EFFECTIVENESS OF THE CONSTRUCTIVISM METHOD OF TEACHING MATHEMATICS AT BASIC LEVEL

A

THESIS BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF EDUCATION

SUBMITTED

TO

DEPARTMENT OF MATHEMATICS EDUCATION

SAPTAGANDAKI MULTIPLE CAMPUS

BHARATPUR-10, CHITWAN, NEPAL

2018

EFFECTIVENESS OF THE CONSTRUCTIVISM METHOD OF TEACHING MATHEMATICS AT BASIC LEVEL
THESIS BY: FANSI MAYA MAHATO, 2018

DECLARATION

I hereby declare that the thesis entitled **Effectiveness of the Constructivism Method of Teaching Mathematics at Basic Level** is the result of my original work. No part of the thesis was earlier submitted for the research degree to any university and educational institution. This thesis is the result of my own research work conducted in the study area whatever, subject matter I have presented in this thesis is my original except some cited materials.

…….

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LETTER OF RECOMMENDATION

This is certifying that Ms. Fansi Maya Mahato, a Student of academic year 2068/069 with campus Roll. No. 26, Exam Roll. No. 2400140 and T.U. Regd. No. 9-2-48-3498-2007 has completed this thesis under my supervision for the period prescribed by the rules & regulations of Tribhuvan University, Nepal. The Thesis entitled "Effectiveness of the Constructivism Methods of Teaching Mathematics at Basic Level" has been prepared based on the results of his investigation. I hereby recommend and forward this thesis to be submitted for the evaluation as the partial requirements to award the Degree of Master Degree of Education.

.....	.....
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LETTER OF APPROVAL

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ENTITLED

"Effectiveness of the Constructivism Method of Teaching Mathematics at Basic Level" has been approved for the partial fulfillment of the requirements for the Degree of Master of Education.

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ACKNOWLEDGEMENT

I am greatly indebted to my supervisor **Mr. Binod Khanda Timilsana,** member of Department of Mathematics Education, Saptagandaki Multiple Campus, Bharatpur for his proper guidance and supervision to me at every stage from selection of the problem till the completion of this thesis. Without this guidance, this study would not have been completed. His keen interest and valuable suggestions in this research have been a source of great inspiration to me.

I am grateful to my respected teacher, Mani Raj Mahato, head of Department of Mathematics Education Saptagandaki Multiple Campus, Bharatpur for his creative suggestion and constant inspiration while accomplishing this research work. I would like to express my thanks to respected teachers, Basanta Raj Lamichhane, and Rudra Prasad Chalise for their valuable comments and suggestion to bring the work into present form.

I am also very much indebted to the teachers and students of Janata Higher Secondary School, Kawasoti -16, and Jeevan Jyoti Higher Secondary School, Kawasoti-03 for the their kind co-operation and continuous assistance during my data collection.

I would also like to express my special thanks to my husband, Mr. Prithivi Lal Mahato, my daughter Pariyan Mahato, my father, Nira Pati Mahato, my mother, Jit Kumari Mahato and father–in–law, Om Narayan Mahato. Their continuous emotional support and inspiration helped me a lot to accomplish this research work.

Last but not the least, I express my thankful to Mr. Shubarna Neupane of Fonet Computer, Bharatpur, Chitwan for his excellent service in technical support.

Fansi Maya Mahato

ABSTRACT

Mathematics is widely used in every field of social and other sciences because of its usefulness. This utilitarian value causes mathematics to become a compulsory subject in school education.

In developed countries, curriculum land teaching methods have been continuously changing. However, in the context of Nepal, teaching method has remained unchanged. Considering this, there are many approached to improve the situation of mathematics in Nepal.

We still need a revolution to bring changes in the field of mathematics in Nepal. And this revolution should be to depart from all the traditional methods of teaching mathematics and pure mathematics itself. So the researcher has intended to study the effectiveness of constructivism in mathematics teaching at basic level. The objectives are to find the effectiveness of the constructivism method of teaching mathematics at basic level and compare the achievement of the students taught by constructivism with the achievement of the student taught by tradition method.

In order to fulfill these objectives the researcher selected two schools in Nawalparasi district. One was selected as experimental and the other was selected as control group by tossing a coin. Both the experimental and control groups were taught by researcher himself. Experimental group was taught by constructivist method and the control group was taught by traditional method on the topic ‘menstruation’. Pretest was administered before the experiment. The duration of experiment was 30 days. After 30 days a post test was administered on both groups and after that the mean, variance and standard deviation were calculated. The differences in mean achievement scores were tested by using t-test at 0.01 levels of significance. Finally, the researcher concluded the achievement of the students of experimental groups was better effectiveness than traditional method of mathematics method of mathematics teaching in basic level.

In order to fulfill the objectives of the study the researcher developed a four-week class observation form for four-weeks where, student-student interaction, teacher-student interaction and motivation of students are involved. To measure this there are five categories: Excellent Good Average, General and Poor.

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CHAPTER- I

INTRODUCTION

Background of the Study

Mathematics is created by the mind of man and is therefore, primarily concern with ideas, process and reasoning. It was developed with empirical and logical reasoning from counting, measurement, calculation, study of shapes and motions of physical object. With has continuously been developed and improved with changing needs of contemporary society. The beginning of mathematics was advanced with ancient period of human civilization. With the advancement of science and technology. The need of advance mathematical concept & skills and their application have been demanded.

Mathematics has recently achieved a new status and become more genera. It is applicable to every aspect of individual life. Social work, economic, political etc. Today, mathematics is used throughout the world on many fields including science, medicine, economics etc.

