Secondary School, Damak-14, Jhapa. Students of two sections were selected. The pre-test, post-test non-equivalent group design was adopted in carrying out the study. The experimental group was taught with instructional materials while the control group was taught with chalk and talk alone. Pre and post test was administered on both groups before and after the treatment. The data generated were analyzed using t-test statistics at 0.05 level of significance. A significant difference existed between the post-test performance of pupils in the experimental and control groups.

Finally, the researcher concluded that the achievement of students of experimental group is better than the achievement of the control group. So teaching of mensuration by using instructional materials causes better achievement than teaching without using instructional materials in grade-V.

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Chapter-I

INTRODUCTION

Background of the study

All materials that could be used in classroom situation to facilitate teaching learning process are called instructional materials. Instructional materials are considered as powerful means for teaching. Students are motivated by the use of teaching aids. Teaching aids give the realistic picture on theory and practice. Instructional materials are a generic term used to describe the resources teachers used to deliver instruction. Instructional materials can support student learning and increase student success. Ideally, the instructional materials will be tailored to the content in which they are being used, to the students in whose class they are being used, and the teacher. Instructional materials come in many shapes and sizes, but they all have in common the ability to support student learning. Instructional materials can refer to a number of teacher resources; however, the term usually refers to concrete examples, such as worksheets or manipulatives.

Teaching materials are different from teaching "resources", the latter including more theoretical and intangible elements, such as essays or support from other educators, or places to find teaching materials. Instructional materials are important because they can significantly increase student achievement by supporting student learning. For example, a worksheet may provide a student with important opportunities to practice a new skill gained in class. Instructional materials, regardless of what kind, all have some function in student learning. Instructional materials can also add important structure to lesson planning and the delivery of instruction. Particularly in lower grades, instructional materials act as a guide for both the teacher and student. They can provide a valuable routine. Johnson defines "Instructional materials are essential for the mathematics teachers as spokes are for the wheel. They are necessary for learning mathematics pleasant satisfying excellence. Models, pamphlets, films, given that would be difficult to obtain in any other ways". "Dienes subject has following words to say about the use of materials, "The use of concrete materials in the classroom to build up mathematical imagery. Such imagery once build up can be manipulated without the aid of any concrete objects."

Since mathematics is an abstract as well as logical science, it is also a difficult. Mathematics education is a compulsory subject to be taught to all the student of Nepal. So it can be made interesting and understandable to the students only if the teacher is well-qualified and skillful in handling the various kinds of teaching approaches correctly with the use of appropriate materials. There are lots examples of instructional materials. Some of them are audio, recording, OHP, charts, tape, pictures and etc. Mainly, instructional materials are categorized into three different kinds. They are: 1. Literature 2.Audio-visual aids 3.Models and manipulative materials.

All of these instructional materials are very important in teaching and learning process because all of these serve as aid for instruction. Through this, the teachers will able to make his/her strategies in teaching more effective and meaningful and the students will be able to understand, easily absorb the lesson. Instructional materials serve as the channel between teacher and students in delivering the instruction. They may also serve as the motivation on the teaching-learning process.

Instructional materials are highly important for teaching, especially for inexperienced teachers. Teachers relay on instructional materials in every aspect of teaching. They need materials for background information on the subject they are teaching. Young teachers usually have not built up their expertise whenever they enter into the field. Teachers often use instructional materials for lesson planning. These materials are also needed by teachers to access the knowledge of their students. Teachers often assess students by assigning tasks, creating projects and administering exams. Instructional materials are essential for all of these activities.

Teachers are often expected to create their own lesson plans. This can be difficult, especially if the teacher has limited background knowledge on the subject. Teachers are expected to have a wide variety of expertise in many different fields. Often, they need instructional aids to supplement their knowledge. Instructional materials can help provide background knowledge on the subject. Lesson planning is often the most stressful aspect of teaching. Teachers are usually dependent on them to do their job properly.

Assessing students correctly can sometimes be a challenge. There is some controversy about the effectiveness of exam in assessing the ability of students.

Instructional materials can offer some insight into the best methods of creating exams. These materials can also help teachers create assignments and projects idea for students. Teachers are required to use several different methods for assess their students in order to provide the most accurate assessments. Instructional materials often provide innovative and creative way to assess students' performance. It is hard to imagine any teacher who is capable of teaching effectively without the accompaniment of instructional materials most likely experiences stress and anxiety on a daily basis.

In the context of Nepal, most of the schools are still using the traditional methods of teaching. Teachers are using lecture and other traditional methods for teaching mathematics. A few of the school budget is allocated for educational materials which includes both stationery and instructional Aids. This sum is inadequate for the provision of instructional materials. In this condition, it is evident that the use of instructional materials in school is limited. Without using necessary materials the teacher will be unable to adopt modern inquiry.

As a math teacher, one needs to find the best instructional materials for mathematics education. It is important for students to get proper math education, but many students find it difficult to learn. In many cases, mathematics education is one of the most difficult disciplines to teach. Math classes, particularly at higher levels are usually stale and boring, consisting of the teaching giving a lecture at the chalkboard. But supplementary instructional materials in mathematics can change. The way you teach lesson is use a variety of math class educational materials to create to different learning styles. One of the biggest problems with understanding math is that it is hard for some students to grasp the concepts in a traditional system. Use games in math class to make it fun. Mathematics education doesn't have to be boring.

Instructional materials are important for effective teaching. They play vital role in making teaching interesting and efficacious in any level of education, in their lack the process of teaching becomes difficult and ineffective.

Statement of the Problem

Mathematics is compulsory subject in our school education. Some teachers teach mathematics in classroom with their best but many students are unable to

understand mathematics adequately. The view of people toward mathematics is not positive till now, though many researches carried out. Mathematics is still considered as a complex subject on the view-point of student and their parents. Most of the students are failed in exam due to its cause. It means it is a major issue of our educational society of Nepal. There are many factors which play vital role in mathematics achievement out of them teaching materials or instructional materials is one of the most influencing factor for achievement of mathematics. Students participate actively in learning mathematics if teachers use appropriate instructional materials. So teacher should select appropriate instructional materials. Appropriate instructional materials motivate students to learn and make learning meaningful.

In general most of the Nepalese children face failure in mathematics at school level due to teaching without instructional materials. In the classroom, teachers teach mathematics without using teaching materials. So, the researcher will study on 'Effect of instructional materials in teaching mathematics at primary level. 'In others words the study has sought answers to the following research questions:

- Is there important role of instructional materials in teaching mathematics?
- Does achievement differ significantly when instructional materials are used?
- How do students feel while teaching with materials?

Significance of the Study

The teaching of mathematics has concerned some factors like as teaching style, teaching strategies, teaching methods and using of instructional materials. Teaching of mathematics becomes more meaningful by use of proper materials. Mathematics is one of the major subject in our education system. It is taught from the elementary level. The present problem faced by people is of well understanding of its structure.

Students, curiosity, motivation, participation play important role to promote mathematical skills in the students. For this, teacher should select proper instructional materials. While implementing the curriculum of mathematics using proper instructional materials can help students to learn mathematics with proper understanding. So there should be research on instructional materials. The significance of this study can be stated as follow:

- This study helps to identify the role of instructional materials on achievement of mathematics.
- It helps to find out whether the instructional materials are used in our school environment or not?
- It helps to primary level mathematics teacher to use instructional materials in classroom environment.
- It helps to educational policy makers, and curriculum framer as a simple reference for selecting the proper instructional materials.

Objectives of the Study

This research was carried out framing the following objectives

- To show the effectiveness of instructional materials in teaching mensuration at primary level.
- To explore feelings of students during experimental period.

Hypothesis

Hypotheses are the assumptions or guesses about the population involved. Such assumptions that may or may not be true are called hypotheses. In words, hypotheses as used in research refer to prediction of results made before a study is made. In conducting any research the next step after the selection of the problem is to formulate hypotheses. A tentative answer to a research question is called a research hypothesis and an assertion or conjecture about the distribution of one or more variables or one or more population is called a statistical hypothesis.

Research Hypothesis

a) There is difference between the achievement scores of experimental and control groups after experiment.

Statistical Hypothesis

a) $H : \mu_1 = \mu_2$ (Null Hypothesis)

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

Where μ_1 and μ_2 are the means score of the experimental and control groups on pre-test.

b)$H_0 : \mu_3 = \mu_4$ (Null Hypothesis)

$H_1 : \mu_3 \neq \mu_4$ (Alternative Hypothesis)

Where μ_3 and μ_4 are the means score of the experimental and control groups on post-test.

Delimitation of the Study

It is impossible to look after all the aspects related to research topic in a single specific research study. Therefore delimitation of the study should be made clear. To make the research study systematic objective the following delimitations were followed:

- The study was conducted to the grade-V students of Saraswati Higher Secondary School of Jhapa district.
- The topic "Mensuration" was taught.
- The experimental time duration was 1 month only.
- Some of the variables like socio-economic status, parents education, IQ was controlled.
- The study was conducted to find out the effectiveness of instructional materials.

Definition of the Related Terms

Achievement

The achievement of the study is defined in terms of the scores obtained by the learners.

Instructional Materials

Instructional materials means all materials that are designed for use by pupils and their teachers as a learning resources and help pupils to acquire facts, skills, or opinions or to develop cognitive processes.

Participation

Involvement of students in classroom activities. The act of sharing in the activities of a group at the time of experiment.

