EFFECTIVENESS OF TANGRAM IN TEACHING CONCEPT OF GEOMETRY AT BASIC LEVEL

A THESIS

BY

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LETTER OF CERTIFICATE

This is certified that **Mr. Bishnu Bahadur K.C.**, a student of academic yea 2068/69 with Campus Roll No.2510, Thesis No. 1160, Symbol No. 281273 and T.U. Registration No. 9-2-413-218-2006 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 Tangram in Teaching Concept of Geometry at Basic Level"**has been prepared based on the results of his investigation. I recommend and forward that his thesis be submitted for the evaluation for awarding of Master of Education.

....

(Mr. Dipak Mainali) (Assoc. Prof. Laxmi NarayanYadav)

Date: .....

LETTER OF APPROVAL

Thesis

By

BISHNU BAHADUR K.C.

Entitled

"Effectiveness of Tangram in Teaching Concept of Geometry at Basic Level" has been approved for the partial fulfillment of the requirement for the Degree of Master of Education.

Committee for the viva-voce	**Signature**
Assoc. Prof. Laxmi Nayaran Yadav (Chairman)	.....
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Mr.Dipak Mainali (Member)	.....

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ABSTRACT

This is an experimental research on the topic "Effectiveness of tangram in Teaching Geometry at Basic Level". The objectives of the study were to find out the effect of tangram on achievement score of student to whom taught by using tangram and without using Tangram in geometry and to examine the effectiveness of tangram on learning behavior of basic level students in geometry. The design of the study was pre-test, post-test non equivalent group design. For this study two schools were selected which are Shree Pashupati Higher Secondary School for control group with a total of 32 students and Shree Nepal Ganesh Higher Secondary School for experimental group with a total of 30 students which are situated in Bardiya district. The sample size of the research was 17 students for each control and experimental group selected from grade III students. The data were collected in terms of achievement test and observation and the collected data were analyzed by the means of statistical method such as mean, standard deviation, variance and t-test.

The findings of the study were the mean achievement score of the students of experimental group was higher than that of control group. Also the student's behavior such as attendance in classroom, class work completion, habit of doing homework completion, giving of answers style were improved. Therefore, the use of tangram in teaching geometry brings positive change. So, it is recommended to all to use tangram while teaching geometry especially at basic level.

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Chapter I

INTRODUCTION

Background of the study

Mathematics is no things more than a game played according to certain simple rules with meaningless mark on paper. It is queen of all science. It is developed from society. The history of mathematics education reflects that contemporary society has been served today's situation in the field of society. Mathematics directly deals with human life. It is believed that the development of mathematics and development of human civilization from the Stone Age to modern world. Mathematics has been integral part of human life and will have been same importance till the existence of the earth.

The word"mathematics" has been derived from the ancient Greek word "*Mathema"* which meant learn, study and science and also mathematical is derived from the Latin word mathematike which meant mathematical art. This indicates that mathematics is taken as a process of learning and learning is taken by mathematic art.

Normally it is defined as counting and calculation part of human life and related to measurement, calculations, discovering of relationships and dealing with the problem of space. It is the study of patterns of structure by different methods like playing, discovery, acting etc.

Arithmetic, geometry, algebra and trigonometry are the main branches of mathematics. Among them geometry is one of the most useful and important branch of it. It is one of the most ideal and impracticable branch of mathematics which includes huge quantities of knowledge and ideas. So, it can be consider as ocean of knowledge and ideas. It is also philosophical method of study. The etymological meaning of geometry is defined by the Greek words Geo (meaning the earth) and metria (meaning measuring) so that geometry is initially considered as the studies of the measurement of the earth.

In the geometry teaching we use different instructional materials (geometry box, geo boards, pattern blocks, geometry solids figure, tangram). Among them tangram is one of the important and useful instructional material for give the concept of different geometric figures. It is suitable for teaching of geometrical concepts at basic level. Tangram is made by cutting of square ply woods, cartoons or hard paper into seven pieces of different geometric figures.

Literally tangram means "seven borders of skills". It is a puzzle consisting of different geometrical shapes in managed manner. It is also known as the dissection puzzle. The first known use of the word "tangram" was in 1825 by Dr. William Potts Dewes in his pediatric text book, medical treatment of China.

According to Oxford dictionary "Tangram is a Chinese puzzle square cut into seven pieces to be combined into various figures".

Talking about the tangram it is reputed to be developed at the time of Song Dynasty in China and then in 19^{th} century it was carried over the Europe by trading ships and became popular during the time of 1^{st} world war. Early Chinese mathematicians and Chinese math professors

manipulated geometric shapes of tangram in their problem solving. Now these techniques are used by the teachers of different governmental and non-governmental schools of Nepal.

Tangram is very useful for basic level students to give the concept of geometry. In this level students achieve the concept of geometry and identify the different properties of geometrical concepts by observation and looking up the geometrical figure. So, it is on effective means of teaching. Students can form a group and identify the geometrical figures by the help of tangram. This is the way of learning by playing games and also other different games can be played by the help of tangram.

Statement of problem

Geometry is one of the part of mathematics in which we deals about points, lines, geometrical figures and theirs assumes and postulates. So, most of the student feels, it is a tough topic to discuss and learn. This problem of this study is mainly concerned with the effectiveness of tangram in teaching concept of geometry at basic level. It is caused due to the use of traditional methods of teachings like lectures, etc. with the limited use of teaching aids. The tangram is most useful and interested teaching materials of geometry for the study of geometrical figures in basic levels. And also tangram provides effectiveness and conceptual idea for studying of geometrical figures.

According to BaichandraLuitel,"Improving geometry teaching",Curtin University of Technology(2003) Stated that there are problems in teaching learning geometry at school level in Nepal. These problems are about contextualization of learning, ways of teaching and using of teaching materials.

Also, in my experience while I was teaching in school level, students felt difficulty in learning geometry especially in proving theorem and constructing geometrical figures. At that time we did not use teaching materials in teaching geometry. Without using instructional materials, it was difficult to give clear concept of geometrical content like concept of figures, their properties and idea to sole geometrical problems effectively. It was a blend of the above research and my personal goals to become a better teacher that led me to investigate the practice of using manipulative material tangram in my third grade classroom. My goal is to study what, if any,impact manipulative material tangram has on student engagement, participation in class andacademic performance to give the conceptual knowledge of different figures. Therefore to overcome these problems and uplift the achievement score in geometry at basic level, the use of tangram may be the effective tool.So, I have proposed the research study entitled "Effectiveness of tangram on teaching concept of geometry at basic level".

In this study the researcher tried to find out the answer of following questions:

1. Does the use of tangram in teaching concept of geometry at basic level more effective than without using it?
2. Does the use of tangram in teaching concept of geometry at basic level help to promote achievement of students?

Objectives of the study

The objectives of the research study are as follows

- To find out the effect of tangram on achievement score of students in geometry

- To examine the effect of tangram on learning behaviour of students in geometry.

Research hypothesis

The research hypothesis of the study are as follows

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

Alternate hypothesis (H_1): $\mu_1 > \mu_2$

Where,

μ_1 = Mean achievement score of the students teaching through the use of Tangram.

μ_2 = Mean achievement score of the students teaching without use of Tangram.

Significance of study

The purposed research is concerned about the use of manipulative teaching materials of mathematics at basic level. Geometry is integral part of mathematics in school curriculum. It gives practical knowledge but lack of appropriate method and materials it is difficult to feel the concept of geometry properly. Tangram is one of the effective and interesting materials that can be used widely in teaching concept of geometry in basic level. In summary the research studies is the following significant:

- The study is given of the appropriate use of tangram for the teaching concept of geometry of geometrical figure at basic level.
- The study is brought changes on teaching methodology.
- The study is provided information to the concerned authorities to take appropriate step to geometric teaching.

Definitions of the related terms

Tangram

A traditional Chinese puzzle square cut into seven pieces to be combined various figures that must be arranged to make particular designs.

Manipulative Materials

It refers to those materials which are operated by both students and teachers.

Effectiveness

The degree of which objectives are achieved and the extent to which targeted problems are solved. The effectiveness in this study is defined in the terms of magnitude of the score obtained by experimental group in the mathematics achievement.

Concept

An idea for mental picture of a group or class of objects formed by combining all their aspects.

Geometry

The branch of mathematics concerned with the properties and relations of points, lines, surface, solids and higher dimensional analogues.

Public Schools

Public Schools are those schools which receive the government grant for the salary of teachers and other purpose.

Creativity

The ability to make new things or think of new ideaof any objects is called creativity. Relating this with teaching geometry in basic level using tangram creativity can be defined as the ability of students to provide new thinks, idea about geometrical figure.

Curiosity

The desire to learn or know more about something or someone is called curiosity. In teaching concept of tangram the curiosity means the interest, motivation of pupil to do some things himself/herself.

Application

Application means that act which is applying in anywhere with any task.In the research study, application means the appropriate applying of tangram in geometry teaching.

Delimitation of the Study

The delimitations are those characteristics that limit the scope and define the boundaries of research study. The delimitationsarein researcher control.Delimiting factors include the choice of objectives, the research questions, variables of interest, theoretical perspectives that researcher adopted (supposed to what could have been adopted), and the population researcher choose to investigate.

The research studywill have the following delimitation

- The research was conducted on public school of Bardiya district.
- The research was based on effectiveness of tangram.
- The research was conducted on grade IIIstudents only.
- The research was completed within 15 days.
- The research covered geometry only
- t- Test for independent sample was used at 0.05 level of significance

Chapter II

REVIEW OF THE RELATED LITERATURE

A review of related literature is important source of further study of research test. It takes the research task to undertaken in a better perspective and essential for guidance of research planning. Number of books, research reports , papers and other booklet can be found that concerned with curriculum, teaching materials, methods and so on . There are many literatures on the other field of the study but very few attempts have been made to study of the difficulty of learning geometry at basic level.The purpose of this literature review was to explore the traditional instructional methods, the trend toward alternative instructional methods, the role of participation in the classrooms, the use of manipulative materials in the mathematics class, and the effects of manipulative on student learning. So, the following review of literature helped the guideline for using tangram in teaching concept of geometry at lower secondary level and fulfills the objectives of this study.

Lamsal (2004) did on experimental research on "A Study on Effectiveness of Problem Solving Approach in Teaching Mensuration at Secondary level Mathematics of Grade IX Students", with the aim to compare the achievement of students taught by problem solving approach to the achievement of students taught by traditional approach. A posttest equivalent group design was adopted to conduct the experiment in concept mensuration of IX for four weeks. Sample of 58 students (31 boys and 27 girls) were taken and the developed test consisting 30 items. Statistical tools were mean, standard deviation and variance. Also t-test was used and concluded that achievement of students taught by problem solving approach of teaching improved significantly better achievement than the students taught by traditional approach.

Ernest (1994) conduct a study entitled "Evaluation of the Effectiveness and Implementation of a Math Manipulative Project ". This paper reports on a project to enrich high school algebra and geometry programs through the manipulative materials. The evaluation design utilized qualitative and quantitative methodology to determine effectiveness and impact of training with manipulative on 40 high school teachers. The final evaluation was based on : (1) review of the program proposal; (2) participation in the planting process for the workshops with the project staff; (3) observation of the methodology of the trainers and provisions for participant involvement in each of the workshops sessions; (4) group discussion of classroom implementation strategies; (5) observation of the use of manipulative in the participants classroom and (6) review of the participants self-reports of student utilization and response to the manipulative. The project was successful in addressing the stated objectives of the proposal through the techniques of well organized workshop training sessions, follow-up reporting and evaluation, and extended local training. The manipulative are being used extensively, and student attitudes, participation, and performance have been enhanced.