Mathematics is now widely studied because of its usefulness. Mathematics instruction become broader and more inclusive than in the past. Considering this, different educational reports. Nepal National Education Planning Commission (1954). National Education System Plan (1971-1976) and National Education Commission (1992) gave more importance for the improvement of School level education, curriculum, teaching methods, teaching materials. Teaching training improvement of teacher's service. With the advent of the NESP (1971-1976), mathematics given a significant place at all levels of school curriculum. Mathematics structure is characterized by underfund terms, axioms and rules and logic. But applying mathematics curriculum only is not sufficient for the students. We should be aware about the output of curriculum. One of the main output of curriculum is teaching method. Some significant researcher have been done consuming new approach of teaching mathematics since past few years. According to these researcher, there are curriculums instructional materials, textbook, teachers guide to conduct the regular teaching activities in the classroom and teachers training package for improving the Achievement of the students. There is lack in

designing and developing suitable teaching methods for different subjects as well as topics, there is la hope for a new method in which social and individual facts can shape and balance each other. The new methods include an increased awareness towards learning opportunities among students. The constructivist method is also recently used as a: new method of teaching (as cited in Upadhya, 2001)

Constructivism

The term constructivism refers to the idea that learners construct knowledge by themselves. Each learner individually constructs meaning as he/she learns. Constructivism is a theory of knowing and theory about coming to know (Jaeger, 1992). It emphasizes the importance of the learner's active engagement during learning processes. In constructivism, the learner constructs his/her own understanding of each mathematical concept rather than passively receive knowledge from the teacher. According to this theory, learning is an active process in which learner constructs new ideas or concepts based upon his/her current or previous knowledge.

Upadhyay (2001, p13) justifies as:

In constructivism, the role of teacher changes from talking and describing to listening land asking questions to the students". He furthers states, "constructivist theory posits that students make sense of the world by synthesizing new experiences into what they have previously understood. They form rules through reflection on their interaction with objects and ideas. When they encounter an object, idea or relationship that does not make sense to them, they either interpret what they see to confirm to their rules or the adjust their rules to better account for the new information.

Jacquelive and Martin write.

Constructivism is a philosophy of learning founded on the premise that by reflecting on our experiences, we construct sour won understanding of the world we live in each of us generates our own 'rules' and 'mental models' which are used to make sense of our experiences. Learning therefore is simply the process of adjusting our mental models to accommodate new experience.

It is generally acknowledged that constructivism constitutes a very important, practical and theoretical perspective in current education research. A first version of constructivism originating in the work of Piaget holds that knowledge is actively constructed by the learner and passively transmitted by the educator. There is a radical constructivism of on Glassersfeld (1990), in which cognition is considered adaptive in the sense that it is based on and constantly modified by the learner's experience. Beyond that, there is the social constructivism version of Vygotsky, who is an effort to challenge Piaget role of communication and social life in meaning formation and cognition. The latter version of constructivism is accentuated by theories of sociology of scientific knowledge (SSK), which argue that all knowledge is a social construct in the frame of science and technology studies.

There are some guiding principles of constructivism, they are listed in number:

1. Learning is a search for meaning. Learning must start with the issues around which students are actively trying to construct meaning.

2. Meaning requires understanding the phenomena as a whole as well as parts. And parts must be understood in the contest of wholes. Therefore, the learning process focuses primarily on the concepts, not on the isolated facts.

3. In order to teach well, we must understand the mental models that students use to perceive the world and the assumptions they make to support those models.

4. The purpose of learning is for an individual to construct his or her own meaning, not just memorize the right answer and regurgitate someone else meaning. since education is inherently interdisciplinary, the only valuable way to measure learning is to make the assessment part of the learning process, ensuring it provides students with information to the quality of their learning

Constructivismis at once a theory of ‘knowing‘ and a theory about ‘ coming to know (Jaeger,, 1992) . As such, its implication for instructions and understanding how learners construct meaning and profound. Constructivist varies greatly in their understanding, selection and interpenetration of how to apply constructivism. However, the central idea of its application is the same. Constructivism emphasizes the importance of learner’s active engagement during the learning process. The learner constructs or generates meaning from his or her experience rather than passively receiving knowledge.

However, in traditional methods of teaching mathematics, the students remain passive in classroom. They have just listen to the teacher or make photocopy of what the learner notes on the board. This method always focuses on teaching rather than learning. In contrast, constructivism focuses its attention on. how people forming models in response to the question s and challenges that comes forming models in response to the questions and challenges that comes from actively engaging mathematics problems and environment not from simply taking in information, nor as merely the blossoming of an innate gift.

While applying conventional method in the classroom the teacher plays role of director. The students have to remaining silent while the teacher barks all the time from on corner to the next or just stands before the students. In contrast, the role of teacher in a constructivist learning environment shifts room that of an authority figure to that of a facilitator figure.

Constructivism Impacts on Learning

Under the theory of constructivism, educators focus on making connections between facts and fostering new understanding in students. Instructors tailor their teaching strategies to student response and encourage students to analyze, interpret and predict information. Teachers also rely heavily on open ended question and promote extensive dialogue among students.

Curriculum

Constructivism calls for the elimination of a standardized curriculum. Instead, it promotes using curricula customized to the student's prior knowledge. Also, it emphasizes work place experience while problem solving. Where the sequencing of subject matter is condemned, it is the constructivist viewpoint that the foundation of any subject may be taught to anybody at any stage in some form (Duffy and Jonassen, 1992). This means that instructors should first introduce the basic ideas that give life and form to any topic or subject Area, and then revisit and build upon these repeatedly. This notion has been extensively used in curriculum. Vygotsky finding suggest that the curriculum should generally challenge and stretch learner's competence. The curriculum should provide many opportunities to apply previous skills, Knowledge and experience with "authentic activities connected to real life environment." "Since children learn much through interaction, curricula should be designed to emphasis interaction between leanness and learning tasks.

Assessment

Constructivism calls for the elimination of grader and standardized testing. instead, assessment becomes part of the learning process so the students play a vital role in judging their own progress. In the mathematics education community, constructivism appears to have been very influential in legitimizing students mental processes such as how they learn to add or develop the concept of function. It has facilitated moving away from behaviorism with its logical positivist viewpoint, which tends to ignore the internal working of the mind and thus effectively discouraged research on many interesting mental questions.

Modern theorists have begun to examine critically the implications of the philosophy. With the advent of computer based instruction and the ever-growing capabilities of technology, the potential for creating has multiple exponentially.