Feelings

Feelings are the internal responses of students to the techniques and materials used by researcher at experimental time. In other words feelings are how do students perceive things in either physically or mentally.

Experimental Group

Group of students taught by using instructional materials.

Control Group

Group of students who were taught by using traditional method.

Intervention

Teaching of experimental group using instructional materials.

Effectiveness

Obtaining higher mark on post-test by experimental group due to materials.

Chapter-II

REVIEW OF THE RELATED LITERATURES

This chapter reviews the different features of the articles and findings of different researchers. To conduct any research researchers needs to review the related literatures so that a researcher gets ideas and guideline for his/her research. Some related literatures which are received by the researcher are discussed as followed:

Adan, (2010) did a research on the topic " The experimental teaching in some of topics in geometry". The aim of this study was to compare the experimental teaching method with the teacher centered traditional method based on students' success. This study had conducted with 54 students, randomly divided into two groups; an experimental and a control groups. Experimental teaching method wad used to teach experimental group and traditional teaching method was used for control group. The test was applied to both groups in two different times. The first test was applied before the treatment and the second test was applied after the experiment. The scores of the students were compared by applying t-test at 0.05 level of significance. According to the research results, it was found that experimental teaching method was more effective than teacher centered traditional teaching method in the knowledge and comprehensive level.

Adhikari, (2014) did a research of the topic " Effectiveness of experimental verification in teaching geometry at secondary level." The main objective of this study was to analyze the effect of experimental verification in learning mathematics. A pre-test, post-test equivalent group design was adopted for study. Two groups were selected by stratified sampling method from two government schools of Chitwan district. A pre-test was administered to both groups which resulted that the groups were comparable at 0.05 level of significance. Both experimental and control groups were taught by researcher for 3 weeks by using and without using experimental verification respectively. A sample of 40 students was selected for both experimental and control groups. After the completion of experiment, an achievement test was administered for both groups. The result of test was analyzed by using t-test at 0.05 level of significance. Researcher found that mean achievement scores of students

taught by using experiment verification was better than the mean achievement scores of the students taught without using experimental verification.

Baral, (2005) did a study on "The effectiveness of the instructional materials in teaching geometry at primary level."The researcher studies primary level(class -5) students in kaski district. Each class contains 20 students. Instructional materials were used with the experimental groups to teach geometry unit. The same unit was taught to control group using only the text and traditional instruction. The study was conducted over a period of 20 days. Using t-test, the researcher concluded that the experimental group scores significantly higher than the post-test than the control group.

Bhusal, (2000) did a research on "A study on the effectiveness of teaching geometry using discovery module and expository module of teaching in secondary level."The aim was to find out the discovery module of teaching geometry is more useful than expository to prove geometrical theorems as well as to compare the achievement of the students taught by using discovery and expository module of teaching. Thirty students were sampled and divided into two equivalent group. They were taught for 3 weeks. The t-test was applied to draw the conclusion that discovery module of teaching was better than the expository module of teaching in geometry.

Clung, (1997) conducted the research on "A study on the Use of Manipulatives and Their Effect on Students Achievement in High School Algebra I Class." The purpose of the study was to evaluate the effects of manipulatives on students achievement in high school algebra I class. The study was conducted during the third nine weeks grading period in the spring of 1997 at a high school in Lewisburg, West Virginia. The study groups used in the study were two algebra I classes. One class had an enrollment of 24 students and the other enrollment of 23 students. The classes were sophomores and juniors. The groups and instructional strategies used included: (1) Group A (control group)…students were taught using the traditional teaching method of lecture, homework, and in- class worksheets. (2) Group B (experimental group) …students were taught using the traditional method of lecture, and homework but instead of in-class worksheets, students worked with the manipulative algeblocks. Both groups were taught at the same rate and by the same method except for the use of the manipulative. A pre-test was administered to each group at the beginning of the

study and at and the result tested to be certain that the groups were homogenous. The results were analyzed using a two- sample t-test and at 0.05 level of significance, no significance difference was identified in the achievement levels of the two groups. A post-test identical to the pre-test was given to the both groups at the conclusion of the study in order to determine if the groups were homogeneous. The results of the post-test were also analyzed using two sample t-test. At 0.05 level of significance, there was a significance difference in the achievement levels of the two groups at the conclusion of the study. When comparing the mean scores of the post-test, it was discovered that the mean score of group A was higher than that of group B which would indicate that the students taught using traditional method of lecture, homework, and in-class worksheets outperformed the students taught using the manipulatives.

Ernest, (1994) conducted on study on “Evaluation of the effectiveness and implementation of math manipulative.”The study consisted of 40 high school teachers from 26 schools. The teachers attended the weekly long training workshop in the use of manipulative implemented the teaching strategies discussed during the workshop in their classroom instruction during the following year, then attended a fellow up session it discuss strategies and problems identified during the implementation phase of the study .Data was gathered to evaluate the week long teacher training workshop and the implementation of manipulative in classroom instruction. On-site observation were conducted to record utilization by course and manipulative, student participation, students attitudes towards the manipulative and interaction with the content. Evaluation of the workshop revealed that the teachers found the quality of instruction to be excellent to very good. Evaluation of the math manipulative and that “on task” involvement was very high. Teachers reported that the students enjoyed and were more interested in assignment when manipulative were used

Ghimire, (2012) conducted a research on " Effect of reinforcement in learning mathematics at secondary level". The main objective of this study was to investigate the effect of reinforcement on students' achievement. A pre-test, post-test non-equivalent control group design was adopted for the purpose of the study. Two schools' students of grade-IX were selected purposively for experimental and control groups. The experimental and control groups of students were taught statistics through

reinforcement teaching strategy and conventional teaching strategy for 15 days. After completing the experiment, achievement test on the unit of statistics was administered to both groups and mean scores were calculated from the sample of 20 students in each group. The difference in mean achievement scores was tested using t-test for determining statistical difference between them. The statistical t-test at the 0.05 level of significance and the classroom observation showed that the reinforcement teaching technique was better than the conventional teaching technique in teaching statistics.

Ghimire, (2001) did a research on the topic " A study on the impact of experimental verification in teaching the deductive proofs of geometric theorems." The aim of the study was to find the effect of prior use of experimental verification on proving the geometric theorem. The study was conducted among 30 students of grade-IX of two different schools for 15 days. At the end of the experimentation time an achievement test was conducted and the scores were analyzed by using t-test with 0.05 level of significance. He concluded that there was a good effect of the prior use of experimental verification in proving the geometric theorem.

Gyawali, (2009) conducted a research on " The study of effectiveness of Van Heile approach in teaching geometry at secondary level". The objectives of this study were to explore the effectiveness of Van Heile approach in teaching geometry and reducing the gender difference in achievement in geometry. For this study 40 students were selected as sample involving in control and experimental groups 20/20 students in each group. This study was experimental quantitative type. In this study researcher found the mean achievement of the students taught by Van Heile's approach and the conventional method. Using t-test, the researcher concluded that Van Heile's approach more effective than the conventional method in geometry at secondary level.

K. C. (2005) did a research on the topic " Attitude of secondary level students towards the role of experimental verification for the theoretical prods in geometry". The sample of this study contained 128 grade-X students from four different schools. As the instrument, opinionnaire was used to collect the attitude of students. The set of opinionnaire contained 28 statements supporting to the role of experimental verification for the theoretical proofs of geometry. For the analysis chi-square test with 0.05 level of significance was applied. He concluded that the students have

positive attitudes towards the experimental verification for the theoretical proof in geometry.

Khanal, (2014) did an experimental research on the topic " Effect of reward in learning mathematics at basic level". The main objective of this study was to compare the mathematical achievement of grade-IV students taught by providing reward and without providing reward. A pre-test, post-test non-equivalent control group design was adopted for the purpose of the study. 18 students of Shree Navajyoti Lower Secondary School, Nawalparasi, were selected for experimental group. 20 students of Shree Kumariwati Higher Secondary schools, nawalparasi, were selected for control group. The experimental and control group of students were taught geometry through reward teaching strategy and conventional teaching strategy respectively for 20 periods. At the end of the experiment, achievement test on the unit of geometry was conducted to both groups and mean scores were calculated. the difference in mean achievement scores was tested using t test. In conclusion, the researcher found that the mean score of experimental group was more than the control group. He was concluded that the mean achievement score of students taught by providing reward became higher than main achievement score of student taught without providing reward in teaching mathemat.

The abosve studies had been done to find out whether the achievement of students in mathematics is affected by the variables such as materials, mathematical games, rewards, puzzles etc. or not. These studies become helpful materials for researcher to draw the conclusion of his research work. most of the researches were related to secondary level and this research became only one research related to instructional materials for teaching mensuration at primary level.

Chapter-III

RESEARCH METHODS AND PROCEDURES

Tools and techniques applied in research process are called methods. Research methods are the particular strategies researchers use to collect the evidence necessary for building and testing. The research methods are the procedures the researcher followed order to collect data and analysis data. The methods and procedures did not only aid the researcher in identifying and describing various research activities but it also assists the reader in understanding the continuity of the research activities of how the research was done.