Lin et al (2011) did study on "The Impact of Using Synchronous Collaborative Virtual Tangram in Children's Geometric". This study aimed to develop a collaborative and manipulative virtual Tangram puzzle to facilitate children to learn geometry in the computer-supported collaborative learning environment with Table PCs. design of this study was collaborative Chinese Tangram activities with problem solving learning strategies. Participants were 25 sixth graders of a suburb elementary school of Tai-Chung City. Twenty Five grade 6 (11-year old) students 15 males, 10 females from an elementary school in Tai-Chung City, Taiwan took part in this study. They were division into 8 groups of high, medium and low ability according to the pre test school. The experiment duration was for 4 weeks. Experimental process was pre test (10

minutes), group scribbles warm-up practice (30 minutes) perform the task 1 (40 minutes). Perform the task 2 (40 minutes), posttest and questionnaire (40 minutes) and students interviews. The researchers analyzed the result of pre test and posttest collection and comparing the lowest and highest score mean and the standard deviation. It was concluded that the mean difference was significant at 0.05 levels. The researchers concluded that the collaborative learning activity of virtual tangram could reduce the gap between high ability and low ability students.

Cain-Caston (1996) did study on, "Compare the Mathematics Achievement of Third Grade Students who were taught using Manipulative and Third Grade Students whowere taught using Worksheets." Student achievement of the 70 third graders in four classrooms was assessed using the California Achievement Test Form E. As a result of the study, Cain Caston believed that the practice of using worksheets discouraged students from thinking about or solving mathematical problems for themselves and simply required them to recite a previously memorized fact or theory. For the student, there is no meaning or understanding behind the facts and in turn will make more advanced problems more difficult for them.

Baral (2005) conducted a study on " The Effectiveness of the Instructional Materials in Teaching Geometry at Primary Level" with the aim to compare the achievement of the students taught by with and without using instructional materials at primary level. The researcher studied at primary level (grade 5) Students in Kaski district. This study was utilized pretest-posttest non-equivalent group design. Each group 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 book by traditional method. The same unit was conducted over a period of 20 days .Using t-test the researcher concluded that the experimental group scored significantly higher than the control group by taking posttest.

Baran, Dogusoy&Cagiltay (2007) did a study on "How Do Adults Solve Digital tangram Problem? Analyzing cognitive Strategies through Eye Tracking Approach". The purpose of the study was to investigate how adults solve Tangram base geometry problem on computer screen. Twenty graduate students, between 20 to 30 years age, participated to this study .They used digital Tangram software to solve two different problems, with different complexity levels. Participants were first allowed to play with an easy figure to become familiar with the software .After they felt comfortable with the controls, they proceeded to the actual tasks. The participants tried to solve problems by placing seven geometric objects into correct location.

Roos(2008) conducted a research entitled "The Effect of Mathematical Manipulative Materials on Third Grade Students' Participation, Engagement, and Academic Perform".This study is the summary of research conducted in a third grade classroom during a unit on multi-digit addition and subtraction. The classroom teacher utilized mathematical manipulative materials throughout the course of this unit as a supplement to aid in the conceptual understanding of addition and subtraction. This study showed the effects of those manipulative on third grade students' participation, engagement, and academic performance. Data collected from teacher observations and video recordings indicated a positive relationship between manipulative and student participation and engagement. A pre-test/post-test and student work samples were used to

determine effects on academic performance. Data showed students' academic performance increased, however the relationship between academic performance and manipulative was found to require further research and study.

Kontaş (2016) conducted a research in the topic "The Effect of Manipulatives on Mathematics Achievement and Attitudes of Secondary School Students".The purpose of this study is to investigate the effect of manipulatives (concrete learning materials) both on the academic achievement of secondary school students in mathematics and on their attitudes towards mathematics. Pretest-posttest control group experimental model, which is one of the quasi-experimental research designs, was used in the study. The study group consisted of 48 seventh grade students (24 in experiment group and 24 in control group) studying in a state school in the Southeastern Region of Turkey in 2014-2015 school year. The ages of students range between 13 and 14. Mathematics achievement test and mathematics attitude scale were applied in order to collect the research data. As a result of the research, post- test mathematics academic achievement scores of experiment and control groups were found to differ significantly in favor of posttests in both groups. The scores of attitude towards mathematics for experiment and control groups were significantly different in posttests in favor of the experiment group.

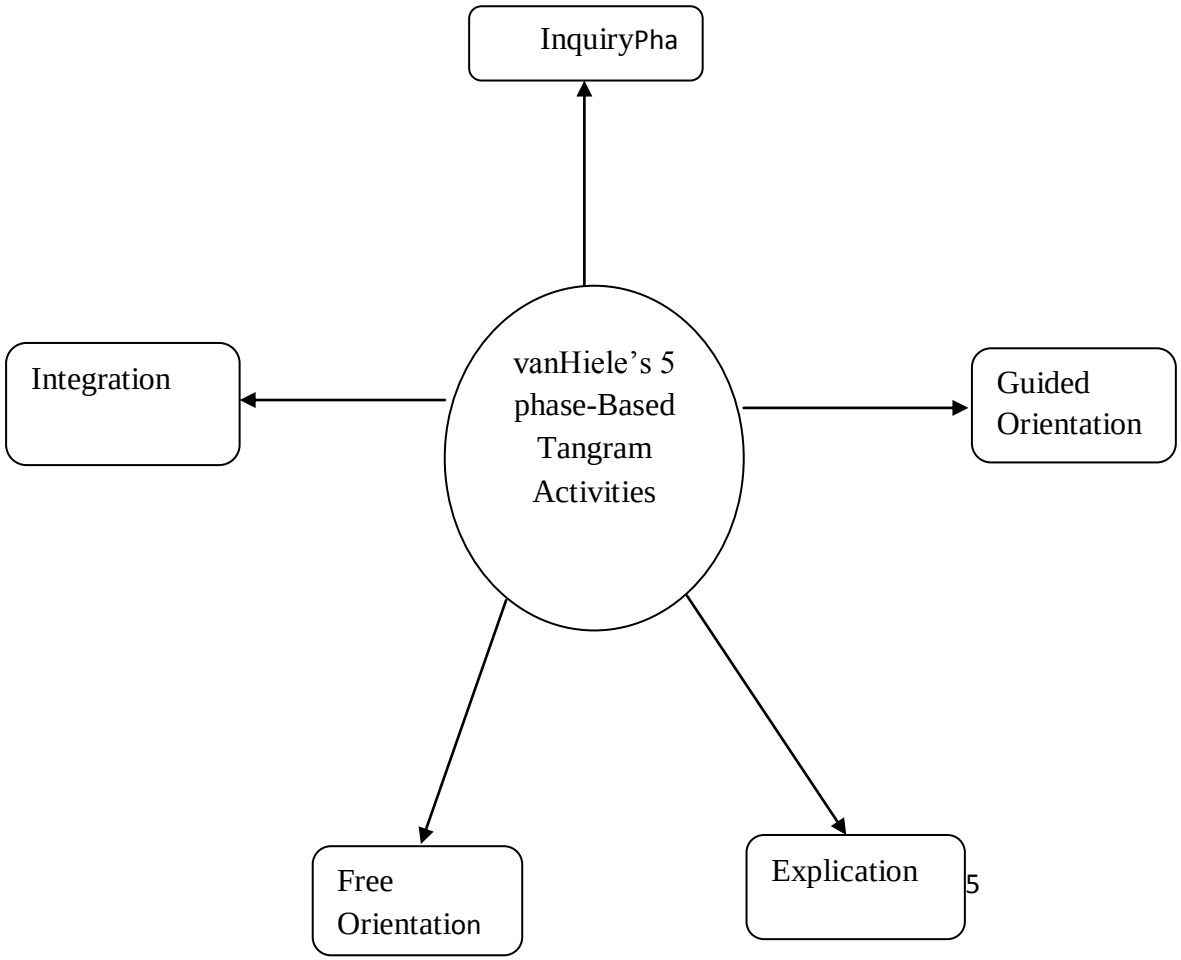
Siew& Chong (2014) did a research on "Fostering Students' Creativity through van Hiele's 5 phase-Based Tangram Activities".The aim of this study was to determine whether van Hiele's 5 phase-based tangrams activities could help to foster creativity among Grade Three primary school students. Students' creativity was investigated in terms of Torrance's Figural Test of creative thinking: Fluency, Originality, Elaboration, Abstractness of title, and Resistance to a premature closure. The study further examined students' responses to learning experience in tangram

activities. A pre-test and post-test single group experimental design was employed in the study. This research design involved assessment on the students' creativity based on the figural constructing task which was implemented prior and subsequent to the intervention. A total of 144 Grade Three students took part in the study. The students learned Two-dimensional geometry and Symmetry through the van Hiele's 5 phases of learning using tangram. The intervention took place for 3 hours. Paired samples t-tests which compared the mean scores of pre- and post- figural test were computed to determine if a significant difference existed. The results showed that there were significant differences in mean scores between pre- and post-figural test. The in-depth analysis about the five dimensions of Torrance's creativity found that the applied intervention was only significant in improving students' elaboration, no significant changes in students' fluency and abstractness of title, and significant dropping performance in originality and resistance to premature closure. Generally, students felt that the tangram activities had provided an opportunity for them to think creatively. In conclusion, this study shows that the tangram, when integrated with van Hiele's five Phases of learning is able to foster student's creativity in geometric lessons.

Neupane(2002) conducted an experimental research on "The effectiveness of play- way method in mathematics teaching at primary level". The aim of the research was to explore the effectiveness of play- way method in mathematics teaching at primary level and to compare the achievement of students taught by play- way method versus traditional method. The study showed that play- way method resulted significantly better method over traditional method of teaching mathematics at primary level.

Conceptual framework of research study

The conceptual framework is the summary of literature review which gives clear idea to conduct research effectively. The conceptual framework of the study with reference to van Hiele's five phase of learning in tangram activities are as follows:



Source: NyetMoiSiew& Chin Lu Chong (2014)"Fostering Students' Creativity through van Hiele's 5 phase-Based Tangram Activities, School of Education and Social Development, University Malaysia Sabah, Sabah, Malaysia

Above five phases as presented in above diagram will be used as follow

Inquiry Phase

At the inquiry phase, students will work cooperatively to explore certain structures of holistic examples and non-examples. In this process, they will try to manipulate, construct and recognize geometric shapes by using a combination of 7 tans tangram.

Guided Orientation

In this phase, the students will be asked to examine the properties of geometric shapes and other things according to topic. With teacher's guide, they will explore the geometric shapes given. This process will be guided carefully and they then will record the properties of the

shape. For instance, while examining an equilateral triangle, students may find some properties such as three equal sides; three equal angles and three symmetries.

Explication

The phase of explication introduces new terminology of polygons and their properties. Students will be taught to describe the polygon using appropriate mathematics language, such as congruent, corners, straight sides, right angles, face, equilateral triangle, square, quadrilateral, regular and irregular polygons, pentagon, hexagon, heptagon and octagon.

Free Orientation

After their acquaintance with special terminologies used to describe the polygons, students may explore new geometric shapes. Here is the stage where students can unleash their creativity completely by doing composite mission.

Integration

At this stage, students will be required to summarize the properties of a geometric shape. They will generate an overview of what they have learned about a geometric shape. Their efforts of making generalization will be regarded as creative as they formulated their own conclusion for themselves. For example, students may compose a rule that an octagon has eight equal sides; its corners are the same–all are equal angles; and it can be folded to exhibit 8 line symmetry. Students also will learn about other polygons such as heptagon in a similar manner.