Classroom

Classroom acts as a community formed by individual of different cultures. A constructivist classroom exhibits a number of discernable qualities markedly different from a traditional classroom. The environment is democratic, the activities are interactive and student centered, and the students are empowered by a teacher who operates as a facilitator. The teacher and the students share responsibility a decision making and demonstrate mutual respect. The learning relationship in a constructivist classroom is naturally beneficial to both students and teachers.

Student:

Constructivist theory points that students make sense of the world by synthesizing new experiences into what they have previously understood. Students create their own knowledge by acting on the environment by reflecting on his past activities.

Teacher

The role of teachers is to create/facilitate and elicit the learning environment for the students. Teacher's questions elicit the correct response from the pupil. Teachers asks open-ended questions and allows time for response. He encourages students to connect and summarize concepts by analyzing, predicting, justifying and defending their ideas. Teachers help student to attain their own intellectual identify.

Society

The role of society is to evaluate the knowledge of the students received in the environment created by the teachers. Society has two functions in education. Firstly, it provides opportunity to the learners and secondly, it judges and shapes the knowledge of student if it is viable and workable in the society.

Statement of the Problem

Mathematics is one of the very essential disciplines in the new era of science and technology. It has close relationship with many other branches of knowledge especially with science. The perception of both the students and teachers is that mathematics is a very difficult subject. This perception is largely attributed to teaching learning activities. So, there is a need to bring radical change in its teaching learning methods. In order to become and efficient and effective teacher, it is necessary to understand the relationship among the mathematics contents and various teaching strategies for presenting mathematics lessons.

The successful learning depends upon the teaching procedure or method of teaching that can motivate the learners in the learning process through active participation doing things themselves.

Almost all national baseline surveys of school education in Nepal indicate the poor achievement in mathematics. Considering low achievement, in mathematics constructivist method can be a hope for betterment in Nepal.

Therefore, this study mainly concerns about effectiveness of teaching mathematics by using constructivism method at the basic level.

Objective of the Study

The objectives of the study were:

1. To find the effectiveness of the constructivism method of teaching mathematics at basic level.
2. To compare the achievement of the students taught by constructivism and traditional method.

Statement of the Statistical Hypothesis

To make the hypothesis statistically tasted, the research hypothesis is translated in to the following statistical hypothesis

$H_0 : \mu_1 - \mu_2 = 0$ (null hypothesis)

$H_1 : \mu_1 - \mu_2 > 0$ (alternative hypothesis)

Where μ_1 and μ_2 are mean achievement scores of students taught by using constructivism method and without using constructivism method respectively.

Significance of the Study

The world is now running in a very exciting century. The development of technology has made tremendous impact on all aspects of human life even the science of mathematics education, could not stand separated from the impacts of development the main role of mathematics education is how teachers can teach mathematics effectively. The traditional methods and techniques of teaching don't give emphasis to creativity, imagination power and reasoning power of the students.

Realizing this fact, the researcher attempts to conduct this experimental researcher to determine the effectiveness of the constructivism technique in mathematics teaching in the contest of Nepal in basic level students.

The teachers, students, textbook writers, syllabus designers and methodologist can modify their views or approach in the light of the information provided in the study. Similarly, other interested persons who are directly or indirectly involved in mathematics teaching will also get benefit from the study.

Delimitation of the Study

I. This study is limited in a sample of grade vii students of Shree Janata Higher Secondary School. Kawasoti -16, Nawalparasi and Shree Jeevan Jyoti Higher Secondary School, Kawasoti-3, Nawalparasi.

II. This study is conducted with experimental and control group.

III. The result of the study can be applicable only in teaching mathematics related to basic level at grade seven students.

IV. Experimental period of the study was 30 days.

V. The Study was covered only the unit "Menstruation" of the entire Mathematics curriculum of basic level in grade vii.

Definition of the Related Terms

Public School

In this study, public schools are those schools which receive the government grant for the salary of the teacher and other purposes.

Students Achievement

In this study, student's achievement means the scores obtained by the students in the test which is prepared by the researcher.

Conventional/Traditional Method

While applying conventional method in the classroom the teacher plays the role of director. The students have to remaining silent while the teacher barks all the time from one corner to the other or just stands before the students. However, in conventional methods of teaching, the students remain passive in classroom. They have to just listen to the teacher or make photocopy of what the teacher notes on the board.

Experimental group

Group of students who are taught mathematics by using constructivism method is an experimental group.

Control group

Group of students who are taught mathematics by using traditional method is an experimental group.

CHAPTER - II

REVIEW OF RELATED LITERATURE

Review of Literature

In this chapter the researcher introduces the theoretical discussion, which is relevant while interpreting the findings of the study. There are various theories related to children's learning and development.

According to Piaget (1926) construction is basically a theorem based on observation and specific study about, how people learn. It says that people construct their own understanding and knowledge of the world, through experiencing thing on reflecting on those experiences. When we encounter something new, we have to reconcile it with our previous ideas and experience, may be changing what it with our previous ideas and experience, may be changing what we believe or may be discarding, the new information as irrelevant.

Principles of Constructivism

According to Piaget (1926) some principles of constructivism are

1. Knowledge is actively constructed by individual.
2. Learning is both an individual and social process.
3. Learning is self-regulated process.
4. Learning is an organizational process that enables people to make sense of their world.
5. Language plays an essential role of learning.
6. Motivation is key component in learning.

Regarding the constructivism of knowledge, personal constructivism, social constructivism, radical constructivism and critical constructivism are the different brands and degree of constructivism that explore how child perceive the world on the basis of their knowledge (Pradhan, 2003). Individual constructivism and social constructivism are the focus of our study.

For the study, Piaget theory of individual constructivism and Vygotsky theory of social constructivism has been used for the interpretation of findings of the study which described hereafter.

Individual Constructivism

Constructivism means a kind of consideration about themes and builds up a strong mental plan. So different individual have their own construction about existing phenomena. Learning mathematics requires construction not passive reception and to know mathematics, requires constructive work with mathematical objects in a mathematical community.