The aim of this study was to find out the effectiveness of instructional materials on teaching of "mensuration" at primary level mathematics. The method used by the researcher in this study was of the experimental study design. The chapter is related to 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

This is the study of experimental type having two groups experimental and control. Experimental group was taught by using instructional materials on the other hand control group was taught by using traditional method. The pre-test and post-test non- equivalent group design was adopted for this study. The design is presented in the following table:

Table no: 1

Design of the study

Groups	Pre-test	Treatment	Post-test
E	T_1	X	T_3
C	T_2	O	T_4

Where

E= Experimental group,

C= Control group,

T_1 =Pre-test given to experimental group,

T_2=Pre-test given to control group,

X=Teaching using instructional materials,

O=Teaching without using instructional materials,

T_3=Post-test given to experimental group,

T_4=Post-test given to control group

This was an experimental study conducted on Damak Municipality Ward no. 14 Jhapa, Nepal. The name of the school is Shree Saraswati Higher Secondary School. Two groups of students were selected to fulfill the purpose of the study. These groups were selected from two sections and made homogeneous on the basis of pre-test result. Those students who were selected for this study were from different economic classes and background of the family.

Population and Sample of the Study

The population of the study consisted of all the grade-V students of Saraswati Higher Secondary School of Jhapa district. Two groups were made homogeneous as nearly as possible by conducting interview, pre-test marks and excluding some irregular, extra talent and high economic class students. According to school register, there were thirty five students in section A and 41 in section B. Researcher made two groups having twenty-five students in control group and thirty in experimental group. All the students in grade-V were considered while conducting the classes, but only twenty five students from control and thirty from experimental groups were considered for the study.

Formation of Control Group and Experimental Group

To fulfill the purpose of this study two groups were formed by researcher. For, this researcher administered an achievement test and took interview to the students. Marks obtained by students in pre-test and interview were main factor to determine experimental and control groups.

There were two sections of grade-V students in Saraswati Higher Secondary School consisting 35 students in section A and 41 in section B. The researcher took

interview of the students of both groups to find out their economic condition, parental education and talent. After taking the interview, the researcher decided to exclude some students who were from high economic family and parents were more educated. Some students who were irregular also excluded. Five irregular, two high economic class and three extra talent students of section- A were excluded. Similarly six irregular, four students who were taking class, and one talent students of section- B were not included in this research. From remaining students researcher formed two groups, section- A control and section- B experimental, with the help of tossing coin.

Dependent and Independent Variables

A variable that stands alone and is not changed by the other variable you are trying to measure is called variable. On the other hand, variable that depends on other factor is called dependent variable. For example, someone's age might be an independent variable and test score could be a dependent variable because it could change depending on several factors such as how you studied, how much sleep you got the night before you took the test.

On this research 'instructional material' and 'achievement' were the independent and dependent variables respectively. This research finds the effect of independent variables 'materials' over the dependent variable 'achievement'.

Intervention

An intervention is a deliberate process by which change is introduced. In this research, to find the effect of instructional materials in teaching mensuration what was done for experimental group is intervention. For that, two sections' students of Shree Sasaswati Higher Secondary School were selected. An achievement test conducted to divide experimental and control groups. For experimental group, researcher made teaching episodes were used to teach. On the other hand, traditional method of teaching was used for control group. Model of cuboid, cube, die, chalkbox, cardboard model of triangles, quadrilaterals, squares, rectangles were the instructional materials for teaching experimental group. The methods to prepare model of cube and cuboid were also taught for experimental group. Sometime, group works were given to experimental group by dividing them into groups. They participated actively in group works. Continuous feedback was given to them. They were curious to do homework

and class work. These all were happened due to the use of instructional materials in teaching. At the end of the experiment, an achievement test was conducted for both experimental and control groups. Comparing the pre-test and post-test marks of experimental and control groups conclusion was drawn. In this way, the effect of instructional materials in teaching mensuration at primary level was found.

Method of Developing Teaching Episodes

The teaching episodes were developed by the researcher on unit Mensuration. Ten episodes were formed with activities which were applied for teaching experimental group. These episodes were designed to help the researcher in teaching and to give the concepts of mensuration at primary level. Teaching materials mentioned in episodes were formed by researcher. Some materials were collected by researcher and students. These episodes dealt with perimeter of polygon, area of rectangle and square, perimeter of rectangle and square, area of cuboid and cube and volume of cuboid and cube.

Method of Experiment

At first, the researcher conducted the achievement test and took the interview of both sections students to divide them into experimental and control groups. After that, researcher taught the experimental group by using instructional materials on the other hand control group was taught without using instructional materials. The research was conducted for 1 month. The topic 'Mensuration' of primary level or grade-V was taught to both experimental and control groups. All the students of both sections were included in experimental period. At last, post-test was administered for both groups. With the help of marks obtained by students of experimental and control groups in pre-test and post-test conclusion was drawn.

Control Exercised in the Experiment

The main objective of this research was to investigate the effectiveness of independent variables 'instructional materials' over dependent variable 'achievement'. Intervening variables such as parental education and socio-economic condition, teacher's qualification, school condition were same in the both groups. Those students who were extra talent and whose economic condition was high also

excluded from this research. These intervening variables were found researcher by taking interview among the whole students. On the case of teacher qualification, school condition, researcher taught both groups so teacher qualification does not effect for the achievement score for the students. On the case of economic condition all the students were from the same financial background. Text book may be the intervening variable for the achievement, but the researcher followed the same book for the both group so it did not have any impact for the achievement.

There were two sections of grade-V students in Saraswati Higher Secondary School and section- A consisted of 35 students and section- B 41. The investigator interviewed the students of both sections one by one to find out their economic condition, parental education and talent of the students. After taking the interview, the researcher decided to exclude some students who were from high economic class and parents were more educated. Some students who were irregular also excluded. Five irregular, two high economic class and three extra talent students of section-A were excluded. Similarly six irregular, four students who were taking tuition class, and one extra talent students of section- B were not included in this research. From remaining students researcher formed two groups, section- A control and section-B experimental group.

Tools

Achievement test was the main tool for the data collection of this study. Researcher constructed the achievement test which consisted of knowledge level questions, understanding level questions, skill level questions and problem solving questions. Questions were based on the topic of mensuration of grade-V. After conducting the test quantitative data were collected.

For qualitative data, interview and observation were conducted by researcher in their classroom activities. Involvement of students in group activities, curiosity, interest and feelings were observed for both experimental and control groups with the help of the observation checklist. Researcher was conducted the interview of the students to know the view of students about instructional materials.

Validity and Reliability of Tests

The validity of the instrument used for data collection was determined by expert judgement of three mathematics teachers and two experts in measurement and evaluation. The reliability of the instrument was determined using test-retest method with two weeks interval using pupil with the same characteristics as the sample of the study. A reliability co-efficient was determined for the instrument using Pearson's product moment correlation formula. Correlation coefficient was 0.94.

Validity Threats

Validity is crucial to any research as it focuses on how well we have measured what we intended to measure. Due to the importance of validity of experimental research we should be aware of what could compromise it. There are two categories of validity that are concerned with threats to research; they are internal and external validity (Campbell and Stanley, 2012).

Internal validity is most concerned with strength and control of a research design and its ability to determine casual relationship between independent and dependent variables (Campbell and Stanley, 2012). In this research the researcher controlled the different factors that affect the treatment of experimental and control group. Researcher controlled those students whose parental education and financial status were very high and controlled those students who were taking tuition classes regularly. Researcher controlled the different types of intervening variables. The researcher found these variables by using interview and interaction among the whole students.

External validity consists of a determination whether the result of the experiment can be generalized to an entire population from which sample was drawn in the study. Threats to external validity can create significant result during an experiment (Campbell and Stanley, 2012). In this study only tool those students whose parental education, economic and school conditions were same. On the case of teacher education, researcher taught both groups. Researcher followed same book and same contents to teach for both groups so it did not affect the achievement. The same teaching methods were applied in both groups during the research period but only

instructional materials were used for experimental group. So, the confounding variables did not affect in achievement of students.

Data Collection Procedure

The procedure of data collection describes how the relevant information was gathered. This study based on quantitative data obtained from the achievement test and qualitative data obtained from the observation of the students, their view and curiosity in mathematics. With the help of the three mathematics experts and experts in measurement and evaluation, researcher made pre-test questions set. It was administered at Shree Dipini Lower Secondary School, Damak 10, Jhapa. There were 16 students in grade-V. After 10 days, re-test was administered for the students of same school and grade. Test, re-test scores were collected and correlation coefficient of scores was found for the reliability of the test. It was 0.94. Hence the researcher found that questions were reliable. So, pre-test was administered for grade-V students of Saraswati Higher Secondary School and marks obtained by them were collected. By analyzing marks of pre-test, their economic condition, talent and regularity two groups experimental and control were formed. Both, experimental and control groups were taught by researcher from 2069-5-13 to 2069-6-30. Experimental group was taught using instructional materials, and control group was taught without using instructional materials. At the end of the teaching, an achievement test was administered on both groups. After completing the test, answer sheets were collected and scored by the researcher and then scores were tabulated for the analysis. In this way quantitative data were collected.

For qualitative data, regular observation of the students was made by the researcher. Classroom activities, involvement on group work, curiosity in learning, and interest were observed. Students of experimental group were curious and interested to learn. They involved actively in group work and other activities given by researcher. On the other hand, students of control group were not curious and interested to learn. To know the view of the students about the instructional materials, researcher had asked some questions to them. Students of experimental group were in the favor of instructional materials. They said that instructional materials were helpful in teaching.

Data Analysis Procedure

The collected data were analyzed and interpreted by using statistical devices by giving critical appraisal using the following procedures. To analyze the obtained data the researcher used the following procedures and statistical tools.