Chapter III

METHODS AND PROCEDURE

Research is the systematic approach to obtain new and reliable knowledge (Ethridge, 1995). Research methodology is the science which determines how the research becomes complete and systematic. So, methodology is a branch of research. This chapter delineates the design of the study and methods that will be used to collect information. The purposed research study will be quantitative in nature along with experimental design. In this chapter, the researcher describes the methods and procedure that will be used in research study.

Design of the Study

A research design is procedural plan that isto be adopted before starting the research study. Therefore research design is the main guideline for researcher. The design that was applied to the study is pre-test post-test non-equivalent group design. The pattern of the studywas as follows

Group	Pre- test	Treatment	Post- test
E	T_1	Using Tangram	T_2
C	T_3	Using usual method	T_4

Where

E= Experimental group

C= Control group

$T_{1,}$ T_3 = Pre- test of Experimental and Control group respectively

T_2, T_4 = Post- test of Experimental and Control group respectively

Population and Sample of the Study

Population is the entire field of concern where the result and findings are generalized. Also, sample is the representative portion of the population through which result is drawn. The population of the research study was all students of grade three of Bardiya district with mix abilities. Among the public schools of Bardiya district, two schools were selected as sample. The creativity for every student was evaluated before and after intervention.

Sampling Procedure

This was experimental study. Researcher has chosen two school of Bardiya district.They were Shree Pashupati higher Secondary School and Shree Nepal Rastriya Ganesh Higher Secondary School. According to school register, there were 32 students in (SPHSS) and 30 students in (SNRGHSS) in grade III For the selection of the students, the whole student of grade three divided into two groups then two group was made homogenous as possible as on the basis of their pre achievement score. Furthermore, the researcher excluded irregular and dropped out students

from the sample in order to control the effect of extraneous variable to the experimental accuracy. In each group, there were 17 sample students for the selection experimental and control group in which less achievement score students were chosen as experimental group and more achievement score students were chosen control group.

Research Tools

Research tools are the instrument that helps to collect the information for the research study. In this study researcher used achievement test and observation as the research tools.

Achievement Test

Achievement test was the main instrument for collecting data or information for the research study. The researcher administrated two achievement tests one as thepretest and other as the posttest. The questions of both tests were developed by the researcher according to teacher's guide and specification guide of grade III of geometry portion which were published from CDC Sanothimi Bhaktapur. Pilot study was adopted to establish the validity and reliability of the both test item (See Appendix 3). Pre- tests of both groups contained 10 objective questions of multiple choice of 1 mark, 10 questions of subjective type where each subjective question were cover 2 marks and 5 of subjective question were cover 4 marks.

Observation

Observation is an act or instance of viewing or noting a fact or occurrence for some scientific or special purpose. In this study the student's classroom activities and other related things observed purposefully. The student's activities such as student's participation in discussion, interaction in classroom, completion of homework and classwork, interest in subject matter, discipline of the both groupwere observed.

Research Variables

A research variable is defined as anything that has quantity or quality that varies. In this research study, the research variables were as the following

Independent Variable

The factor that was manipulated and has genuine effect on the observed consequence in the experimental setting is called independent variable. In this research independent variable is tangram which effect the achievement score of students.

Dependent Variable

A dependent variable is what the researcher wants to measure in the experiment and what is affected during the experiment. In this research study thedependent variable are the achievement score of the students obtained by teaching through without using tangram in teaching geometry

Extraneous Variable

Extraneous variables are factors other than independent variable that might affect the dependent variable. In other words, extraneous variables are undesirable variables that influence the relationship between dependent and independent variables. They are not variables that are actually of interest. In this proposed research study the extraneous variables were been subject matter, teacher variable, irregularity in the classroom, health status of the students, examination environment, test, scoring procedure, amount of homework etc.

Controlling of Extraneous Variables

An extraneous variable is a factor whose presence affects the variables being studied so that the result does not reflect the actual relationship. There are various ways of controlling extraneous variables including randomization, restriction and matching. In this research study the extraneous variables were related subject matter, teacher variable, irregularity in classroom attendance, exam environment, test and scoring procedure. These variables were controlled in the following way

Subject Matter

In both experimental and control group same content were taught with reference to the text book of grade three issued by CDC.

Teacher Variable

The experimental and control both group were taught by researcher himself to control the teacher related variable.

Irregularity in Classroom Attendance

Irregularity of student's in classroom attendance may affect the result of the experiment. To control irregularity in classroom attendance, the sample students were selected from regular students as far as possible and also they were be requested to present every day in the classroom.

Duration of Teaching Period

Both groups were taught for 45 minute per day to remove the effect of time on the experiment.

Exam- Environment

If exam environment is not fair then the marks secured by the students were not represent the actual situations of student's understand. So, to make experiment more reliable and valid it is necessary to make exam- environment fair and peaceful.The exam environment has been made peaceful and fair by guarding researcher himself. Cheating, asking with friends were completely be controlled.

Test Paper

The reliability and validity of test were established and also the difficulty level and discrimination level of each question were calculated to make test more reliable and to control the test related factor.

Scoring Procedure

Scoring was be made reliable by using answer key for multiple choice questions and for subjective type question step wise marking scheme was be prepared.

Amount of Homework

If amount of homework given to two groups is different than that may affect the result. Therefore same exercise and equal number of problems were given to two groups as homework.

Lesson Plan Notes

The lesson plan is that pre planed activities of lesson in a classroom of a teacher that will be done by teacher when he enter the room. The researcher thought 11 topic of geometry at basic level for the experimental group. They were thought the topic by using Tangram which is given as back. The activities of all lesson plans are related with use of Tangram in geometry at class III. For reliability and validity, it was checked by students performance like interest, giving answer style, closed to the teacher and asking questions while teaching on the topic etc.

Item Analysis of the test

Item analysis help the researchers to standardize the test item such that it can measure the actual performance on target trails of target students in the context of students. For this, researchers piloted the test items in Shree Nepal Rastriya GaneshHigher Secondary School, Manau-2, Bardiya, among the 20 students. There were 25 questions containing three group A,B and C. Among them group A contained 13 objective type questions where each question take 1 mark, group(B) contained 6 questions where each question takes 2 marks and group(C) contained 5 questions where each question takes 5 marks. The time taken by each students to complete the test was recorded and mean time to complete the

test was recorded i.e. 1:30 hr among the all questions, one question was rejected from group A and 2 questions were modified from group A and also one question modify from group B for standardization. From the test items were scored 1 for correct response and 0 for incorrect response on each objective item. The test items of short answers types scored one for scoring the marks of 50% and above and 0 for such items scoring the marks below 50%. The test items of long answer types were scored one for scoring the marks of 40% and above and 0 for such items scoring the marks below 40%.

In item analysis, the difficulty index (P-value) and discrimination index (D-value) of the text was computed to check the quality of test items. The test items were analyzed to examine their power to separate the more from less capable students in performing the text task. This was done by calculating the response of top 27% students and bottom 27% students. So, the researcher took 6 upper and 6 lower score students out of 20 students. The calculation of discrimination index (D-value) of the test item was done on the basis of this kind of analysis. The table of item analysis is given in appendix 3. Taking into account of obtained the level of difficulty (P-value) and index of discrimination (D-value) of each items. Only those items were selected P-value ranging between 25% to 75% and D-value was ranging between 0.20 to 0.80. The other items were rejected. The 1 item in the research study was rejected. The remaining items were accepted for the final form Appendix 3

Reliability and Validity of Test

Reliability is the degree to which an assessment tool produces stable and consistent result. There are many ways of determining reliability such as test- retest method, parallel form method, and spilt half method etc. In this research study spilt half method was adopted to examine whether the test is reliable or not. For this the test had been administered to 17 students of another school before starting the experimental study which is shown in Appendix 6. Then correlation between odd and even number werecalculated.

Validity refers to how well a test measure what it is purposed to measure. The validity of constructed test established through criterion-validity by comparing the scores previously obtained in the school examination and the score of the constructed test.

Data Collection Procedure

The experimental and control group were taught by researcher himself. These instructional activities were made as a part of regular school activity. The experimental group was taught by using tangram and the control group was taught without using tangram.

At the end of the teaching, the standardized testwas administered to each group. Students were inspired to answer freely and without any discussion among them. After then answer sheets were collected and checked by the researcher himself and obtained marks of the students were tabulated for further analysis.

Also the data were collected from observation by noting the student's activities like participation in discussion, interaction in classroom, completion of homework and classwork, interest in subject matter, discipline in a diary for further analysis. The main focus on how the Tangram

was effective to develop concept of geometry. So the data was collected to address student's difficulties in learning geometry and to facilitate student's progress by using Tangram.

Data Analysis Procedure

The collected data from achievement test was analyzed by using statistical tools. The researcher used the following statistical tools for analyzing the collected data

- Mean, standard deviation and variance were calculated for both groups with their secured marks in the pre and post test both to find out the average achievement score of sample students.
- t- Test for independent sample was used at 0.05 level of significance in post- test whether the difference between means is significantly difference or not which is given as Appendix 7.

The data collected through observation was analyzed qualitatively or verbally produce the reasonable conclusion in natural seating also the qualitative data were analyzed with reference to conceptual framework.

Chapter IV

DATA ANALYSIS AND INTERPRETATION OF DATA

Introduction

This is an experimental study. The main focus of this study was to explore the effectiveness of tangram in teaching concept of geometry at basic level. This main purpose was to explore the effectiveness of tangram. For this purpose, achievement test as the pre-test and post-test was adopted of the class Three students. This statistical analysis of the obtaining data was presented in this chapter. The data of the achievement test score were analyzed under the headings on comparison of main achievement score of control group and experimental group for pre test data, comparison of main achievement score of control group and experimental group for post test data and comparative bar graph of mean achievement score of experimental and control group for the pre test and post test

The Achievement Score of Control and Experimental Groups for Pre-Test Data

The pretest score of pupils experimental and control group are presented in Appendix 7 and the summary of statistical calculation for both groups on the pre test is presented in table 2.

Table 2

Mean, Standard Deviation and Var. of Pre test Result

Group	Number	Mean	S.D.	Var.	t-value	Level of significance
E_1	17	23.82	4.48	20.15		
C_1	17	23.64	4.76	22.74	0.11	0.05

Table 2 presented the mean, S.D and coefficient of variation of the groups, experimental and control groups on the pre test. The other word, the main score of the experimental group was 23.83 and the mean score of control was 23.64. The S.D of experimental group was 4.48 and the S.D of control group was 4.76.The calculated in one tailt-test was 0.11 which was less than corresponding tabulated value 1.69 at 0.05 level of significance with the degree of freedom 32. Therefore, null hypothesis was accepted. Hence, there is no significance difference between student's achievement in geometry teaching with and without using tangram.

From the above the mean and standard deviation of the experimental and control group were nearly equal. Since the mean score of the test is differed by 0.18 between two groups. Hence, there is no difference of achievement of experimental and control groups.