Constructivism is a philosophy of learning founded on the premise that by reflecting on our experience, we construct our own understanding of the world, we like in each of us, generate our own rules and mental models which we use to make sense of our experiences. Learning therefore is simply the process of adjusting our mental models to accommodate new experience.

Z.P. Dinse communicated through that children should learn by "physical action and mental reflection "through their own experience constructivism assumes that learners construct their own knowledge is actively created by students. Mathematical ideas are made by learners not found like a people or accepted from other like a gift.

Concerning the psychological aspect, Piaget stresses on the key word "Action" through which he advocates that knowledge the word is not directly through our senses, but primarily through our action.

Action is understood as being all behaviors by which, we cause a change in the world around us or by which we change our own situation in relation to the world.

Psychologists Piaget, Burner provides different postulates about construction of knowledge. They are as follows:

- Knowledge is physically constructed by learners who are involved in active learning.
- Knowledge is symbolically constructed by learners who are making their own representation of action.

Upadhyay, (2003) states that mathematics is an art, art demand creativity constructivism considers the every aspects of learner and tried to carry out his increase curiosity to the students about as object.

Constructivism is on theory among from a variety of disciplines. We know that constructivism is a philosophy of learning and teaching of an object existing in the world we construct many kind of knowledge or assuming of construction which we use to make sense of our experience. Therefore, it is simply the process of adjusting our mental models to accommodate new experiences. Jean Piaget (1896-1980) had given the new road map of mathematics. He brought a revolution in the field of mathematics and awarded a new idea to mathematics education by challenging the previous epistemologies, empiricism and rationalism. He introduced the statement "Action is the prior source of knowledge", Piaget has known as an integrationist as well as constructivist. Cognitive development came from his training in the natural science and epistemology.

Piaget was very interested in knowledge and how children came to know their world. He developed his cognitive theory by actually observing children. Using a standard question or a set of questions as a starting point he followed the child's of question as stating point he followed the child's train of thought and allowed the questioning to be flexible. He believed that children's spontaneous comments provided valuable clues to understand their thinking. His theory on intellectual development is strongly related to biological science. He saw cognitive growth as an extension of biological growth and is being governed by the same laws and principles. A central component of Piagets development theory of learning & thinking is that both involve the participation verbally but must be constructed and recognized by the learner. This model emphasized a learner's centered teaching and learning strategies & learning personal that depends on individual.

Social constructivism

Social constructivism is a sociological theory of knowledge according to which human development is socially situated and knowledge is constructed through interaction with others.

According to Lev Vygotsky culture gives the child the cognitive tools for development. The tools culture provides a child include cultural history, social context, and language. Adults such as parents and teachers conduits for the tools of the culture, including language. Today they also include electronic forms of information access.

Example of social constructivist classroom activities are whole language, collaborating learning, situated learning, anchored instruction, games, simulations, cases and problem solving.

Knowledge is a product of human interaction. Knowledge is socially and culturally constructed that is influenced by the group and it's environment. Learning is a social activity.

Vygotsky's theory is one of the foundations of constructivism. It asserts three major themes regarding social interaction, the more knowledgeable other, and the zone of proximal development.

Social Interaction

Social interaction plays a fundamental role in the process of cognitive development. In contrast to Jean Piaget's understanding of child development (in which development necessarily precedes learning), Vygotsky felt social learning precedes development. He states: "Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (Inter psychological) and then inside the child (Intra psychological)".

The More Knowledgeable Other (MKO)

The MKO refers to anyone who has a better understanding or a higher ability level than the learner, with respect to a particular task, process, or concept. The MKO is normally thought of as being a teacher, coach, or older adult, but the MKO could also be peers, a younger person, or even computers.

The Zone of Proximal Development (ZPD)

The ZPD is the distance between a student's ability to perform a task under adult guidance and/or with peer collaboration and the student's ability solving the problem

independently. According to Vygotsky, learning occurred in this zone. Vygotsky focused on the connections between people and the social context in which they act and interact in shared experiences.

According to Vygotsky, humans use tools that develop from a culture, such as speech and writing, to mediate their social environments. Initially children develop these tools to serve solely as social functions, ways to communicate needs. Vygotsky believed that the internalization of these tools led to higher thinking skills. Dienes writes "the primary method of this program is the induction of mathematical concepts from physical embodiments of the concepts. The process of generalization and abstraction are vital process which in practice must become familiar mathematically. The process of mathematical generalization is an out most importance with this notation. "He emphasized the process of generalization and abstraction while problem solving is being conducted.

Bell has given in discovery lesson the teacher may select activities that require the students to use inductive process as well as deductive process, where as many lessons will require combinations of inductive and deductive process, pure lecture by the teacher seldom encourage the students discoveries. On the discovery teaching the teacher should be the discussion leader, but should not be that of presenter of knowledge. Deductive discovery lesson in high school mathematics are must appropriate. Students of that level are unfamiliar generalization. Deductive discovery lessons are useful when theorems are to be inferred from definitions, axioms and other theorems when proofs of theorem are to be constructed.

Shrestha (1972) "A study to compare the effectiveness of the inquiry method verses the conventional methods of teaching mathematics in a respected elementary classroom of Nepal Southern Hlinois University, USA". In this research the researcher concluded that the performance of pupils taught by inquiry method of instruction does not improve significantly as compared to the performance of pupils taught by the conventional method

Khatiwada (1974) concluded his research study entitled "A study to compare the students activity ratio and their achievement in the third grade mathematics conducted by trained and untrained teachers in the school in the town of Birgunj." He concluded

that the teaching was more pupil centered in the classes conducted by trained teachers than the class conducted by the untrained teachers.

Maskey S.M (1975 entitled "A Comparative study of mathematics achievement of primary schools students under different class sizes." concluded that mathematics achievement of the third grade students is affected by their class size. The students of smaller class size had better achievement in mathematics than the larger one. The smaller class will be more appropriate conducting problem solving method.