- Mean, standard deviation and variance were calculated for both groups from their secured marks in the test.
- t-test was used at 0.05 level of significance to find whether the difference of two means is statistically significant or not. Method of pool variance was used. When the samples are small and their variance are equal nearly, we can use the method of pooled variance to test the significance difference between two independent means. the critical values of t-test were found for $N_{1+}N_2$-2 degrees of freedom.
- Qualitative data were analyzed by making theme. Observation and interview of students were conducted with the help of the questionnaire and observation checklist given in appendix. Interest, involvement in activities, regularity, behaviour with friends were observed. Views of students about instructional materials were found by taking interview. With the help of the collected information from observation, interview, and interaction with students their feelings classroom activities were analyzed in a descriptive nature.

Chapter-IV

ANALYSIS AND INTERPRETATION

The major objective of the study was to determine the effectiveness of instructional materials in teaching mensuration. Experimental method was adopted to test the effectiveness of instructional materials by comparing with that of traditional method commonly adopted in primary school for teaching mathematics. Two groups were selected and study materials were prepared for grade-V mathematics. A sample of 55 students from two section of Saraswati Higher Secondary School was selected for the study. Out of 55 students 30 were identified as experimental group and other as control group.

The treatment was teaching experimental group using instructional materials and traditional method of teaching in control group. After the experiment, the post test was conducted by administering test prepared by researcher. The statistical analysis of the obtained data is presented in this chapter. The data of the achievement tests scores were analyzed under the following headings:

- Comparison of experimental and control groups on pre-test scores.
- Comparison of experimental and control groups on post-test scores.
- Comparison of pre-test scores of boys and girls of experimental group.
- Comparison of post-test scores of boys and girls of experimental group.
- Comparison of pre-test and post-test scores of girls of experimental group.

Comparison of Experimental and Control Groups on Pre-test Scores

The pre-test scores of pupils of experimental and control groups are presented in appendix. The t-test analysis for the comparison of mean achievement scores of pre-test has been presented in table no 2.

Table-2

Comparison of Pre-test Scores

Groups	N	Mean	S. D.	Variance	t-value
Experimental	30	12.43	7.34	53.85	0.0048
Control	25	12.44	8.07	65.13	

Data in table 2 shows that there are 30 students in experimental group. The mean score obtained by them is 12.43 and standard deviation is 7.34. Similarly, mean and standard deviation of control group are 12.44 and 8.07. At this stage, mean and standard deviation of experimental and control groups are nearly equal. The table shows that the t-test calculated value (0.0048) is less than t-test table value (1.96) at 0.05 level of significance with $N_1+N_2-2=53$ degrees of freedom. Based on the result, the null hypothesis is accepted at 0.05 level of significance. There is no significant difference between students achievement of experimental and control groups on pre-test scores.

Comparison of Experimental and Control Groups on Post-test Scores.

The post-test was administered to both groups experimental and control after giving treatment. The post-test scores of experimental and control groups have been presented in appendix and mean, standard deviation and variance have been calculated to calculate t-value.

Table-3

Comparison of Post-test Scores

Groups	N	Mean	S. D.	Variance	t-value
Experimental	30	18	6.63	43.93	-2.21
Control	25	13.6	8.18	66.88	

Data in table-3 shows that mean and standard deviation of experimental group are 18 and 6.63. Similarly mean and standard deviation of control group are 13.6 and 8.18. The difference between mean of experimental and control groups is 4.4. The table shows that the t-test calculated value (-2.21) is less than the t-test table value (-1.96)

at 0.05 level of significance with $N_1 + N_1 - 2 = 53$ degrees of freedom. Based on the result, the null hypothesis is rejected at 0.05 level of significance. The test analysis indicates that the difference in mean is found significant at 0.05 level. Analysis of the pre-test scores indicates that the groups were comparable at 0.05 level of significance. So, the better performance of experimental group over control group on the post-test scores might have been attributed due to new treatment (i.e. use of instructional materials) given to experimental group.

Comparison of Pre Test Scores of Boys and Girls of Experimental Group

For the comparison of pre-test scores of boys and girls of experimental group, mean, standard deviation, variance and t-value are calculated. These values are presented in the following table.

Table-4

Comparison of Girls and Boys Scores of Pre- test

Groups	N	Mean	S. D.	Variance	t-value
E(Boys)	12	12.5	8.33	69.73	0.0402
E(Girls)	18	12.39	6.57	43.23	

Data in table 4 shows that there are 12 boys in experimental group. The mean score obtained by them is 12.5 and standard deviation is 8.33. Similarly, mean and standard deviation of girls of experimental group are 12.39 and 6.57. . The table shows that the t-test calculated value (0.0402) is less than t-test table value (2.04) at 0.05 level of significance with $N_1+N_2-2=28$ degrees of freedom. Based on the result, the null hypothesis is accepted at 0.05 level of significance. There is no significant difference between achievement of boys and girls of experimental group on pre- test scores.

Comparison of Post Test Scores of Boys and Girls of Experimental Group

On the basis of post-test scores of boys and girls of experimental group, mean variance, and standard deviation have been calculated to calculate t-value. All these values are given in the table 5.

Table-5

Comparison of Girls and Boys Scores of Post-test

Groups	N	Mean	S. D.	Variance	t-value
E(Boys)	12	17.5	6.9	47.58	-0.31
E(Girls)	18	18.33	7.34	52.82	

Data in table 5 shows that there are 12 in experimental group. The mean score obtained by them is 17.5 and standard deviation is 6.9. Similarly, mean and standard deviation of girls of experimental group are 18.33 and 7.34. At this stage, mean and standard deviation of boys and girls of experimental groups are nearly equal. The table shows that the t-test calculated value (-0.31) is greater than t-test table value (-2.048) at 0.05 level of significance with $N_1+N_2-2=28$ degrees of freedom. Based on the result, the null hypotheses is accepted at 0.05 level of significance. There is no significant difference between the achievement of boys and girls of experimental group on post test.

Comparison of Pre Test and Post Test Scores of Girls of Experimental Group

With the help of the pre-test and post-test scores of girls of experimental group, mean, variance, and t-value have been calculated. These values are presented in the following table.

Table-6

Comparison of girls Scores of Pre-test and Post-test

Scores	N	Mean	S. D.	Variance	t-value
Pre Test	18	12.39	6.57	43.23	-2.56
Post Test	18	18.33	7.34	53.82	

Data in table-6 shows that mean and standard deviation of pre test scores of girls of experimental group are 12.39 and 6.57. Similarly mean and standard deviation of post test scores of girls of experimental group are 18.33 and 7.34. The difference between mean is 5.94. The table shows that the t-test calculated value (-2.56) is less than the t-test table value (-2.101) at 0.05 level of significance with $N_1+ N_1-2= 34$

degrees of freedom. Based on the result, the null hypothesis is rejected at 0.05 level of significance. The test analysis indicates that the difference in mean is found significant at 0.05 level. So, the better performance of the girls of experimental group on post test over girls of experimental group on pre test scores might have been attributed due to new treatment (i.e. use of instructional materials) given to them before post test.

Students Feeling While Teaching With Materials

Qualitative analysis is made on the basis of observation of students by researcher in their classroom activities. Observation is a kind of tool that helps to seek information and knowledge through the use of sense organs. Etymologically, observation could be understood as the act of watching somebody/something carefully for a period of time, especially to learn something. In the research work, observation is an effective and suitable method for reliable primary data collection tools. On the basis of classroom instruction the researcher observed the students activities and noted them daily on his notebook which gives a glimpse of the enthusiasm of students of experimental group. Researcher noted mainly streams of students' activities, their feelings and attendance from observation of class room. The researcher also noted about activeness of student, participation in class room activities, regularity and problem solving capacity. During the experimental period researcher found that every students of experimental group were curious and interested to learn. All the students of experimental group were listening silently and participated in group activities actively. They were feeling easy for learning mathematics.

On the other hand, researcher found that his teaching was not effective in control group because students of that group were not interested and curious to learn. They were feeling bore and difficult to learn. They were not excited to learn mathematics. They did not take mathematics as interesting subject. They frequently complained that mathematics is very difficult subject even they used to say ' I can't do well in mathematics. There was a vast difference in talent and weak students. Only the talent students participated in the classroom activities. They often sat on the front row of the classroom but the weak students rarely participated in classroom activities, they often sat on the last row. They did not do their homework and class work regularly. The attendance rate of control group was lower than experimental group. Most of

students in control group were passive in learning activities so the teacher had to do more exercise in such class rather than students. In summary, most of the students of control group were inactive, not laborious and not concentrated. Very weak performance of students was observed. The students of control group did not interact with each other and even with the teacher. Only few students of control group were serious for their study.

Here, one episode is given. It was the observed class of experimental group.

Episode

Researcher entered his classroom. All the students were happy. They were waiting for his class. Among 41 students 39 were present. Environment of classroom was good.. He started his lesson area and volume of cube by showing model of cube and die. He wrote area of cube = sum of area of all faces. He asked some questions to the students. What is the shape of the face of cube? How many faces does a cube have? All the students were curious to find out the answers. they were interested and curious to learn. No one was lazy. According to the answers given by them, he completed this as: area of cube = $6l^2$. Showing the formulas chart, he clarified the students about the formulas. At that time, they were feeling easy and saying that they solved problems related to area and volume of cube easily. Students were involved in problem solving actively .They were motivated. Most of students did the problem without hints. Some were helping their friends to complete the problem. In this way, researcher completed his observation class. At last, he gave some problems related to cube for homework.