The Achievement of Control and Experimental Groups for Post-Test Data

The post test scores of the students of experimental and control group are presented in Appendix 8 and summary of statistical calculation for both groups on the post test was presented in table

Table 3

Mean, Standard Deviation and Var. of post test result

Group	Number	Mean	S.D.	Var.	t-value	Level of significance
E_2	17	28.53	4.19	17.64	2.72	0.05
C_2	17	24.47	4.48	20.13		

The table 3 presents mean, standard deviation, coefficient of variation of experimental and control group and also significance difference between two mean. The mean score obtained by experimental group was 28.53and standard deviation was 4.19. The mean score obtained by control was 24.47 and standard deviation was 4.48. The coefficient of variations of experimental group was found to be less than the coefficient of control group. The standard deviation of experimental group is less than control group. Therefore,experimental group is more consistence than the control group. Therefore, the mean score of experimental group is higher than the mean score of control group. The calculated one tail t- value in the test was 2.72which is greater than the corresponding tabulated value 1.69 at 0.05 level of significance with degree of freedom 32. Therefore, null hypothesis was rejected and hence the alternative hypothesis was accepted. This indicates that the students of experimental group are significantly benefited in achievement of geometry than the students of control group. In the other words,

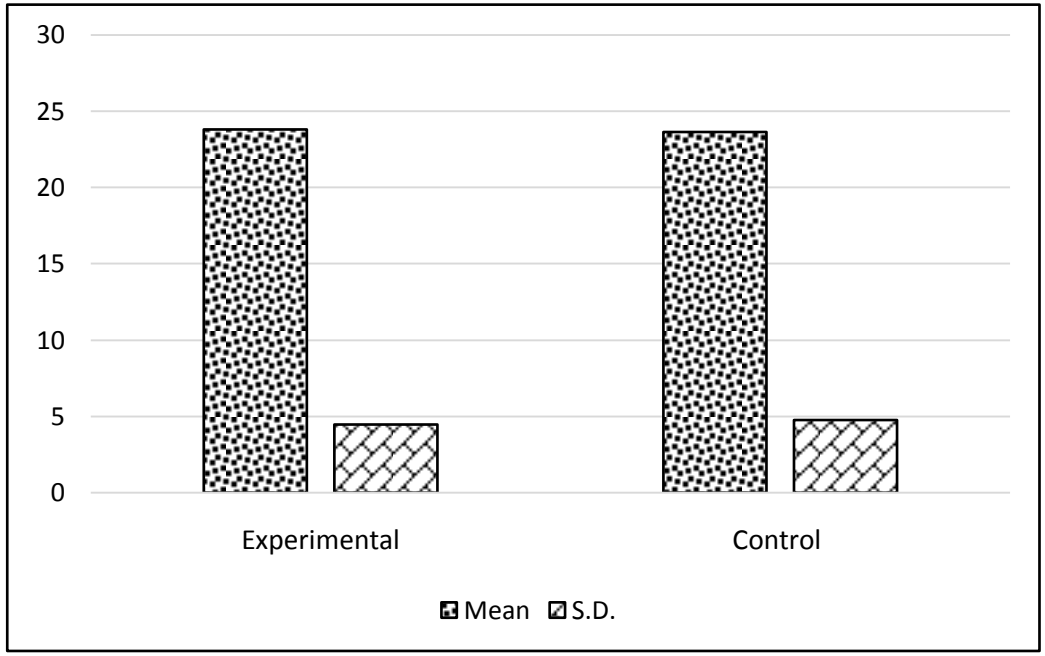
the difference of mean was found significant at 0.05 level of significance. Thus the researcher concluded that the students who were taught geometry with the use of tangram got better achievement than the students who were taught usual method.

Comparative Bar Graph of Achievement Score of Both Groups

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

Figure 1

Mean score and S.D. score Distribution of Pre-test result in Bar Diagram

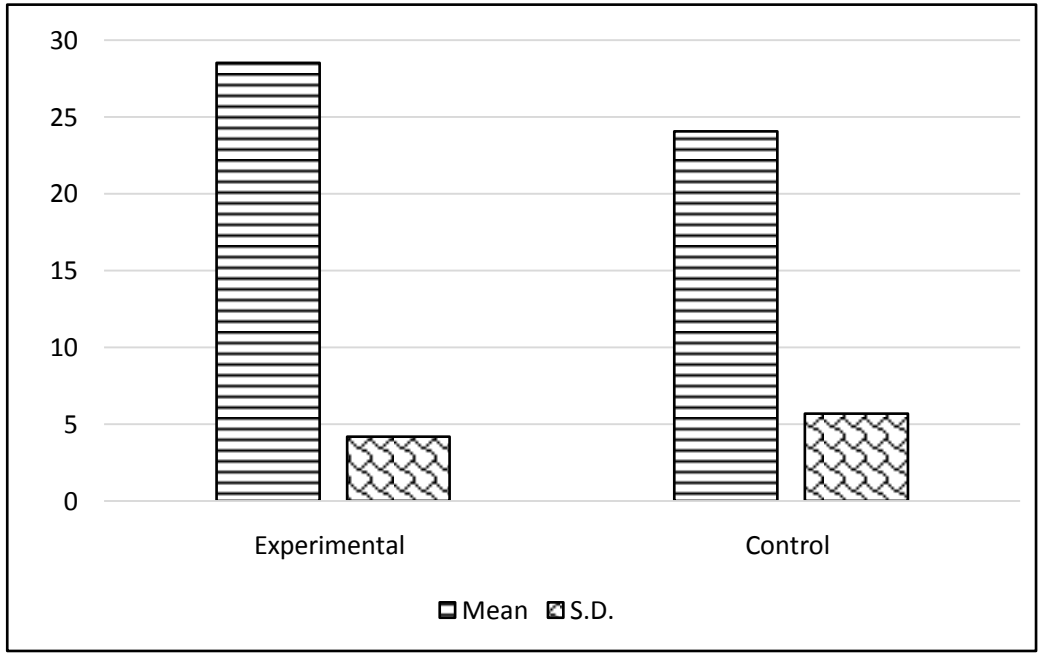


The mean and S.D score obtained by the students of experimental and control groups in the pretest have been shown in figure 1. The figure shows that the mean scores and S.D of experimental group are 23.83 and 4.48 respectively. Similarly, the mean score and S.D. of control group are 23.64 and 4.76 respectively. The difference between two mean was 0.18, this shows that those both group experimental and control

are nearly equal which indicates that there is no difference in achievement score in geometry between experimental and control group of students. Therefore, the figure also indicates that the both group are homogeneous.

Figure 2

Mean score and S.D score distribution of post test result in Bar Diagram



The mean and S.D score obtained by the students of experimental and control group in the post test is shown in figure 2. The mean score of experimental and control group are 28.53 and 24.47. Similarly the standard deviation of experimental and control group are 4.19 and 4.48. The difference between two mean scores of experimental and control group is 4.06 is positive. But the difference between S.D score of

experimental and control group is -0.29. This indicates that experimental group had better result than control group. Therefore, also from figure 2 we can conclude that the use of tangram in teaching concept of geometry have great impact than usual method in basic level.

During experimental researcher had found that every students of experimental group were curious and interest to learn geometry 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 teach. Similarly researcher had found that his teaching was not effectively on control group because students of control group not curious and interested to learn and also they neglect me. Hence the researcher found that there was significant effectiveness of tangram on teaching concept of geometry.

Qualitative Analysis

Qualitative analysis means it is a kind of theoretical experiment done to know the amount of improvement accord in any subject matter .This experiment deals shapes in geometry education. This analysis explains the influences on geometry education.Here, with the help of tangram the students learns different geometrical shapes practically by viewing in the knowledge sustainability .For example:- first when the different shapes present in tangram were shown to the students, It was made them curious to know what they are and how are they going to be used .Then the teacher told about the name, properties and used of those pieces present in tangram. They were asked the example related to those shapes arranged in different pattern to makes objects or figure and the students were told make more objects by using tangram. The

students were made clear different shapes related to geometry can be figure out by using the shapes present in tangram .For example a rectangle can be constructed by using two triangles. The students were thought different mathematical problems by the help of tangram.

By this instrument the students are able to notice the positive changes in their learning habit. This may included their answering way, thinking method and many more aspect.

In this experimental research, the researcher had observed the behavior of students as curiosity, creativity and application that has changed due to the use of tangram in teaching geometry. The qualitative analysis of the specified changed behavior of students has been explained in the following sub topics:

Tangram and Curiosity

Tangram is important instrument used to teach geometric concept. It is more influential in teaching than the theoretical way of teaching. When the researcher (teacher) entered the class and said to task tangram individually. Researcher began his teaching different topic of geometry with the help of tangram.

Using tangram according to lesson plan 5 in teaching geometry in experimental group, students became very interesting of the class because they were study the topic. When the researchers enter the class and said students to take tangram individually. Researchers began his teaching geometry with the help of tangram for measurement of angles of triangle he took one triangle (piece no 7) from tangram and measure it

by the help of protractor. Then he got the sum of interior angle of triangle is 180^0. The researcher told the students do the same task by same method. Students also got the same result. Again, researcher folded triangle like this.

Above figure showed that the sum of interior angle of triangle is equal to the straight angle. Students individually tried to make the above process. Finally, they got success to find the sum of interior angles of triangle is 180^0.

After that researcher asked one question have you understood to find the angles sum question? Which method you liked most?

In the students pointsof view,"*we clearly understand the second method of teaching it is so easy to understand sir. Sir gives us some problem related with it."*

From the above view shown that tangram in teaching students easily understood any problem of geometry so students were saw very curious and glade for learning new things and then they were instated to find the sum of all angle of quadrilateral.

Similarly researcher thought the properties of isosceles by using tangram according to lesson plan no. 2 for the experimental group. Students were able to define the isosceles triangle with properties. When researcher made a isosceles triangle and thought its properties by using

tangram. Then, students became able to make different size of isosceles triangle by helping the tangram. The following response was obtained, when they had know about the isosceles triangle

In students points of view,*" Sir we are now crystal clear about isosceles triangle.We think use of tangram one of the best way to study about geometrical shape .Will you please tell more about it and other shape and asked us questions related to them."*

It showed that students performance skill and active participation in learning geometry. They seem to be curios to take new concept about geometry figure by helping of tangram.

From above, the students, it shown that all the students were curious to learn the shapes combining shapes of tangram. So,we can conclude that the use of tangram was found to be more effective in geometry teaching and the students were found to be more curious to learn about geometry by the use of tangram. The students were told to join the shapes having similar properties. After their study, students were more inquisitive (curious) to learn more conjugated shapes formed after joining the structures present in tangram. Similarly, the students were found to be more curious to tell the names of geometrical shapes by observing their characteristics when they were told to do so for triangle and rectangle. The students were also glad to learn about other polygonal shapes.

Hence, the use of tangram increased the curiosity to learn about geometrical shapes and their types which can be able to increase the education quality of development country.

Tangram and Creativity

Use of tangram in geometry teaching increases the curiosity level of students which increases their creativity to construct other related shapes.

In the process of geometric teaching employing tangram, the creativities, and inspections of respondents are listed below:

Researcher had thought about the different properties (sides, angles) of a triangleby related with the lesson plan noteno.1 for the experimental group students, A student*" immediately showed four sides and four angles of rectangle from the one pieces of tangram."*

While researcher was teaching about right angled triangle(lesson plan no.4) for the experimental group, A student presented *four 90 degrees angles in rectangle.* And also six students presented *the same combing various figure from the pieces of tangram.*

While researcher was teaching about exploration of area of rectangle(lesson plan no.10), A student finds out *the area of a rectangle through formula, however the first approach was basic method.*

While researcher was teaching the length of sides of triangle and angles randomly(lesson plan no.11), A student finds out *the exact length and degree of angles through the help of measurement instruments*.

In the process of teaching similar shaped triangles(lesson plan no.9), A student presented *a square made of combining two similar shaped right angled triangle and compared.*

In the whole, the analysis of responses of above, the students who knew the name of simple geometrical shapes were able to use all the shapes present in tangram, in other top construct similar and different conjugated structure, they were innovated to tell about the characteristic by comparing two shapes for example the students were thought about the properties triangle The students became able to solve the problem related to shape using own creative power and they were able to measure the angle and side of the shape when teacher had just thought them about the way of rough measurement.

From above illustrated responses analysis it is clear that the creativity level of the students were able to form different shapes using their own creative power.