Shrestha (1975) did a research entitled "A study comparing the effectiveness of the discovery method and conventional method in a selected class of Nepal "The main purpose of the research was to test the effectiveness of the discovery method of teaching mathematics to selected class. The research shows that the discovery method is more effectiveness for teaching mathematical concept than that of traditional method.

Cicirelli (1977b) as cited by Adhikari D (2002) mentions in his master degree thesis that Cicirelli found that when the child was being helped by the mother. It was revealed that provided grater Information to children land helping a child to develop problem solving techniques.

Amataya (1978) did a research entitled" A study of the effectiveness of teaching mathematics with and without the use of instructional materials" concluded that the performance of students taught with the used of instructional materials was significantly when compared with the performance of the students taught without the instructional materials.

Comer & heynes (1991) described three general ways in which schools might enhance parental involvements by having parents (a) participate in school events and activities (b) help in the classroom and school programs, and (c) participate in parent groups. They also concluded that parents' participation in the child's education is essential for effective teacher and learning.

Bhusal (2000) kid research on "A study on the effectiveness of teaching geometry using discovery module and expository module of teaching in secondary level". The main target of the research was to find out whether the discovery model of teaching in geometry is more useful than expository to prove geometrical theorems and to

compare the achievement between the groups of the student taught by using discovery and expository method of teaching. The research shows that the discovery module of teaching was better than the expository module of teaching in geometry.

Raut (2000) did an experimental research entitled “A effectiveness of inductive deductive teaching learning approach in secondary schools”. His research shows that the achievement of student taught by inductive- deductive approach of teaching improved significantly better achievement that the performance of students taught by the traditional approach.

This study is quantitative as well as qualitative type of research. So we need a theory to research finding in a valid way. Hence the researcher has considered the learning theory as theoretical base developed by the Soviet psychologist Vygotsky. According to this theory the social being learners learn by interactions with others.

Vygotsky has emphasized most the social nature of cognition arguing that learning awakens a variety of internal developments processes that are able to operate only when learners are interacting with people in their environment in cooperation with their peers. Hence these processes are internalized they become part of the Childs developmental achievement. This concept leads to the concept of readiness. Readiness is Vygotskian terms depend not only upon the state of the child’s existing knowledge as offered by Pigetian theory but also upon his capacity to learn with help. In developing these ideas Vygotsky makes use of key concept which he calls ”zone of proximal development”. This is defined as the difference between what children can do independently and what they can accomplish with the support of another individual who is more knowledge and skilled.

A major theme in the theoretical framework of Piaget is that learners construct new ideas or concept based upon their current /prior knowledge. The learner selects and transforms information, constructs hypothesis and makes decisions. This decision relays to mental and such scheme in mental model provide meaning and organization to experience and allow the individual to go beyond the information given.

It is obvious people do make their own meaning from their own beliefs, construct new ideas from what they observe, listen and perceive. They do not always use the taught method but use their own strategies to solve their problems.

Neupane (2001) did a research entitled "A study on the effectiveness of play way method in mathematics teaching at primary level". The purpose of the research was to explore the effectiveness of the play way method of teaching mathematics at primary level and to compare the achievement of the student taught by play way method and traditional method and traditional method of teaching at primary level. The researcher found that the play way method was significantly better method over conventional method of teaching at primary level.

Upadhayay (2001, Ph. D.) did his dissertation on "Effect of Constructivism on mathematics achievements of grade V students in Nepal " The major objective of the research was to adopt and advocate constructivism in mathematics teaching in Nepalese classroom working on the sample size of students from four school involving two control and two experimental groups .The researcher concluded that the possibility of constructivism in Nepalese School with significant difference in achievement that conventional method of teaching.

Basnet (2004) did an experimental research on "The effects of constructivism in achievement of grade V students in mathematics". The aim of the research was to find out if there exist any relationship between achievement scores and constructivist method in Nepal. He concluded that constructivist method of teaching was better than the conventional method of teaching mathematics."

Pokhrel (2004) did research entitled "Effectiveness of Teaching Mathematics with and without use of constructivism". The researcher intended to determine effectiveness of the constructivist method compared to conventional method of mathematics teaching. He found that constructivism as a better method in teaching mathematics.

Baral (2005) did an experimental research on "the effects of constructivist method on students" achievement in mathematics classroom". The main purpose of the research was to find out the difference in the achievement scores of experimental and control groups. The researcher found that main achievement score of the students taught by constructivist method.

Paudel, Santosh (2007) writes according to Upadhyay (2001) Constructivist theory points that student make sense of the world by synthesizing the experiences into what

they have previously understood. They form rules through reflection on their intersection with objects and ideas when they encounter an object. Idea or relationship that does not make sense to them. They either interpret what they see and confirm to their rules or they adjust their rules to better account for the new information. Then after mentioned activities is not new prescription for mathematics. It is simply a set of activities which are necessary in constructivism.

This review of related literature shows that there have been done some significant researchers under the constructivism. But in the context of Nepal, there is still lack of the information about constructivism its effect in teaching mathematics in basic level how to apply the constructivism in mathematics teaching in basic level. Most of the studies have been conducted with small number of students land limited in a single unit. In most of the studies, the student samples were taken from different schools, which might increase the variability of students. In addition to the lack of clarity of research often disturbs the practitioners who depend on research to determine the best instructional techniques for classroom use. So, the purpose of the present study is to find the effectiveness of the constructivism method of teaching mathematics in basic level.

Conceptual Framework

On the basis of above theory the researcher has considered the three variables that may affect on mathematics achievement of the student (dependent variable) by the following relationship.