Finally, researcher found that students were participating actively in learning activities. They were encouraged to solve the answer of given questions. Researcher and students interaction was friendly, interesting and students were participating in all the classroom activities. They attained the class regularly. It was also found that the systematic use of materials can have profound effects on the role of teacher in teaching learning process. On the basis of the classroom instruction, the teacher observed that the use of instructional materials in teaching mathematics concept was found motivating and interesting to facilitate for active participation in the classroom activities. On the other hand, teaching without using materials was less interesting and

motivating to clarify the mathematical concepts. It was also difficult to activate the students as well as create the interest in the problem.

To analyze the responses of students, the researcher conducted the interview of half an hour for them. Researcher asked following questions and collected the answer given by them.

Researcher asked to students, "What did you feel when I taught you using instructiona and without using instructional materials".

Student A replied, "Teaching with instructional materials is easy than traditional methods."

Student B replied, "I felt learning became interesting."

Student C replied, "Instructional materials helped to all students to understand subject matter."

Student D replied, " I understood this lesson easily."

Student E replied, "All the classes were interesting."

Similarly, other some related questions were asked and students expressed positive view toward the use of instructional materials in teaching mathematics.

Hence, from the above information obtained from classroom observation and views of students about instructional materials, researcher found that instructional materials facilitate students to participate in classroom activities, to be regular in class and to interact with teacher. On the other hand, teaching without materials was less effective. Students of that group were not interested, and less active for learning mathematics. So, instructional materials are effective in teaching mensuration at primary level.

Chapter-V

SUMMARY, FINDINGS, CONCLUSION AND RECOMMENDATIONS

The main purpose of this study was to find out the effectiveness of instructional materials while teaching mensuration at primary level. This study was intended to answer the question whether the use of instructional materials yields better result of students than without using it while teaching mensuration at primary level.

Summary

A pre-test, post-test equivalent groups design was adopted as the design of the study. Grade-five students of saraswati higher secondary school, Damak-14, Jhapa were chosen for the study. Two groups, section A taken as control and B as experimental groups, were made homogeneous on the basis of pre-test result. The researcher taught both groups experimental and control same selected unit following the lesson developed by the researcher. Experimental group was taught by using instructional materials and control group without using materials. Four weeks time period was given to both groups.

At the end of teaching a post-test was administered on both groups. The pre-test, post-test non-equivalent group design was adopted for the purpose of the study. Mean S.D. and variance were calculated in both groups with the help of their obtained marks. T-test was applied in order to compare the mean difference between two groups. The data were analyzed and interpreted statistically to find the conclusion.

Findings

The result of pre-test indicated that there was no significant difference on the pre-test scores of both groups. But the result of the post-test indicated that there was significant difference in achievement at specified level in favour of experimental group.

T-test was used to compare mean scores of experimental groups and control groups on pre-test. The result of the test indicated that there was no significant difference between the groups at 0.05 level of significance. But the result of post-test

indicated that there was significant difference in mean achievement score of experimental and control groups. Similarly there was no significant difference in mean achievement scores of boys and girls of experimental group on pre-test scores as well as post-test scores. But there was significant difference in mean achievement scores of girls of experimental group on pre-test and post-test scores.

On the case of qualitative analysis, researcher found that all the students were curious to learn mathematics in experimental group. They were feeling easy and interesting. But the students of control group were not curios and interested to learn. They were feeling bore and difficulty to learn. Class teacher and students of experimental group were given positive attitude towards the use of instructional materials at primary level.

Conclusion

Instructional materials are very important for mathematics teaching. If teacher promotes instructional materials to make clear concept about lesson, the achievement of students increase. So, it can conclude that the method of teaching at primary level should be changed to increase students' achievement in mathematics.

Recommendations

Followings are the some recommendations and suggestions for the improvement of the teaching situation at primary level classes.

- Concrete materials should be used while teaching mathematics at primary level.
- Mathematics teacher should be encouraged to use materials in teaching mathematics
- Training should be provided for untrained teacher.
- Mathematics teachers should be made to ensure that the instructional materials are relevant to the mathematics concepts that they will be used.

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APPENDIX-A

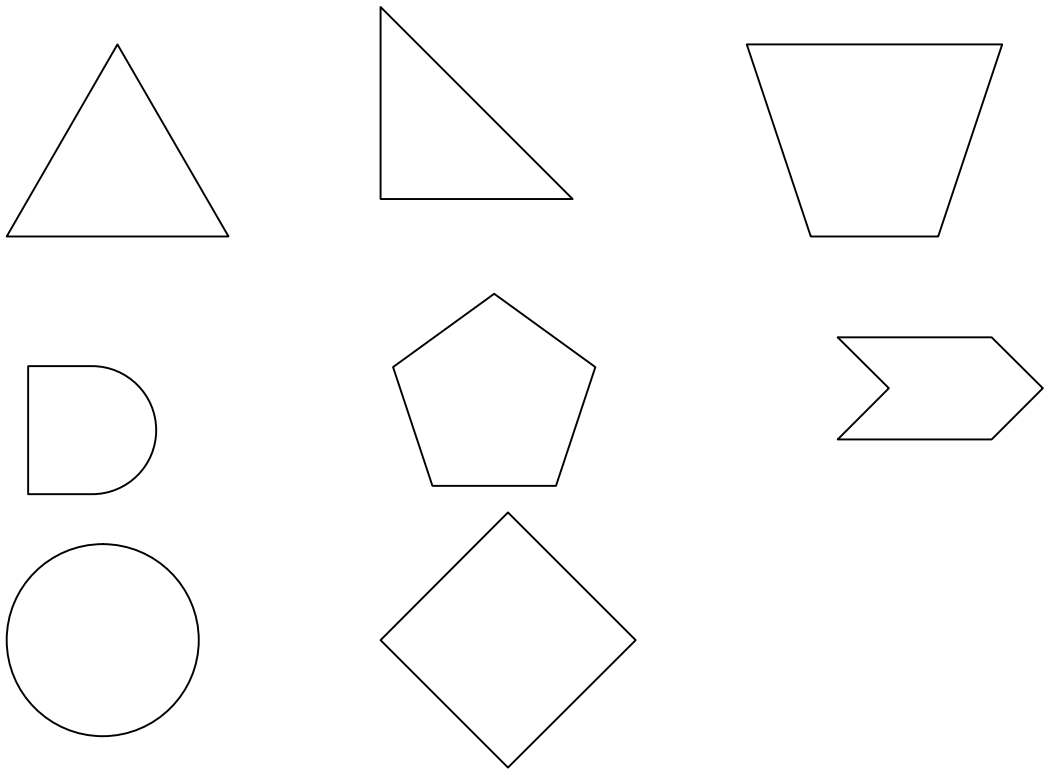
Teaching Episodes-1

Subject: Mathematics Class: V

Unit: Mensuration Date: 2069-5-13

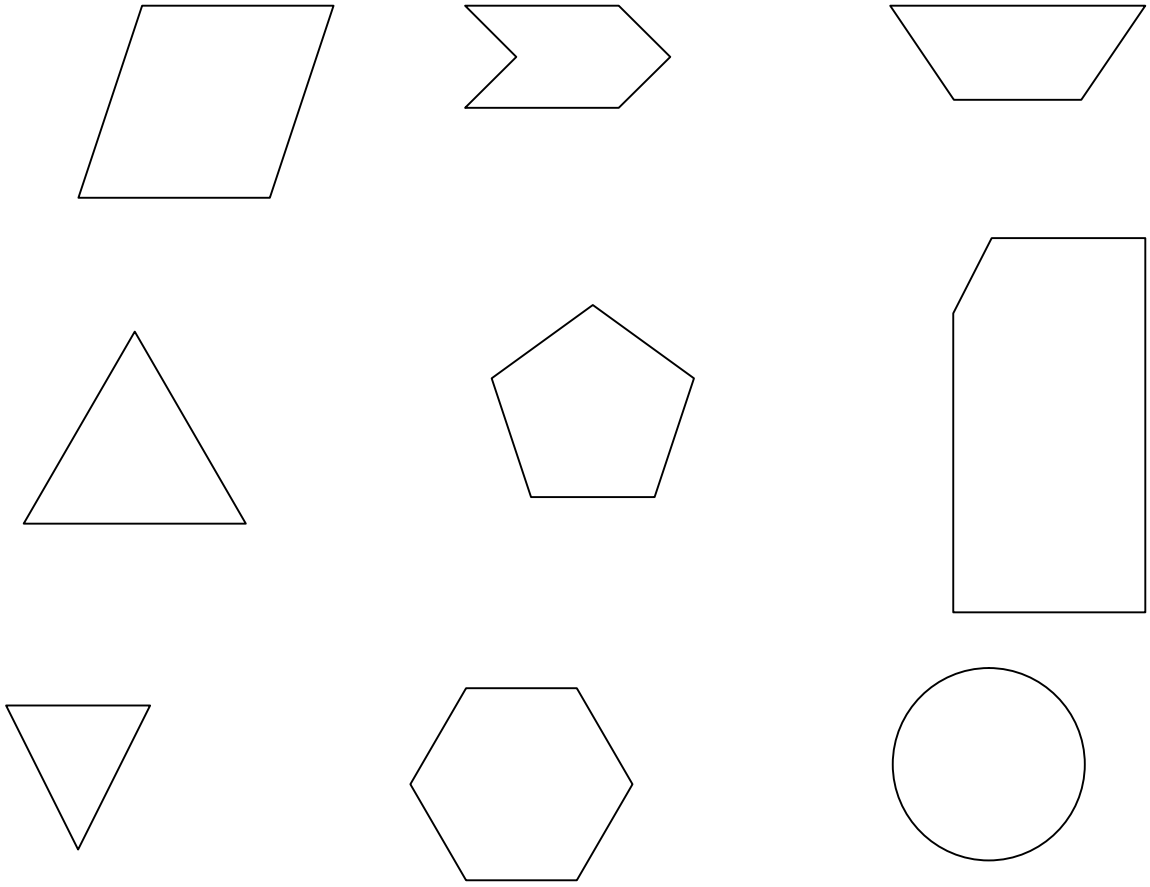
1. Specific Objectives: At the end of the lesson students will be able to
   I. Define triangle and quadrilateral.
   II. Find the right figure of triangle and quadrilateral.
2. Teaching materials: cardboard model of triangles quadrilaterals and other polygons.
3. Teaching procedures and activities:
   a) The teacher provides different models of triangles, quadrilateral and other polygons and let the students to discuss on it. Ask them to know, which is triangle, quadrilateral, and other polygons.
   b) Give some clues and collect all the responses from students.
   c) Draw the some polygons on board and let them to discuss.