Tangram and Application

Expression of different shapes used in our daily life by relating them with the shape present in tangram is the measure application of tangram. The use of tangram is the formulation of different objects helping in our daily life having fixed geometrical shapes. If the students are able to give the example of different objects used in our daily life by relating them with shapes present in tangram is its use.

Geometric teaching employing tangram and various problems on figures, the following practical application was enhanced:

In the process of teaching about uses of tangram, *students displayed various examples of rectangles i.e. books, whiteboard, bench.*

After the class on triangle, *students solved the problems on the value of triangles.*

While teaching right angled triangle, *students solved the textual questions regarding it.*

From the above the researchers conclude that It helps the students to implement the knowledge learned in their daily life and other fields. In experimental group, the number of active participant increase day by day and their performance ability became better and stronger than control group. At the beginning of class, most students were confused to learn concept of geometry. They felt many difficulties while learning geometric concept. Furthermore, the researcher used tangram in experimental group, it contributed in the development of student participation, interactionand interesting confidence level, enjoy class, homework, regularities of students and performance skill than students of control group.

Chapter V

SUMMARY, FINDINGS, CONCLUSION AND RECOMMENDATION

The research was experimental in nature. The purpose of this study was to test the effectiveness of the use of tangram in teaching concept of Geometry at basic level. The summary, findings conclusion, recommendations and suggestion are given blow

Summary

Mathematics is the science of abstract form; its importance is ever increasing. Mathematics is generally regarded as a difficult subject. Mathematics took place as a compulsory subject form elementary level, as its relation with a different discipline. Most of the people think mathematics is difficult subject. There are different areas on mathematics. Only selected topics were taught on grade 3^{rd} mathematics.

Mathematics learning achievement directly affected by some independent variables, It may be teaching methods textbook, parents' education, instructional materials, socioeconomics condition, school teacher qualification, etc. this research directly motivate to see the effect of independent variables 'Tangram' over dependent variables 'student achievement' on the topics Geometry.

The researcher kept all independent variables as silent except Tangram. The main question over this research was to see, is there a effectiveness of Tangram on teaching of Geometry? Does achievement differ significantly when Tangram is used? Over these research questions, this study has been done on Bardiya district, a period of three weeks, of the unit of Geometry grade Three. The desired objectives

of this study were to; to identify the effectiveness of Tangram on teaching Geometry and to compare the achievement between the use of Tangram and without use of Tangram.

This study will have given an evidence of the effectiveness of Tangram in teaching. It is also significance that it will help to provide the concerned personnel mathematics and agencies to use the appropriate of Tangram on geometry at basic level.

The study was experimental, in order to conduct the experimental on the effectiveness of Tangram in teaching Geometry at basiclevel, the researcher developed a teaching module and taught by him. Student of experimental group using Tangramand taught the students of control group by usual method. At the end of teaching a achievement test was administrated on both the groups. The pre test, post test of control and equivalent groups design were calculated in both groups with their obtain marks. t- test was used at 0.05 level of significance to find whether the difference of means statistically significant. The scores obtained by the students in the test was analyzed and thus had the following findings;

Findings

On the basis of the analysis of the scores obtained by experimental and control groups students in pre-test and post-test were given below.

From the Appendix 7 the mean and variance of the scores in the pre-test were respectively found to be 23.83 and 20.15 for the experimental group and 23.64 and 22.74 for the control group. The mean achievement scores of the groups were compared statistically using one

tailed t-test at the 0.05 level of significance. The calculated value of t-test was 0.11 which is less than the tabulated value 1.69 at the level of significance with degree of freedom 32. So the null hypothesis was accepted supporting that there is no significant different between the experimental and control groups.

Similarly from the Appendix 8 the mean and variance of the scores in the post-test were respectively found to be 28.53 and 17.64 for the experimental group and 24.47 and 20.13 for the control group. The mean achievement scores of the groups were compared statistically using one tailed t-test at the 0.05 level of significance. The calculated value of t-test was 2.72 which is greater than the tabulated value 1.69 at the level of significance with degree of freedom 32. The null hypothesis was rejected so the alternative hypothesis is accepted it means the researcher found that the mean achievement score of students taught with using Tangram is more than the mean achievement score of students taught with usual method.The difference between the mean score was significant

Thus, the qualitative analysis explains the influences of tangram in teaching geometry. Here, with the help of tangram the curiosity, creativity and application level increased in the students. The students learn different geometrical shapes practically by viewing in the knowledge sustainability.By this instrument the students are able to notice the positive changes in their learning habit. This may included their answering way, thinking method and many more aspect.Students were curios to learn geometrical concepts by using tangram since it deals with the geometry teaching in practicable and sustainable way.

Conclusion

On the basis of the analysis of the data obtain from the achievement test which has been taken from in the two government school of Bardiya district at class three as control and experimental group. The data has been described in chapter IV, it was found that the mean score of the students of experimental (To whom were thought by tangram) was greater than the mean score of the students of the control (To whom were thought by usual method). The experimental group to whom the use of tangram in the study in geometry it was found that they were forward in various type of activities. Students became more curious towards their study and the answer given by them, were more skillful.. Students were curios to learn geometrical concepts by using tangram since it deals with the geometry teaching in practicable and sustainable way. They are involved in in-depth learning to construct the conceptual of knowledge.

Finally they developed the habit of solving the problem by comparing the problem with the related figures and shapes of tangram which really raised their creativeness obtained. In summing up the result obtained from achievement test was according to our expectation that is better than before. From the result of this study, it can be concluded that the use of tangram in teaching geometry at basic level more effectiveness over than usual method.

Recommendations

On the basis of findings of this study some measure have been recommended for the improvement of the teaching situation in basic level classes as given blow

- Mostly the math teacher should try to use available materials in teaching mathematics.
- Before going to class room every teacher should be confidence in how to use the properly Tangram.
- The mathematics teacher should be encouraged to use tangram in teaching mathematics.
- Materials especially tangram should be used to develop the geometric idea and concepts.
- The mathematics book should be emphasizing on using of materials.
- Training programmes should priority the using of materials,
- Teacher training should help to make materials,

Suggestions for Further Research

On the basis of this, the following suggestions have been put forward for further research.

- The large research studies must be designed and carried out in order to investigate the effectiveness of using Tangram in sample in various schools of different parts of Nepal.
- Workshop, seminars and conference of the teachers should be organized for the improvement of teaching activities and to promote the appropriate technique with instructional materials.
- It may be interesting to replicate this study in different subjects and different classes.

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Lesson plan:1

Chapter:Triangle Time: 45 min

Topic:Triangle and it's parts Period:4th

Class: 3

Specific objective: At the end of the topic students will be able to

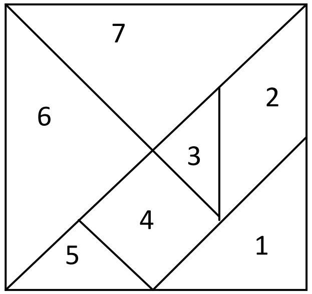
- Give the concept of triangle.
- Notation the name and symbol of the triangle.

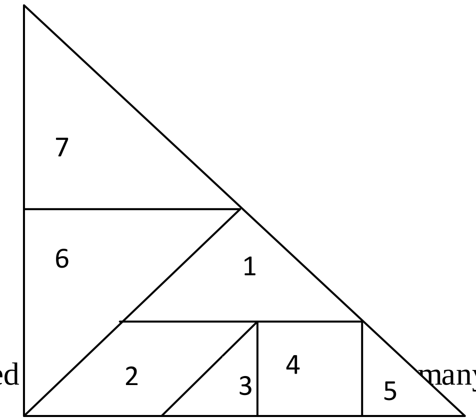
Teaching Materials: Tangram

Teaching Learning Activities:

- First of all, teacher will asksome questions to students such as: what is a line?What is angle?After responding the students, the teacher will clarify them by demonstrating of Tangram.

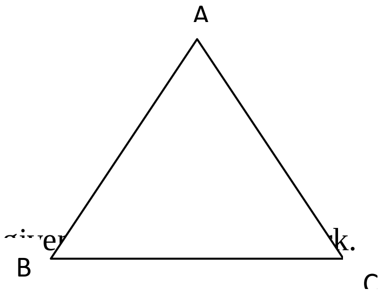
- Among seven pieces of tangram, the teacher will showthe five pieces of triangle having in tangram and other triangles also formed by combining the pieces of tangram.





- After then there will be discussed many sides did you see on the triangle? And similarly how many angles did you see on the triangle? Does it close or open? Then the teacher will be taken answer from the students.

- Then they will be taught how to notation the name of triangle and symbol with example.



It is denoted by symbol △ and written as △ ABC

- 5 triangles with different names will be k.

Homework: Exercise 3.1 will be given as homework.

Lesson plan: 2

Chapter: Triangle Time : 45 min

Topic: Isosceles Triangle Period:4th

Class: 3

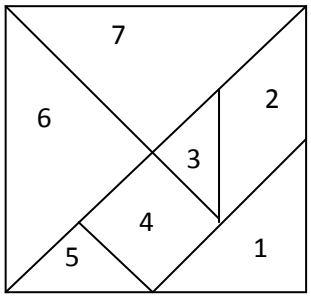
Specific objective: At the end of the topic students will be able to

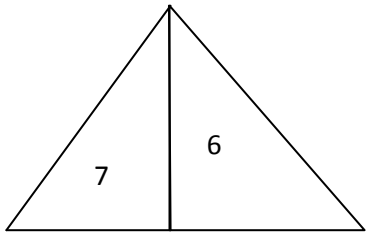
- define isosceles triangle
- Solve the problem related with isosceles triangle.

Teaching Materials: Tangram

Teaching Learning Activities:

- At first isosceles triangle will be shown by adding pieces of triangle as below

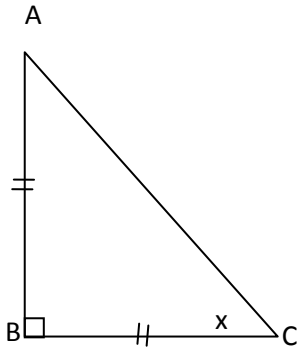




- After then student will be called to measure the sides of angle of the figure shown above
- Then there will be discussion about the sides and angles of the figures. For this, student will be asked following question to clear concept of isosceles triangle.

  Are the any two sides equal?

  Are the any two angles equal?
- Then students will be told that above figure is triangle
- The following figure will be given as class work



Homework: Question no. 3 and 4 of the Exercise 3.2 will be given as homework

Lesson plan: 3

Chapter: Triangle Time: 45 min

Topic: Right angled Triangle Period:4th

Class: 3

Specific objective: At the end of the topic students will be able to

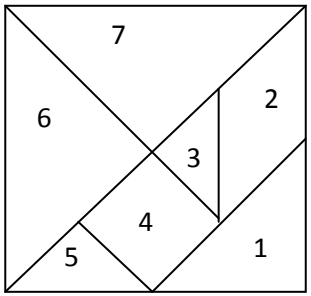
- define Right angled triangle
- solve the problem related to Right angled triangle

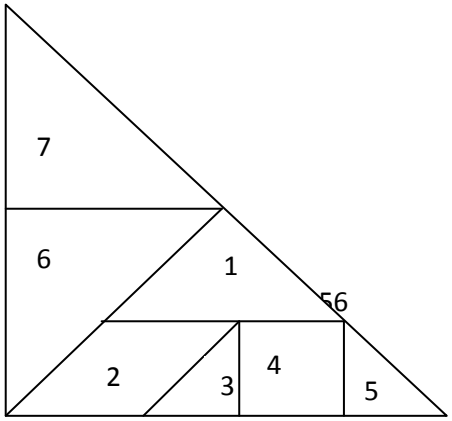
Teaching Materials: Tangram

Teaching Learning Activities:

- The concept of Right angled triangle will be given by discussing on the seven pieces of tangram.