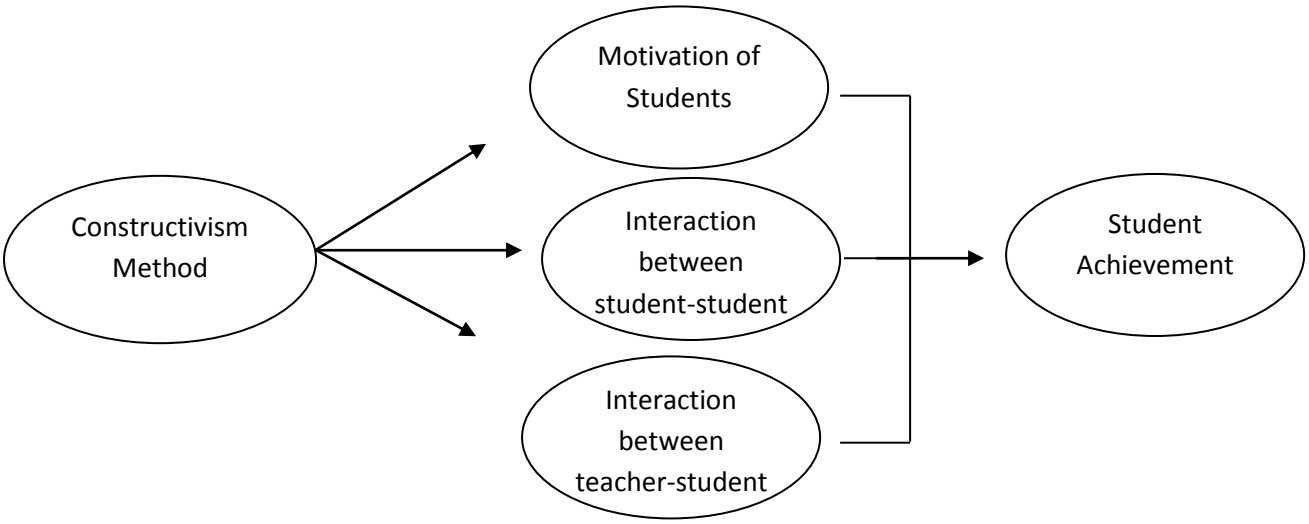

Figure: Diagram of Conceptual Framework of the study

Operational definition of key terms

a) Students Motivation

b) Teacher- Student interaction

c) Student- student interaction

a) Students Motivation

In this study, the first variable effects the student achievement is motivation of the students. Motivation is the process of arousing an action. Sustaining the activity in progress and regulating the pattern of activity, motivation is the dynamic characteristic of the student which includes interests. Curiosity, incentive arouser, derive etc. These can be enhanced by the use of external force.

b) Teacher student interaction

The second variable teacher- student interaction affects the student achievement in this study. The term interaction implies the interaction among teachers and student. It

includes the participation of student in learning, request for asking questions, direct guideline by teacher, etc.

c) Student - student interaction

The third variable student-student interaction affects the student achievement in this study. It includes the class activities of students. Explain discussion etc.

To sum up, constructivism methods basically student motivation, teacher- student interaction and student- student interaction play vital role in teaching mathematics at basic level.

CHAPTER-III

METHODS AND PROCEDURES

In this chapter design of the study, population and sample of the study, controlled exercise during the experiment; instruments for data collection, validity and reliability, item analysis of test paper and procedures of experiment are described.

Design of the Study

A Pre-test post-test equivalent group design was adopted for the purpose of this study. The independent variables were the treatment given to the students (x) and the dependent variable was the mathematics achievement of students which is shown on the following table.

Table No. 1

Design of the Study

Groups	**Pretest**	**Treatment**	**Post-test**
Experimental (ER)	E1	X	E2
Control (CR)	C1	-	C2

For this study, two groups were made by random selection method and made comparable as nearly as possible on the basis of pre-test. Then experimental and control group were identified by tossing a coin. Two groups were given an achievement test. (E1,C1) before treatment given. Mean score on pre-test was compared by using t-test. With the establishment of two equivalent groups E and C in this design, one group received the experimental treatment (X); where as the other groups received the usual treatment. Thus the experimental group was taught by researcher himself by the use of constructivism methods for the duration of on month but the control group was taught by the researcher using traditional teaching technique. Finally, both groups were given post-test (E2,C2). The means, variance was calculated for each group and subjected to a test of statistical significance by using t-test.

Population of the Study

All the students of grade vii in public school of Nawalparasi district were the population of the study.

Sample of the Study

The researcher selected two public schools Shree Janata Higher Secondary school situated at Kawasoti-16, Nawalparasi and Shree Jeevan Jyoti Higher Secondary School situated at Kawasoti-3, Nawalparasi. It is selected by convenient sampling method. These schools consisted students of different ethnic groups, different economic levels of the district. Similarly the percentage of the girl's enrollment in this School was nearly of the equal to the boys enrollment. And it was assumed that there was little age variation as the grade admission is usually based on age. Hence the researchers attempted to control the ethnic, age and sex factors, of the students. The researcher selected class eight by lottery method. There were 105 and 75 students in class eight of J.H.S. School and J.J.H.S School respectively. Among them two equivalent groups were formed by taking 15 students from Janata Higher Secondary School and 15 students from Jeevan Jyoti higher Secondary School by random selection method as the both groups had same number of students. There was no effect of class size. Experimental and control group were identified by tossing a coin. In the experimental design 15 students of Janata Higher Secondary School was an experiment group while 15 students of Jeeven Jyoti Higher Secondary School were considered as a control group.

Instruments of Data Collection

In the study the researcher developed an achievement test- paper and class observation form.

An Achievement test paper

Two type of achievement paper were constructed.

a) Pre-test (achievement test-paper-I)

b) Post-test (achievement test-paper-II)

A) Pre-test (Achievement test-paper-I)

The test consisted of multiple choice items on the basis of specification chart from prescribed test book of mathematics for grade seven. Beside this the test was prepared on the basis of units which had previously taught by their usual teacher. The items were constructed from the area: arithmetic, algebra and geometry.

The test contained items of knowledge level (8%), 6 items of comprehension level (16%) 14 items of skill level (36%) and 16 items of application level (40%)which is according to the basis of secondary level final examination specification grades of mathematics of grade eight Prepared by CDC, Sanothimi.