For example:



d)After discussing about the models and figures, definition of triangle and quadrilateral will be made in class.

4. Evaluation: Which of the following figures are of triangles and quadrilaterals?



5. Homework: i) Write the definition of triangle and quadrilateral.

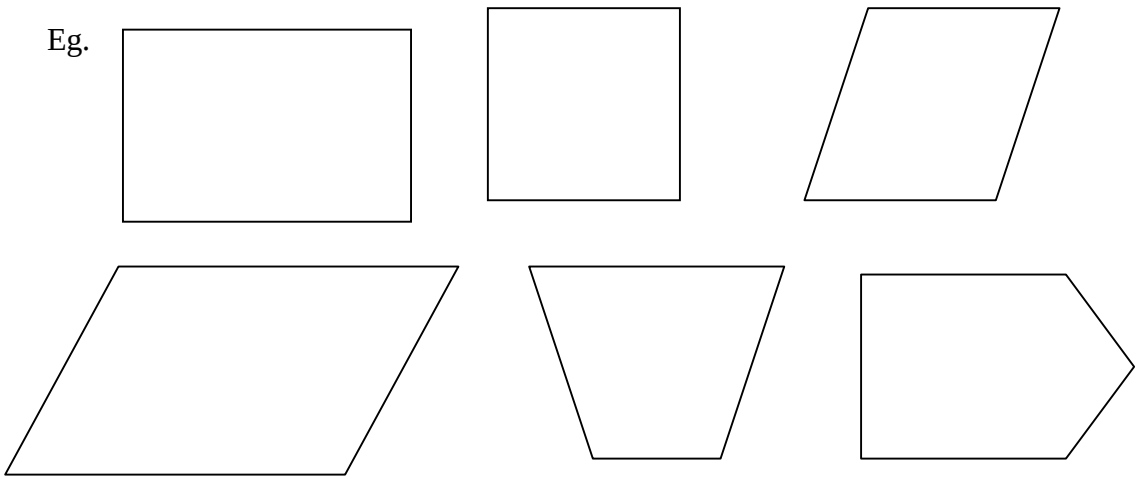
Teaching episode-2

Subject: Mathematics Class: V

Topic: Rectangle and square Date: 2069-5-14

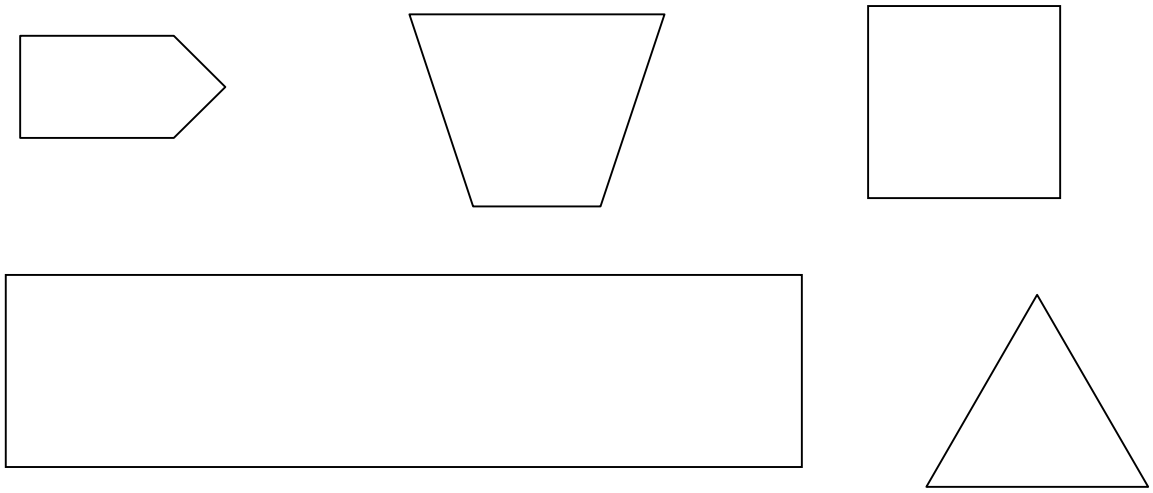
1) Specific objectives: At the end of the lesson students will be able to
   a) Define rectangle and square.
   b) Find the right figures of rectangle and squares.
2) Teaching materials: Cardboard model of rectangle and square.
3) Teaching Procedures and activities:
   a) By providing models, teacher starts his lesson and discusses about them.
   b) Ask them about rectangle and square.
      How do you define rectangle?
      How do you define square?
   c) Let them to discuss about rectangle and square. Ask them to measure length of opposite sides and all angles of models. Ask the students individually about the measures of models.
   d) After that, collect all the responses of the students and draw the conclusion.
   e) Drawing some figures on the board let them to discuss in group.
   f) Ask the following questions.
      Which one is rectangle?
      Which one is square?

Eg.



g) Collect all the responses given by them. If they are still confuse make clear them by giving some other example.

4) Evaluation:
   a) What is rectangle?
   b) What is square?
   c) Find the right figures of rectangle and square.



5) Homework:
   a) Write the definition of rectangle square and quadrilateral.

Teaching episode-3

Subject: Mathematics Class: V

Topic: Perimeter of polygon(triangle, quadrilateral, pentagon etc) Date: 2069-5-15

1) Specific objective: At the end of the lesson students will be able to find the perimeter of given figures.
2) Teaching materials: Cardboard model of triangles quadrilaterals and polygons.
3) Teaching procedures and activities:

a) Provide model of polygon to the students. Clarify the students about perimeter of polygons. For that, ask them to measure boundaries of polygon. If they found ask them to sum all boundaries. If not tell them to measure the way to measure the boundaries of polygon.

b) Draw the conclusion about the perimeter of polygon with the help of the above discussion.

The length of boundaries of a closed figure is called its perimeter.

Perimeter of polygon = sum of length of all sides.

c) Discuss about other more examples.

Example: find the perimeter of triangle having sides 3cm 4cm and 5cm.

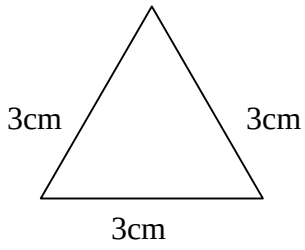
We know that, perimeter of triangle = sum of all sides

= 3cm+ 4cm+ 5cm

= 12cm

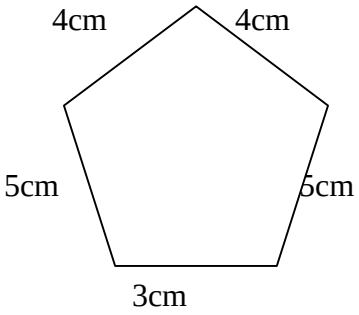
4) Evaluation :

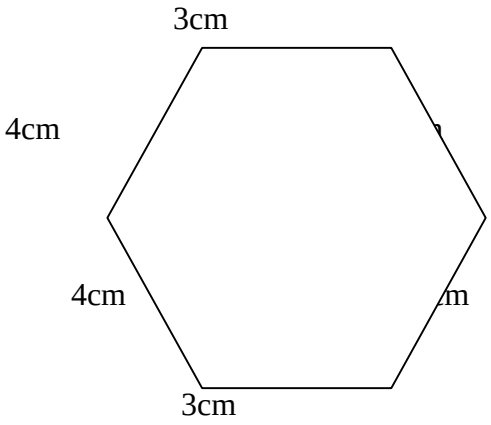
a) Find the perimeter of given triangle.



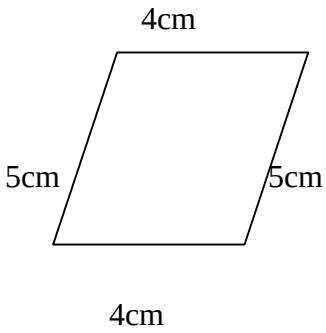
b) Find the perimeter of given figures

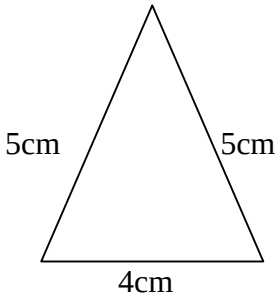
.