  For this at first piece 1 will be shown to clarify the concept of right angle triangle and it is explained that there is one 90^0 angle in right angle triangle.





- After then students will be called to list the right angle triangle that has shown in above tangram.
- And then students will be practiced to make the right angled triangle by joining seven pieces of Tangram as shown in the above figure

Classwork: Make five figure of different size of right angled triangle.

Homework: write the name of different object which is example of right angled triangle .

Lesson Plan: 4

Chapter: Triangle

Time: 45 min

Topic: Angle sum of a triangle

Period:4th

Class: 3

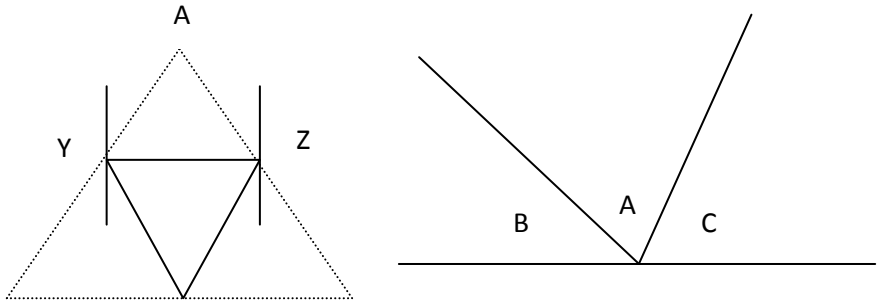
Specific Objectives: At the end of the lesson students will be able to

1. Show the sum of three angles of a triangle is 180 degree by using tangram.
2. Solve the problems related to the angle of a triangle.

Teaching materials: Tangram

Teaching Learning activities:

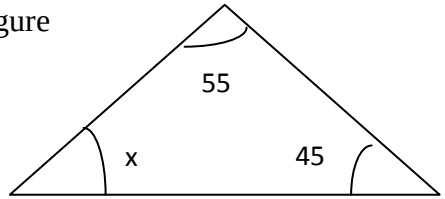
- The concept of sum of triangle is 180 degree will be provided by the tangram as shown in the figure



The ang B the above tr X e A,B and C be fold to X, Y and Z which makes a straight angle and so the sum of three angles of the triangle ABC is 180 degree.

- One problem related to finding angle value of a triangle will be solved. For example

  Find the value of x from the given figure



  Solution: From the figure

  55+ 45+ x = 180 { Being the sum of three angles of a triangle}

  or, 100 + x = 180

  Therefore, x = 80

The following questions will be asked as class work

1. If the three angles of a triangle are 30, 40 and p then find the value of p.
2. If the base angle of isosceles triangle is 40 degree then what will be the value remaining angle?

The question no 1 and 2 of the exercise 1.3 will be given as homework.

Lesson Plan: 5

Chapter: Quadrilateral Time: 45 min

Topic: The sum of angles of Quadrilateral Period:4th

Class: 3

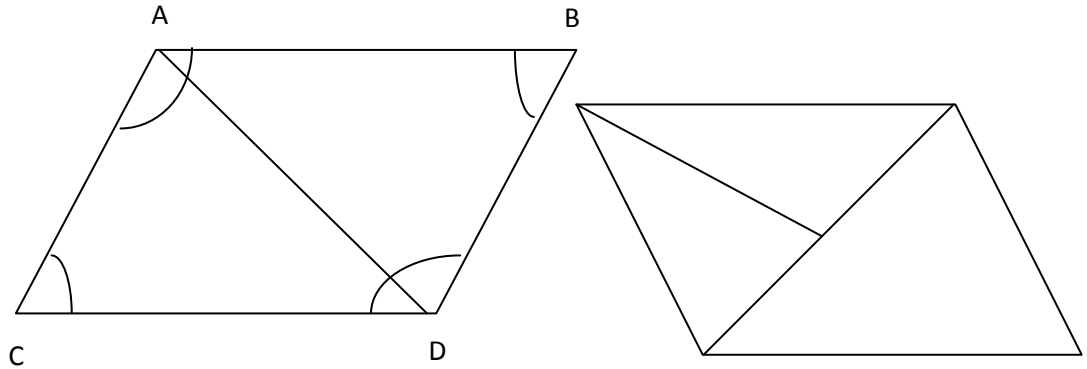
Specific Objectives: At the end of the lesson students will be able to

1. Show the sum of all angles of quadrilateral is 360 degree
2. solve the angles problem related to quadrilateral

Teaching Materials: Tangram

Teaching learning activity:

After known the sum of all angle concept of triangle, the students will be taught the sum of all angles of quadrilateral by combine two triangle and more pieces of tangram like as



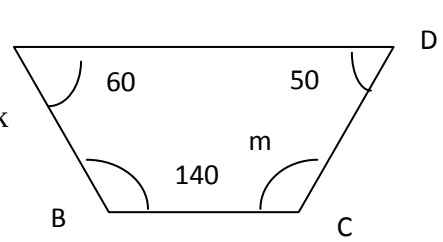
In the figure there are two triangles ABC and ABD in which the sum of angles of triangle ABC is 180 degree and the sum of angles of triangle ABD is 180 degree. Also, the combination of the triangle is a quadrilateral whose angle's sum is 360 degree. i.e.

$<ACD + <CDA + <DAC = 180^0$ and $<DAB + <ADB + <ABD = 180^0$

$<ACD + <CDA + <DAC + <DAB + <ADB + <ABD = 360^0$

$<ACD + <CDB + <ABD + <CAB = 360^0$

The following problems will be given as class work



1. Find the value of m on the following figure

   solution :the given problem is to be related to all angles sum so the

   sum of all four angles is 360 i.e.

$<ABC+<BCA+<CDA+<DAB=360^0$

or,$140^0+m+50^0+60^0=360^0$

or, $240^0+m=360^0$

therefore, $m=120^0$

the given questions as to be the classwork for the students

1. If the three angles of quadrilateral are 60^0,$80^0$and 205^0,find the fourth angle of it.

The question numbers 3 and 4 of the exercise 2.1 will be the given as homework .

Lesson plan: 6

chapter : Quadrilateral Period: 4th

Topic: Rectangle Time: 45 min

Class: 3

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

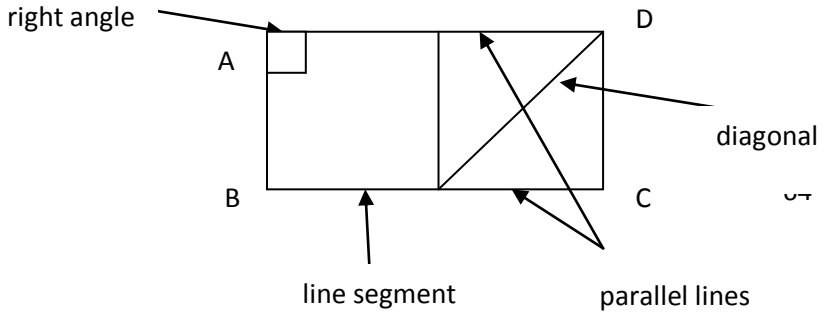
1.Give the definition of rectangle.

2. Solve the problem which is related to rectangle .

Teaching materials: Tangram

Teaching learning activities: At first The concept of rectangle will be cleared by the discussion of the given relative terms with the help of tangram like as

Equal line segment, parallel lines, right angle, diagonal line and quadrilateral



line segment AD and BC are parallel and equal

and also line segment AB and CD are parallel and equal

each corner has right angled

and then defined the rectangle four side of closed figure whose

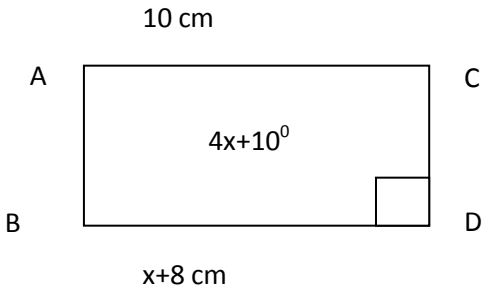
opposite sides are equal and parallel and each corner has right angled and diagonal are equal to each other so the above figure ABCD is rectangle.

Then after, The given problem will be taught as to find the value of given angle and sides of the rectangle .

solution :for the angle

$<BDE=90^0$ {being rectangle]

or,$4x+10^0=90^0$



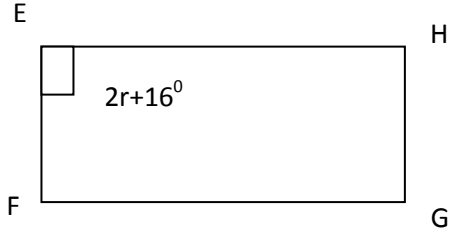
or,$4x=80^0$

or,$x=80^0/4$

therefore,$x=20^0$

now, solving for sides

sideAC=sideBC [being opposite sides of rectangle]



or, x+8 cm=10

therefore, x=2 cm

The following problem will be the class work of the students

1. write any three example of rectangle .
2. Find the value of r in given figure

Question number 1 and 2 of the exercise 2.2will be given as homework.

Lesson Plan: 7

Chapter: Perimeter Time: 45 min

Topic: Perimeter of triangle Period:4th

Class: 3

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

1. Define perimeter of a triangle
2. Find the perimeter of triangle

Teaching materials: Tangram

Teaching Learning Activities:

At first the concept of perimeter will be provided by showing the various shapes of tangram like triangle, parallelogram, rectangle etc. Then they will be called the sum of the length of all sides of a geometric figure is called perimeter.

After then some pieces of triangle of the tangram will be given to the students and they will be called to measure the length of each sides of given triangle and add the length of these sides which is perimeter.

And then students will be asked what is perimeter?

After then some problems will be given as class work as follow

1. Find the perimeter of equilateral triangle whose length of sides is 4 cm
2. Find the perimeter of the given triangle whose sides are 3cm , 4cm and 5cm

Question no 1 and 2 of the exercise 3.1will be given as homework.

Lesson plan: 8

Chapter: congruent and similar figure Time:45 min

Topic: Similar figure Period:4th

Class:3

Objectives :at the end of the topic students will be able to

1.Define any similar figure

2.Distingush similar figures

Teaching material: Tangram

Teaching learning activities:

At first concept of similar triangle will be proved by showing the various geometrical shapes and different pieces of tangram like as

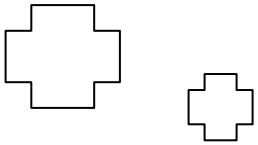
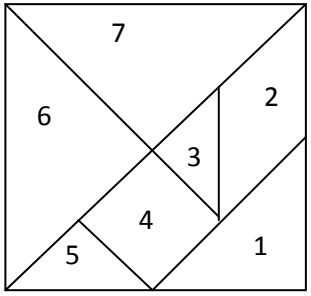


figure no.1



Then, the discussion on the following terms related with tangram .

Corresponding sides, Corresponding angles, Ratio of the sides, Equal size and shape etc

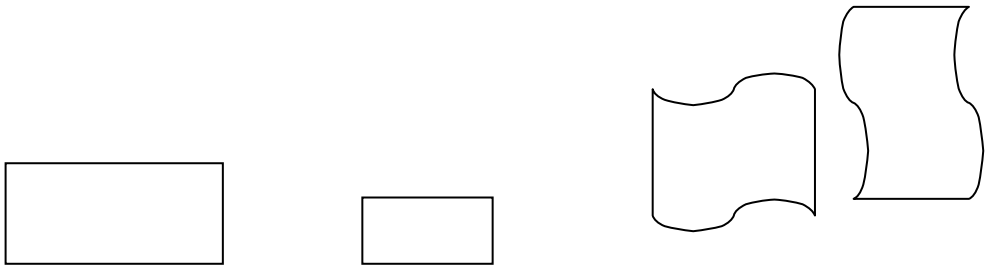
then after, student will be called two or more than two figure are similar if there's shape and ratio of corresponding sides are same and equal .