B) Post-test (Achievement test paper II)

It consisted of 30 multiple-choice items before refinement. All the items of the test were constructed from the unit 'menstruation' of the mathematics test book for grade vii. The unit were taught by the investigator to the students include in the sample during experimental period. The test contained 3 items of knowledge level (8%). 6 items of comprehension level (16%) 12 items of skill level (36%) and 14 items of application level (40%) which is according to basis of secondary level final examination specification grids of grade vii prepared by CDC Sanothimi.

Reliability and Validity of Instrument

The content validity of the test was established and approved by the mathematics experts. For the reliability of test, the researcher carried out a pilot study of the its prepared. 40 students of Shiva Higher Secondary School Kawasoti-1 in Nawalparasi district were used for pilot study (for pre-test) and 45 students of Kumarvarti higher Secondary School of Madyabindu- 2 Nawalparasi of grade vii used for pilot study (for post test paper II) the researcher instructed the students how to respond on the test paper. Time taken by each student was recorded and mean time was calculated. Which was found two minutes per item this time was needed per item for the refined test paper, to finalize, the appropriate items of the test paper.

To finalize, the appropriate items of the test, item analysis chart was developed. Level of difficulties and power of discriminations of each item was calculated, 27% of higher scores and 27% of lower scores (11/11 students) be taken to find the reliability of the 22 students were taken. The reliability of the test was calculated by the formula given by spearman and will find the value. The test will be refined by eliminating in appropriate items. Items those having D - value greater than fixed number (0.27) and P-value lying between 30%of 70%was accepted.

Class Observation Form

Observation is a kind of tool that helps to seek knowledge through the use of sense i.e, eyes, ears, nose and skin. It is a direct way of gathering information having advantage of putting researcher into first hand contact with reality. The researcher reviewed different literature to develop a general assumption on the basis of which researcher developed a detailed list of classroom behavior. The class room observation form has three different sections which are given below.

1. Students - student interaction
2. Student - teacher
3. Motivation of students

Student - student interaction

This implies the interactions between students occur during learning process like thisactivities

- Student solves the problem by their own ideas.
- Student solves the problem using their previously knowledge
- Student solves the problems and follows guide line of export.

Student teacher interaction

In this study the activities of students and teacher in teaching learning process refers students- teacher interaction:

- Teacher motivates the students.
- Teacher encourages the students to ask questions.
- Teacher gives feedback on homework.

- Teacher gives feedback on class work.
- Teacher received students questions
- Teacher provides specific help to weak students.

Motivation is the process of arousing an action, sustaining the activity in learning. In this study the following characteristics refers motivation of students:

- Students are interested in learning
- Students are curious towards learning
- Students stimulate learning activities
- Students activities are directed towards goal
- Students sustain interest in learning
- Students are co-operative to each other
- There is use of self actualization by students.

The class observation form was filled in both experimental and control group 4 times (once a week) during the experimental period As the form consisted of three sections, so , the students- students' interaction and motivation of the students were filled by researcher himself but section related to student teacher interaction was filled by the subject teacher of the respective School. The five points rating scale was developed with five option label. Excellent, good, average, general sand poor which was given weight age a 5,4,3,2. and I respectively. The total percentage of class observation form of experimental and control groups during four different periods was added to get the grand weight age in percentage form which was used for analyzing the data.

Some Affecting Variables Controlled in the Experiment

Since the aim of this study was to explore the effectiveness of treatment x on the mathematics achievement of grade nine students. It was imperative to detect nullity effect of the other variables besides the experimental, which might influence the achievement.

Some of the variables history, maturation, testing and mortality were controlled by the design of the experiment. Some of the variables as subject matter taught, evaluation applied, teacher variables and equating the groups were controlled by the following exercise.

Subject Matter Taught

Same content was taught to both the experimental and control group from the same curriculum, and same textbook prescribed by the government of Nepal.

Evaluation Applied

After the end of the experiment, the same test was given to experimental and control groups. Similarly, the Classroom observation form was applied for same duration of time to both experimental and control groups during experimental period. The researcher himself marked the test paper of the students, so the variation in marking of test paper was also reduced.

Teacher Variation

To control the extraneous variables such as: behavior, personality, qualification of the teacher, the researcher himself taught both the experimental and control groups.

Equating Groups

In this study, the two equivalent groups were made by random selection of students. Both Schools were equally reputed in terms of class seven results. To check equivalency, the researcher calculated F- Test to test homogeneity of variances and T-test to check the mean difference of two groups by these conditions researcher claimed that two groups were equivalent. Finally by tossing a con the experimental and control groups were identified.

Procedure used to conduct the Experiment

Length of the Experiment period

The experiment was conducted for four weeks.

Content

The unit menstruation of grade seven was taught to both experimental and control groups.

Students Selected for Instruction

Fifteen students of Janata Higher Secondary School were experimental group and fifteen students of Jeevan Jyoti Higher Secondary School were control group.

Teacher

The researcher himself taught both Experimental and control for the same duration.

Process of Experiment

The researcher identified two equivalent groups of students such that both groups were assumed to have homogeneity in variances with respect to abilities in Mathematics. For this purpose, the investigator visited tow Schools for sample Fifteen students from each school were randomly selected. The Pre-Test paper administered to both groups the calculated value of F and the mean difference of two groups justified that two groups were equivalent. Then 15 students of Janata Higher Secondary School and 15 students of Jeevan Jyoti Higher Secondary School were considered Experimental and control group be decided by tossing a coin. The Experimental group was taught in the first period (10.15-11.0) and the control group was taught in the third period (11.45-12.30) by the researcher. The control group was taught traditionally. The experimental group was taught by constructivism method by construct their ideas and solve the problems.

In this way the treatment X of constructivism teaching technique was applied to the experimental group. At the end of each week the class observation form was filled.

After the completion of the teaching of above mentioned unit for a period of four weeks a post test was administered to both the groups. Before administering the post test, students were instructed how to response the test item, the duration of test was 1 hour and 15 minutes. Answers to the test item were scored on the basis 1 for correct responses and 0 for incorrect responses. The score obtained by the students were used for statistical.