5) Homework: Find the perimeter of the following figures





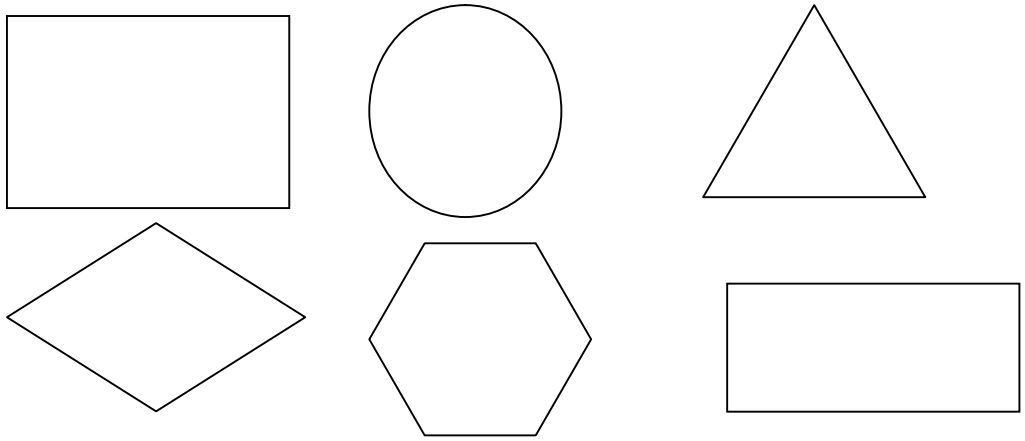
Teaching episode-4

Subject: Mathematics Class: V

Topic: Perimeter of rectangle Date: 2069-5-16

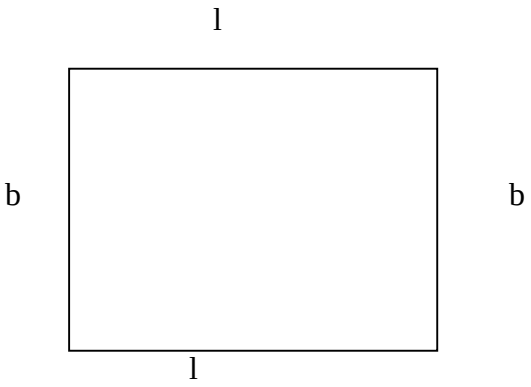
1) Specific objective: on completion of lesson students will be able to find the perimeter of rectangle.
2) Teaching materials: cardboard model of rectangle and formula chart.
3) Teaching activities:

a) By drawing some figures on board, ask to students to know the correct figures of rectangle.



b) Showing materials, discuss about the formula of perimeter.

Example:



Perimeter of polygon: length of boundaries

= l+ b+ l+ b

=2l+ 2b= 2(l+ b)

c) Giving one example, discuss to find the perimeter of rectangle.

Example: Find the perimeter of rectangle having length 5cm and breadth 4cm.

Here, length and breadth of rectangle is denoted by l and b.

Then (l) = 5cm

(b) = 4cm

We know that perimeter of rectangle is denoted by p and

P = 2 (l+ b)

= 2 (5cm + 4cm)

= 2 (9 cm)

= 18 cm

d) Teacher can discuss about other example.

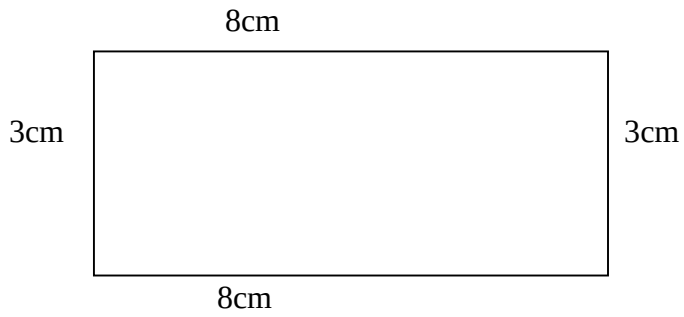
4) Evaluation:

a) What is the formula of perimeter of rectangle?

b) What is the perimeter of rectangle having length 20 cm and breadth 10 cm?

5) Homework:

a) Find the perimeter of rectangle given in the figure.



c) What is the length of rectangle if perimeter and breadth are 18 cm and 4cm ?

Teaching episode-5

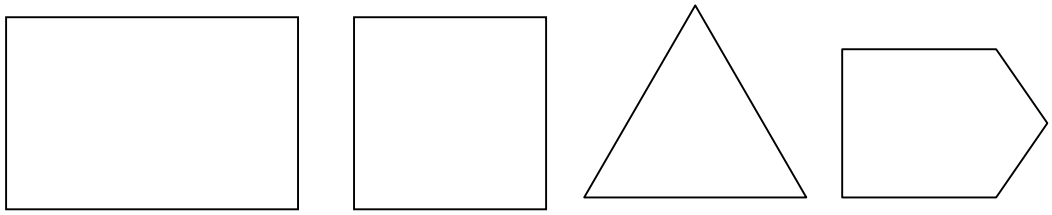
Subject: Mathematics class: V

Topic: Perimeter of square date: 2069-5-17

Specific objective: At the end of the lesson the students will be able to find the perimeter of square.

Teaching materials: formulas chart

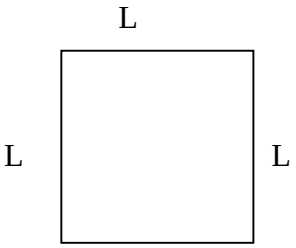
Teaching activities: a) Ask the students to know the correct figures of square. Give some hints, if they don't find.



b) Discuss about the formula of perimeter of square.

Perimeter= L + L+ L+ L

= 4L



(all sides of a square are equal)

c) Discuss about the process to find the perimeter.

Example: Find the perimeter of square having length 10 cm.

Here, length of square is denoted by L and its perimeter by P

Then, L = 10 cm

P = ?

We know that P = 4L

$=4\times10$ cm

$= 40$ cm

d) Discuss about some other examples.

Evaluation:

a) What is the formula to find the perimeter of square?
b) What is the length of square if perimeter is 80 cm?

Homework:

a) Find the perimeter of square of length 5.4 cm.
b) Find the length of square if perimeter is 80 cm.

Teaching episode-6

Subject: Mathematics Date: 2069-5-18

Topic: Area of rectangle and square Class: V

Specific objectives: At the end of the lesson the students will able to

a) Find the area of rectangle.
b) Find the area of square.

Teaching materials: Formulas chart

Teaching activities:

a) Discuss about the characteristics of square and rectangle.
   Opposite sides of rectangle are equal. Do you know about the sides of square?
   Ask them about the angular relation of the square and rectangle.

b) By showing formulas chart, clarify them about formulas.
c) Discuss about the process to find out the area of square and rectangle.
   Find the area of rectangle having length 8cm and breadth 5cm.
   Here, length, breadth, and area if rectangle are denoted by the letter l, b, and a
   Then, l = 8cm
   b = 5cm
   a =?
   Ask the students to say the correct formula of area of rectangle. Collect the responses of some students. If they unable to say, again by showing chart tell about formula. Let them to complete this problem

d) Let them to do some example.
   Find the area of square having length 10cm.
   What is the length of square, if its perimeter is 20cm?
   Find the area of rectangle of length 20cm and breadth 11cm.

Evaluation:

a) Which formula can we apply to find the area of rectangle?
b) Which formula can we apply to find the area of square?

Homework:

a) Find the area of rectangle having length and breadth 10 cm and 8 cm.

b) Find the area of square of 8 cm length.
c) If the area of square is 100 cm^2, then find its length.
d) If the area and breadth of rectangle are 60 cm^2 and 5 cm, then find its length.

Teaching episode-7

Subject: Mathematics Date: 2069-5-19

Topic: Cuboid Class: V

Specific objectives: at the end of the lesson the students will be able to

a) Recognize the cuboid.
b) Say the number of faces, vertices of cuboid.

Teaching materials: Model of cuboid chalkbox etc.

Teaching activities:

a) Ask some questions from previous lesson.
   What is the formula of area of square?
   Which formula can we use to find the area of rectangle?
b) Showing model and chalkbox, discuss about shape, faces, vertex, and edges of cuboid.
   Ask them to count the faces of cuboid.
   Ask them to count edges and vertices.

c) Let them to measure length and breadth of each faces.
d) Make clear concept about cuboid.

Evaluation:

a) How many faces does a cuboid have ?
b) Tell the total number of faces, edges, and vertices of a cuboid?

Teaching episode-8

Subject: Mathematics Date: 2069-5-20

Topic: Cube Class: V

Specific objectives: At the end of the lesson the student will be able to

a) Find out the right figure of cube.
b) Tell the number of faces, edges, and the vertices of a cube.

Teaching materials: Model of cube, Die etc.

Teaching activities:

a) By showing model of cube, chalkbox and die, ask them to differentiate among them.
b) Make clear them about number of faces, edges, and vertices of cubes.
   By giving model of cube, ask them to count faces edges and vertices. Teacher can guide to count them. Collection of responses will be made at the end of the discussion. Those who will be unable to say, teacher can treat them individually.
c) Discuss about the shape of each faces of cube.

Evaluation:

a) How many faces does a cuboid have?
b) Say the total number of edges and vertices of cuboid

Teaching episode-9

Subject: Mathematics Date: 2069-5-21.

Topic: Surface area and volume of cuboid Class: V

Specific objectives: At the end of the lesson students will be able to

a) Find the area of cuboid.
b) Find the volume of cuboid.