From the above figure of tangram triangle no .6 and triangle no.1 have same shape there corresponding sides ratio is equal so both triangle are similar it is denoted by the symbol ' ~

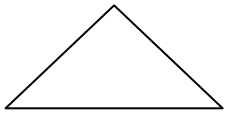
the given problem will be as class for the students as follow.

1. Write the definition of similar triangle .

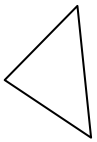
2.Find out which of the following pairs of figure is similar.



i) ii) iii) iv)



v)



vi)

Question 1 and 2 of exercise 4.1 will be the homework for the student.

Lesson Plan: 9

Chapter: line

Time: 45 min

Topic: line segment

Period:4th

Class: 3

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

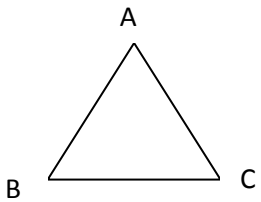
1.Find out the number of line segment of any geometrical figure .

2.Compare the line segment to each other.

Teaching materials: Tangram

Teaching Learning Activities:

At first the concept of line segment will be provided by showing the various shapes of tangram like triangle, parallelogram, rectangle etc. Like as



Where, AB ,BC and AC which are boundary sides and definite length so these are called line segment .

After then some pieces of triangle of the tangram will be given to the students and they will be asked how many line segment has you gotten in each pieces of Tangram .

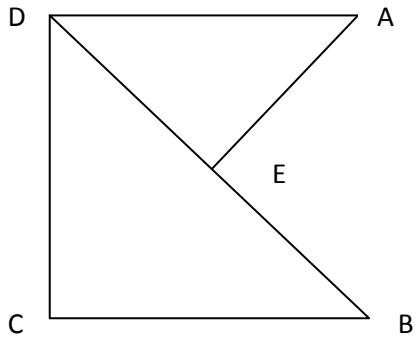
After answer the questions and told them to measure the length of each sides of any one piece.

And then students will be told to put the line segment in ascending order of it?

After then some problems which are made by the combining of pieces of Tangram will be given as class work as follow

1. How many line segments are used in given figure?

2. Measure each line segment of the given figure and compare each other.



The question no 1 and 2 of the exercise 1.2 will be given as homework.**Appendix -1**

Pre-test paper

Class: 3 F.M: 50

Time:1:3o hr P.M: 16

Group "A" $10\times 1 = 10$

Choose the best answer

1. How many line segment are there in the figure

a)2 b)3

c)4 d)5

2. Which of the following symbol denotes the equal ?

a) < b) =

b) # d) >

3. How many digit in one thousand ?

a)4 b) 5

c)6 d)3

4. The between number of the number 5679 and 5681 is

a)6570 b)5678

c)5680 d)5682

5. which of the following number is even?

a)2 b)3

c)5 d)9

6. The multiply of 8 and 3 is

a)14 b)18

c)24 d)42

7. 56 is divisible by 7 is

a)5 b)8

c)9 d)7

8. The number 4 , 5 , 6 , 7 , 8 are known as

a) Devnagarik b) Hindu Arabic

c)Roman d) None

9. How many minute in one hour?

a) 60 b) 30

c)12 d)24

10. In fraction $\frac{a}{b}$,where a is called

a) numerator b) denominator

c) divisor d) quotient

Group "B" $10\times 2 = 20$

11. Multiply:

$$\begin{array}{r} 81 \\ \times\ 23 \\ \hline \end{array} \qquad \begin{array}{r} 86 \\ \times\ 57 \\ \hline \end{array}$$

12. Subtract

$$\begin{array}{r} 534.563 \\ -\ 234.768 \\ \hline \end{array}$$

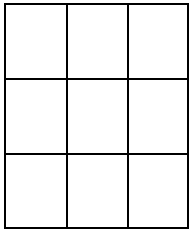
13.If the prize of 5pen is 20, find the prize of 4 pen?

14.Divide

472 ÷ 4 = ☐ 4360 ÷25= ☐

15. How many paisa are there in 8.24 rupees

16.Find the area of given figure?(1 box = 1 sq.cm)



17. Draw the following line segment.

AB=6 cm PQ=9 cm

18. What is the successor and producer number 3529?

19.Ram has 30 rupee 50 paisa. If he spend 15rupee 20 paisa of its,at last how much money is left him ?

20. Round of the number 18 is nearest to ten.

Group "c" $5 \times 4 = 20$

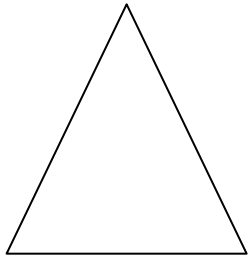
21.Put the number 9582 in place value chart and write in word.

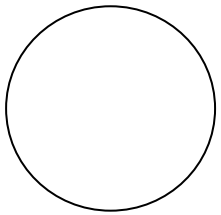
22. Simplify

$\frac{5}{2} + \frac{1}{3} - \frac{2}{5}$

23. Find the H.C.F. of 64 and 124.

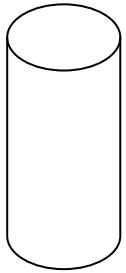
24.Write the name of following geometric figure.

a) 

b) 

c)

d)



Appendix -2

Post-test

Class: 3 F.M: 50

Time:1:30 hr P.M: 16

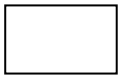
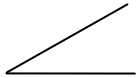
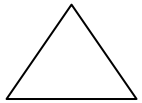
Group "A" $13\times 1 = 13$

Choose the correct answer

1. The instrument which measure and draw line is known as

   a) protector b) compass c) ruler d)setsquare

2. Which of the following figure have three line segments?

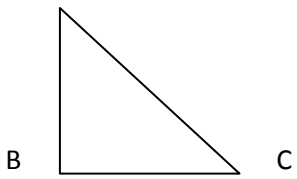
   a)  b)  c) d) 

3. which of the following symbol represent angle

   a)  b)  c)  d) 

4. Which of the following angle is Right angle in the given triangle?

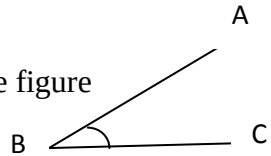
   a) <ABC b) <BAC c) <BCA d) none of them



8. The total number sides in a quadrilateral is

a) 2 b) 3 c)4 d)5

9 .Which of the following angle is denoted in the figure



a)<ABC b)<BCA c)< BAC d)<ACB

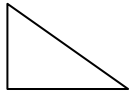
10. The total number of angle in a triangle is

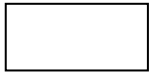
a)2 b)3 c)4 d)1

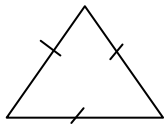
11. The total number line segment in letter M is

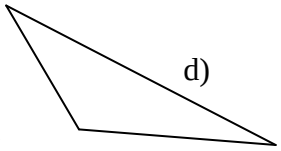
a)2 b)3 c)4 d) None of them

12.Which of the following figure has equal line segment

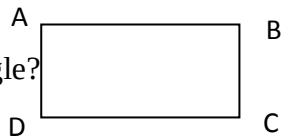
a) 

b) 

c) 

d) 

13. Which line segment is equal to AB in the given rectangle?



a) BC b) CD c) AD d) AC

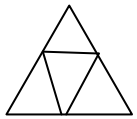
14. The all sides equal triangle is known as

a)scalene triangle b) isosceles triangle c) equilateral triangle d) none of them

15.The sum of all angles of a triangle is

a)90^0 b)60^0 c)180^0 d)360^0

16. How many triangles are there in the given figure?



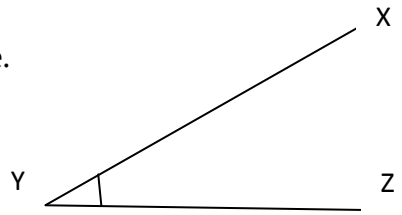
a)4 b) 5

c) 3 d) 2

Group "B" $6\times 2 = 12$

15. Write any two function of ruler and also draw 6 cm line segment.

16. Write the name of given angle.



17. Draw a triangle in your copy and write the name of the it's.

18.Define the isosceles triangle with suitable example.

19.How many line segments and angles are there in a triangle.

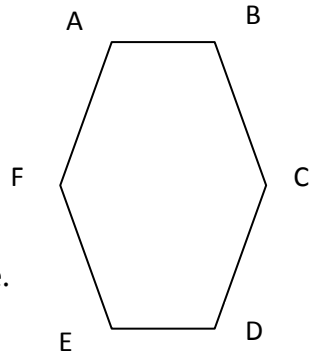
20.Find out the similar shape figure from following .

copy ,book, marble, ball ,coin ,bread

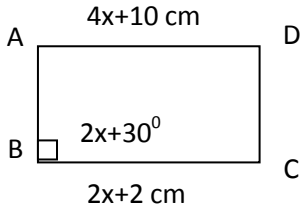
Group "C" $5 \times 5 = 25$

20. Define a triangle and also write its type.

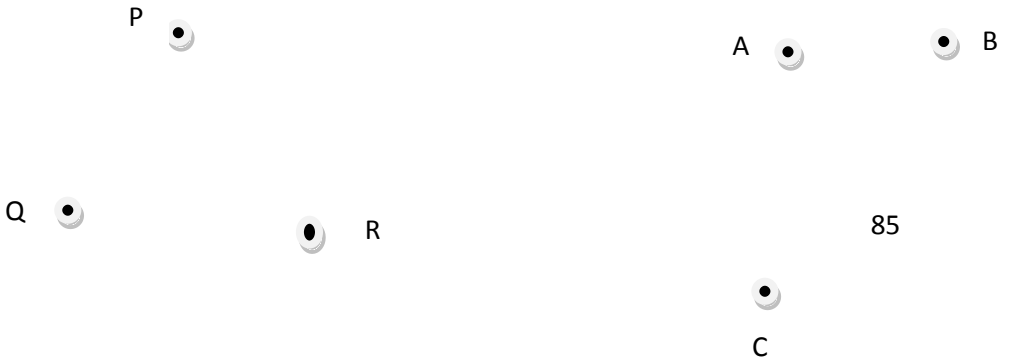
21. Measure and write the line segment of the given figure.



22.Find the value of x and p of the given figure.

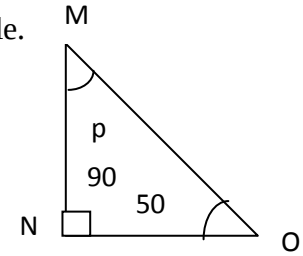


23.Joined the given points respectively and write the name and type of these figure.

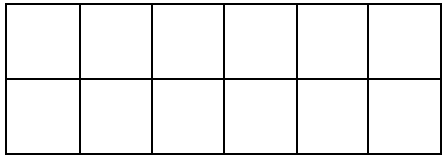


D

24. Find the value of angle p of the given triangle.



25.Find the area of given figure.



Appendix -4

Item analysis of post - test

students	Upper 27% students with correct response							Lower 27% students with correct response							P value	D value	Remarks
Item no.	1	2	3	4	5	6	Total	1	2	3	4	5	6	Total			
1	1	1	0	1	1	0	4	0	0	1	0	0	0	1	41.66%	0.5	Retained
2	1	1	1	1	0	1	5	1	1	0	1	0	0	3	66.66%	0.33	Retained
3	1	1	1	0	1	1	5	0	0	0	1	0	1	2	58.33%	0.5	Retained
4	1	1	1	1	1	1	6	1	0	0	0	0	0	1	58.33%	0.83	Modified

5	1	0	0	1	1	0	3	0	1	0	0	0	0	1	33.33%	0.33	Retained
6	1	1	1	1	0	1	5	1	0	1	0	0	1	3	66.66%	0.33	Retained
7	1	1	1	1	1	1	6	1	0	1	1	1	0	4	83.33%	0.33	Removed
8	0	1	1	1	1	1	5	0	0	0	0	1	1	2	58.33%	0.5	Retained
9	1	1	1	1	0	0	4	0	1	0	0	0	0	1	41.66%	0.5	Retained
10	1	1	0	1	1	1	5	0	0	0	0	1	0	1	50%	0.66	Retained
11	1	1	1	0	1	1	5	0	0	0	0	0	0	0	41.66%	0.83	Modified
12	1	0	1	1	1	0	4	0	1	0	0	0	0	1	50%	0.5	Retained
13	1	1	1	1	1	1	6	1	1	1	0	0	0	3	75%	0.5	Retained
14	1	1	1	1	0	1	5	1	0	1	0	1	0	3	66.66%	0.33	Retained
15	0	1	1	1	1	1	5	0	1	0	1	0	0	2	58.33%	0.5	Retained
16	1	1	1	0	1	1	5	0	0	0	1	1	0	2	58.33%	0.5	Retained
17	1	0	1	1	1	1	5	0	1	0	0	0	0	1	50%	0.66	Retained
18	1	1	1	1	0	1	5	0	0	0	1	0	1	2	58.33%	0.5	Retained

Appendix -3

Item analysis of pre- test

19	1	1	0	1	1	1	5	0	0	0	0	0	0	0	41.66%	0.83	Modified
20	1	1	1	0	1	1	5	0	1	1	0	0	0	2	58.33%	0.5	Retained
21	1	1	1	1	0	1	5	0	0	0	1	0	0	1	50%	0.66	Retained
22	1	0	1	1	1	0	4	0	0	0	0	0	0	0	33.33%	0.66	Retained
23	1	1	1	1	1	0	5	1	1	1	0	0	0	3	66.66%	0.33	Retained
24	1	0	0	1	1	1	5	1	0	0	0	0	0	1	58.33%	0.66	Retained
25	0	1	0	1	0	1	3	1	0	0	0	0	0	2	58.33%	0.5	Retained
26	1	1	1	0	0	1	5	0	0	1	0	0	1	2	58.33%	0.5	Retained

students	Upper 27% students with correct response							Lower 27% students with correct response							P value	D value	Remarks
Item no.	1	2	3	4	5	6	Total	1	2	3	4	5	6	Total			
1	1	1	1	1	1	0	5	1	1	1	0	0	0	3	66.66%	0.33	Retained
2	0	1	0	1	0	1	3	1	0	0	0	0	0	2	58.33%	0.5	Retained
3	1	1	1	0	0	1	5	0	0	1	0	0	1	2	58.33%	0.5	Retained
4	1	1	1	0	1	1	5	0	1	0	0	1	0	2	58.33%	0,5	Retained
5	1	1	1	1	1	0	5	0	1	0	0	0	0	1	50%	0.66	Retained
6	1	1	1	1	1	0	5	0	0	1	0	0	1	2	58.33%	0.5	Retained
7	1	0	1	0	1	1	4	0	0	0	1	0	1	2	50%	0.33	Retained
8	1	1	1	1	0	1	5	0	0	1	1	0	0	2	58.33%	0.5	Retained
9	1	1	1	0	1	1	5	0	1	0	0	0	1	2	58.33%	0.5	Retained

10	0	1	1	1	1	1	5	1	0	0	1	0	0	2	58.33%	0.5	Retained
11	1	1	1	1	1	0	5	0	0	1	0	0	0	1	50%	0.66	Retained
12	1	1	1	1	0	1	5	0	0	0	1	0	0	1	50%	0.66	Retained
13	1	1	1	0	0	0	3	0	0	0	0	0	0	0	25%	0.5	Retained
14	1	1	0	1	1	1	5	0	1	0	0	0	0	1	50%	0.66	Retained
15	1	1	1	1	1	1	6	1	1	1	0	0	0	3	75%	0.5	Retained
16	1	1	1	1	1	1	6	1	1	0	0	0	0	2	66.66%	0.66	Retained
17	1	1	0	1	1	1	5	0	0	1	1	0	0	2	58.33%	0.5	Retained
18	1	1	1	1	1	1	6	0	0	0	0	1	0	1	58.33%	0.83	Rejected
19	1	1	1	1	1	0	5	1	0	0	1	1	0	3	66.66%	0.33	Retained
20	1	1	0	1	1	1	5	0	1	0	0	0	0	1	50%	0.66	Retained
21	1	0	0	1	1	1	4	0	0	1	1	0	0	2	50%	0.33	Retained
22	0	1	1	1	1	1	5	1	0	0	0	1	0	2	58.33%	0.5	Retained
23	1	1	1	1	1	0	5	1	0	0	0	0	0	1	50%	0.66	Retained

24	1	1	1	1	0	1	5	1	0	0	0	1	0	2	58.33%	0.5	Retained
25	1	1	1	1	1	0	5	1	0	1	0	0	1	3	66.66%	0.33	Retained
26	1	0	1	0	1	1	4	0	0	0	0	1	0	1	41.66%	0.5	Retained

Student	X(odd)	Y(even)	X^2	Y^2	XY
1	13	10	169	100	130
2	10	12	100	144	120
3	11	10	121	100	110
4	10	11	100	121	110
5	11	9	121	81	99
6	7	12	49	144	84
7	5	5	25	25	25
8	4	5	16	25	20
9	6	2	36	4	12
10	4	3	16	9	12
11	1	5	1	25	5
12	4	1	16	1	4
	$\sum X = 86$	$\sum Y = 85$	$\sum X^2 = 770$	$\sum Y^2 = 779$	$\sum XY = 731$

Appendix -5

Split half reliability test (pre-test)

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

$$= \frac{12\times731 - 86\times85}{\sqrt{(12\times770 - 86^2)(12\times779 - 85^2)}}$$

$$= 0.73$$

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

$$= \frac{2\times0.74}{1.74}$$

$$= 0.85$$

Appendix -6

Split half reliability test (pre-test)

Student	X(odd)	Y(even)	X^2	Y^2	XY

1	11	12	121	144	131
2	11	11	121	121	121
3	10	11	100	121	110
4	11	10	121	100	110
5	11	9	121	81	99
6	9	11	81	121	99
7	4	6	16	36	24
8	6	3	36	9	18
9	4	4	16	16	16
10	4	3	16	9	12
11	2	4	4	16	8
12	1	4	1	16	4
	$\sum X = 84$	$\sum Y = 88$	$\sum X^2 = 754$	$\sum Y^2 = 790$	$\sum XY = 752$

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

$$= \frac{12 \times 752 - 84 \times 88}{\sqrt{(12 \times 754 - 84^2)(12 \times 790 - 88^2)}}$$

= 0.88

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

$=\frac{2\times0.88}{1.88}$

= 0.93

Appendix -7

Pre- test score of the students of experimental and control group

(Obtained scores arranged in descending order)

S.N.	Score of experimental group	Score of control group
1	30	30
2	29	29

3	29	29
4	28	28
5	28	28
6	27	27
7	26	27
8	25	25
9	24	24
10	24	23
11	22	23
12	22	22
13	21	19
14	19	18
15	18	17
16	17	17
17	16	16
N= 17	405	402
Mean(X)=	23.83	23.64
Standard deviation =	4.48	4.76

Variance =	20.15	22.74
t value	0.11	

Appendix -8

Post- test score of the students of experimental and control group

(Obtained scores arranged in descending order)

S.N.	Score of experimental group	Score of control group
1	36	35
2	35	33
3	34	29
4	33	26
5	31	26
6	30	25

7	30	25
8	29	24
9	28	24
10	27	23
11	26	23
12	26	22
13	25	22
14	25	21
15	24	21
16	24	19
17	22	18
N=	485	416
Mean(X)=	28.53	24.47
Standard deviation =	4.19	4.48
Variance =	17.64	20.13
t value	2.72	

Appendix 9

Observation of classwork: Daily classwork completion of students of experimental and control group were observed and they were recorded separately in the following table

Observation	with help complete		without help complete	
	E.G.	C.G.	E.G.	C.G.
1st day	3	12	14	5
2nd day	4	14	13	3
3rd day	2	14	15	3
4th day	3	13	14	4
5th day	1	11	16	6
6th day	6	12	11	5
7th day	8	6	9	11
8th day	3	9	14	8
9th day	2	11	15	6
10th day	6	10	11	7

11th day	5	8	12	9
12th day	1	12	16	5
13th day	0	6	17	11
14th day	0	7	17	10
15th day	1	5	3	12

Appendix 10

Observation of Homework: Daily homework completion of students of experimental and control group were observed and they were recorded separately in the following table

Observation	with help complete	without help complete

	E.G.	C.G.	E.G.	C.G.
1st day	2	7	15	10
2nd day	3	8	14	9
3rd day	4	6	13	11
4th day	4	5	13	12
5th day	3	7	14	10
6th day	6	8	11	9
7th day	4	4	13	13
8th day	3	3	14	14
9th day	5	2	12	15
10th day	4	6	13	11
11th day	7	3	10	14
12th day	5	4	12	13
13th day	1	5	16	12
14th day	2	3	15	14
15th day	0	2	17	15

Appendix 11

Observation of Attendance: No. of present and absent students were recorded in the following table

Observation	No. of present students		No. of absent students	
	E.G.	C.G.	E.G.	C.G.
1st day	15	13	2	4
2nd day	14	14	3	3
3rd day	16	14	1	3
4th day	17	15	0	2
5th day	17	13	0	4
6th day	16	12	1	5
7th day	15	16	2	1
8th day	16	17	1	0

9th day	17	15	0	2
10th day	16	14	1	3
11th day	17	16	0	1
12th day	14	14	3	3
13th day	15	16	2	1
14th day	17	17	0	0
15th day	16	13	1	4

Appendix 12

Observation of Creative Behaviour

Observation / Topi	creative behaviour		Remark
	E.G	C.G.	
Triangle its parts	show the different triangle by combining the pieces of tangram	not gave that type of behaviour	
Isosceles triangle		-	
Right angled triangle	made right angled triangle from the pieces of tangram and show the right angle in square triangle while	said the right angle mean 90^0	

	thought by triangle		
sum of angle of a triangle	after knew the sum of angle of triangle , said sum of quadrilateral	-	
sum of angle of a quadrilateral	no	-	
Rectangle	show more than two figure from the pieces of tangram	-	

Appendix 13

Observation Curiosity Behaviour

Observation / Topi	curious behavior		Remark
	E.G	C.G.	
Triangle its	A students asked some questions on	-	

parts	the side and angles after study equilateral triangle. i .e . *If all sides of equilateral are equal, so is the case on angles then?*		
Isosceles triangle	asked questions from a student • *the base line made with equal sides is known as base angle then what about the remaining angle of isosceles triangle?*	A student show isosceles triangle figure on his copy.	
Right angled triangle	asked question from a students • Two angles equaling 90 degree each cannot be called a triangle?	-	
sum of angle of a triangle	asked questions from students • *The addition of three angles equaling 180 degree is called triangle, then what if addition is more than it?* • *If the addition of three separate*	Solved the problem of it.	

	angles is 180 degree, then is it a triangle?		
Rectangle	• made different rectangle from the pieces of tangram • a student asked a question on that topic. i.e. *If both have 90 degree angles, then rectangle is square and vice –versa?*	Defined rectangle.	