Teaching materials: Model of cuboid, formulas chart

Teaching activities:

a) Discuss about the formulas of surface area and volume of cuboid

For example: Total number of faces of cuboid are 6 and each faces is of rectangular shape.

Therefore area of cuboid = Area of six faces

= lb+ lb+ lh+ lh+ bh+ bh

= 2lb+ 2lh+2bh

= 2(lb+ lh+ bh)

b) Discuss about the process to find out the area and volume of cuboid.

c) Let them to do some examples.

For example: find the total surface area of cuboid having 5cm, 4cm, and 3cm length, breadth, and height.

Here, l = 5cm
b = 4 cm
h = 3cm
s = ?

We know that

S = 2 (lb + lh +bh)

(Ask this formula to the students)

= 2 ( )

(Ask to complete this blank. Let them to discuss it.)

Evaluation:

a) Which formula can we use to find the surface area of cuboid?
b) Which formula is applicable to find the volume of cuboid?

Homework:

a) Find the total surface area of cuboid having length 5cm breadth 4 cm and height 4 cm.
b) Find the volume of cuboid having length 10 cm breadth 8 cm and height 4 cm.

Teaching episode-10

Subject: mathematics Date: 2069-5

Topic: surface area and volume of cube Class: V

Specific objectives: At the end of the lesson the students will be able to

a) Find the area of cube.
b) Find the volume of cube.

Teaching materials: Model of cube, formula chart

Teaching activities:

a) Discuss about the formulas of surface area and volume of cube.
   By showing model of cube, how many faces does this solid have? Ask them about the shape of faces.
b) Giving one example, make clear them to calculate area and volume of cube.
   Find the volume of the cube of 8cm length.
   To solve this problem, following discussion can be made.
   How many faces does this model have?(By showing model of cube).
   Can you about the shape of faces of cube? Collecting the responses of some students, this problem can be done by discussion.
   Length (l) = 8cm
   Volume (v) = ?
   Ask to some students
   We know that volume of cube $v = l^3$
   $=(8cm)^3$
   $= 512cm^3$
c) Let them to do some examples.

Evaluation:

a) Which formula is applicable for finding the surface area of cube?
b) Which formula can we use to find the volume of cube?

Homework:

a) Find the volume of the cube of length 5 cm.
b) Find the surface area of cube having length 10 cm.
c) If volume of cube is 125 cm^3, find its length and surface area.

Appendix-B

Pre-test Questions

Class: V F. M.: 30

Topic: Mensuration Time: 1hr 30min

Group A

Tick (√) the best answer 5×2=10

1. which is the formula for finding perimeter of rectangle ?

(a) 2 (l + b) (b) l × b (c) 4l (d) l^2

2. Area of cube is……..

(a) $5l^2$ (b) l×b×h (c) $6l^2$ (d) 4l

3. How many faces does cuboid have?

(a) 8 (b) 7 (c) 6 (d) 5

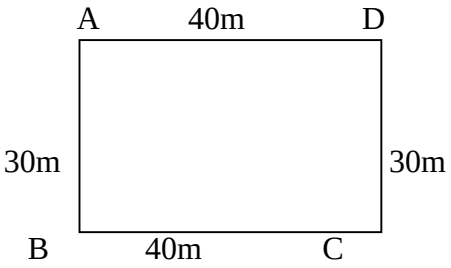
4. The length of a square room is 10m, what is its perimeter?

(a) 40 m (b) 20 m (c) 30 m (d) 50 m

5. What is the area of given figure?

(a) 70 m^2 (b) 1200 m^2

(c) 700 m^2 (d) 140 m

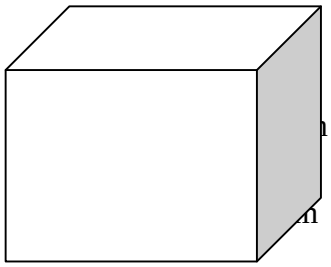


Group: B

5×4=20

6. Find the area of square whose perimeter is 36 cm.

7. Find the surface area of the following cuboid.



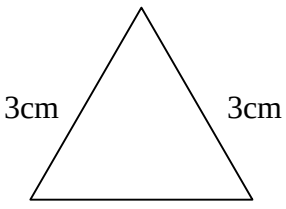
10cm

8. The volume of cube is $64m^3$. Find its length.

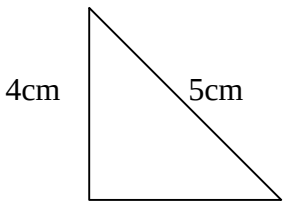
9. A cuboid has a volume of 100 cm^3, if its length and breadth are 10cm and 5cm respectively. Find its height.

10. Find the perimeter of the following figures:

a)



b)



Appendix-C

Post-test Questions

Class: V F. M. 30

Topic: Mensuration Time: 1hr 30 min

Group- A 5×2= 10

Tick the best answer.

1) Which is the formula for finding the perimeter of square?

   a) 4l b) 2 (l + b) c) l^2 d) l+ b

2) Area of cuboid is…

   a) 2(lb+lh+bh) b) $6l^2$ c) lb d)

3) How many faces does a cube have?

   a) 5 b) 6 c) 8 d) 10

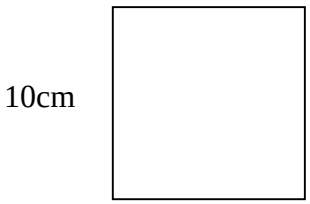
4) The length and breadth of rectangle are 5cm and 4cm, what is its area?

   a) $40cm^2$ b) $20cm^2$ c) $18cm^2$ d) $9cm^2$

5) What is the area of the given figure.

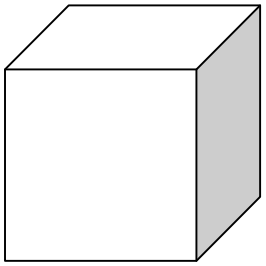
   a) $20cm^2$ b) $100cm^2$

   b) $120\ cm^2$ d) $40cm^2$



Group-B $5 \times 4 = 20$

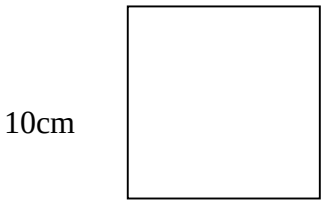
6) Find the perimeter of the square whose area is $100cm^2$.
7) Find the surface area of the given cube.



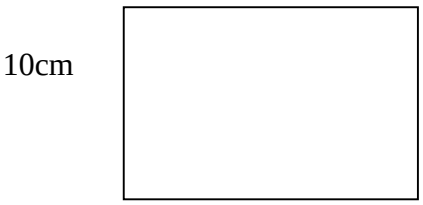
8cm

8) If the volume of cube is 125 cm^3 find its area.
9) A cuboid has volume $400cm^3$, if its breadth and height are 8cm and 5cm, find its length.
10) Find the perimeter of the following figures.

a)



b)



Appendix-D

Pre-test scores of experimental and control groups

Roll no. of Students of Control Group	Scores	Roll no. of Students of Experimental Group	Scores
1	27	1	28
3	25	2	23
4	28	3	20
5	20	4	21
8	17	6	15
9	14	7	15
10	18	8	21
11	22	9	7
12	20	10	23
14	11	11	15
15	9	13	7
16	6	17	6
17	8	18	9
18	5	20	3
19	3	21	7
20	2	22	4
21	4	23	3
24	11	25	7
25	3	26	4
26	18	27	15
27	13	28	11
29	2	29	17
30	15	30	13
32	7	32	11
33	3	33	2
		34	25
		36	17
		37	10
		40	2
		41	12
Sum	311		373

Appendix-E

Post-test scores of control and experimental groups

Roll no. of Students of Control Groups.	Scores	Roll no. of Students of Experimental Group	Scores
1	27	1	30
3	26	2	28
4	28	3	25
5	21	4	24
8	19	6	22
9	13	7	25
10	19	8	23
11	24	9	15
12	19	10	28
14	9	11	21
15	10	13	19
16	9	17	13
17	11	18	14
18	3	20	9
19	7	21	11
20	4	22	10
21	4	23	9
24	10	25	22
25	8	26	10
26	21	27	20
27	18	28	12
29	4	29	20
30	20	30	15
32	4	32	15
33	2	33	10
		34	28
		36	21
		37	16
		40	6
		41	19
Sum	340		540

Appendix-F

Test Re-test Scores of Students

Roll no. of Students	Test Scores	Re-test Scores
1	25	28
2	26	26
3	11	8
4	17	16
5	24	24
6	4	6
7	6	10
8	2	2
9	26	29
10	13	15
11	19	14
12	20	22
13	21	20
14	25	27
15	2	4
16	5	3
Sum	246	254

Appendix-G

Questionnaire for Interview with Students

1) What do you feel when I taught you using instructional materials?
2) What type of difference do you find while teaching using materials and without using materials?
3) Is it necessary to use instructional materials for teaching mathematics at primary level?
4) Which way of teaching is better according to your view, using materials or without using materials?
5) Does your teacher use instructional materials for teaching mathematics?
6) Are you satisfied with the teaching methods of your teacher?

Appendix-H

Classroom observation checklist

This observation form was used to observe the effectiveness of instructional materials in teaching mensuration at primary level. Under following seven indicators, it was observed.

S. N.	**Statement**	**Indicators**		
1	Interest of students in learning			
2	Involvement of students in class activities			
3	Motivation			
4	Classroom environment			
5	Behavior with friends			
6	Relation between teacher and student			
7	Regularity of students			