Data Analysis Procedure

The t-test with two tailed was used in the pre-test where independent variable was not used as a treatment for any group. But the t-test with on tailed was used in the post test were the independent variable was used as treatment to the experimental group against to control group. In both case, F-test was used for comparing the variances of two groups. Hence in both cases.

1. The two population were normal
2. Two populations have same variances
3. The samples have randomly selected.

Since on condition was mentioned by Harry and Althoen (1994), the investigator used t- test with pooled variance.

CHAPTER - IV

ANALYSIS AND INTERPRETATION OF DATA

The present study entitled "Effectiveness of teaching mathematics by using constructivism method at the basic level" is experimental in nature. The aim of this study was to find the effectiveness of constructivism in teaching mathematics at basic level. The investigator established to equivalent groups having same abilities in mathematics by the help of random selection method. The equivalency of group were justified by the help of pre-test result. Experimental and control group were identified by tossing a coin. Experimental group was taught by researcher using constructivism technique of control group was taught by himself using traditional method. The class observation from was prepared and filled in both experimental and control group in once a week (i.e. 4 times in 4 week) during the experimental period. The analysis has been done under the following section.

Analysis of Pre-Test Result

The pretest row scores of student of the experimental group & control are presented in appendix. The summary statistics on the achievement of the experimental group and control group on the pre-test is presented on table below.

Table No. 2

Comparison of Pre-Test Result

Groups	N	$\overline{X}$	Sd.	Var.	F-value	t- value	Level of significance (α)
E_1	15	22	8.18	67	0.975	-0.47	Two tailed test at 0.01
C_1	15	23.4	8.29	68.68			

$t_{0.08.(28)}$=0.01(28)=2.763

The table reveals that the mean, variance and the standard deviation of the pre-test scores of experimental group and control group were 22,67.0,8.18 &23.4,68.68,8.29 respectively. The two population variance are homogeneous since the calculated value of F=0.975 is less than it's tabulated (F0.05.15=3.52, so t-test with pooled variance formula was used to find the value of t. the result of t-test indicated that there was no significant difference between the groups on pre-test scores. Thus the experimental

group and control group were balanced in abilities in mathematics (i.e. equivalent) which was the basic condition that ought to be met in the experimental design for this study.

Analysis of Post-Test Result

The post test scores of students of the experimental group and control group has been presented in appendix I. The summary of statistical calculation for the experimental group and control group is given in table below.

Table No. 3

Comparison of Post-Test Result

Groups	N	$\overline{X}$	Sd.	Var.	F-value	t- value	Level of significance (α)
E_1	15	27	6.24	39.0	0.585	1.882	one tailed test 0.05
C_2	15	22	8.16	66.7			

$t_{0.05.(30)} = 1.701$

Above table presents the means, variance and standard deviation of both group on post-test. The scores of experimental group ranged from 20 to 34 with means score 27 and standard deviation 8.16 in ordered to see whether initial difference is existed between two groups, t-test was calculated at 0.05 level of significance. On the table 3, the calculated value 1.95 is greater than the critical value i.e. tabulated value 1.71 at 0.05 level of significance. Therefore, the null hypothesis Ho: h1=h2, there is no significance different between two means of experimental and control group is rejected and the alternative hypothesis H1: hh1-h2>0 is accepted. This indicates that the student's achievement scores, who were taught by constructivist method, are significantly different from that of students who were taught by traditional method of teaching. So according to Piaget. J (1926) constructivism is basically a theory based on observation & specific study about that people construct their own understanding & knowledge of the world, through experiencing things on reflecting on those experiences.

Here, experimental group become active & control group become passive in classroom activity so Piaget writes "knowledge in not passively received rather knowledge is actively created by students he stresses on the key word "Action"

through which he advocates that knowledge is gained. Knowledge is symbolically constructed by learners who are making their own representation of action.

Thus, the researcher concludes that the achievement of the grade vii students, under the constructivist method achieved better achievement than the students taught by traditional method.

Descriptive Analysis of Class Observation Form

In the present study the, the treatment (X) was given to experimental group after equating two groups. The treatment was the constructivism used in classroom teaching as the researcher had taken three independent variables.

Motivation: Constructivism emphasizes, the level of and sources of motivation for learning. According to von Glassersfeld; Capacity and confidence of learner is the basis of motivation, source of motivation of learner .If a learner has confidence for his skill and knowledge and he thinks that he has the capacity to solve any problems and he gets motivated to do everything more and more he wants to again further skills and knowledge.

Student- student interaction: according to constructivism on the basis of physical maturity of a learner, if he interaction between groups of learner in co-operative environment is made zone of proximal development occurs causing development in cognitive level and scaffolding method is suitable. Therefore, interaction is a most between learners.

Teacher-students interaction: In learning process interaction is made between supporter and learner depending upon subject matter for creative development. It means constructivism directs to focus in Reciprocal teaching, peer collaboration cognitive apprenticeship, problems based instruction, web quests, anchored instruction etc.

In constructivism technique, motivation of students- students interaction teacher-student interaction must be necessary, so it was the intention of investigator to find out whether the condition of these three variables on the experimental and control groups. For their purpose the observation form was filled 4 times during the experimental period to both experimental group and control group. The model of

observation forms in appendix O. The average percentage given to three variables of experimental group and control group has been compared in the following table.

Table No. 4

Comparison of Percentage for Three Variable of Experimental and Control Groups

S.N.	Variables	Experimental Group	Control Group
1.	Motivation of Students	84.28%	46.85%
2.	Students - students interaction	87.85%	27.85%
3.	Teacher - students interaction	77.85%	47.14%

From the above table, the total percentage for motivation, students–students interaction and teacher- students interaction of experimental group and control are found 84.28%,87.85%,77.85% and46.42%,27.85%,47.14% respectively. Motivation is the key component in learning so language plays an essential role of learning. Hence, the investigator found that the motivation of students in experimental group is higher than motivation of that of control student in control group and the interaction between students and teacher in experimental group is more than group. Here, constructive technique of teaching used in experimental group. Increased the rate of interaction and motivation of students towards learning which finally caused better achievement of students in experimental group. Hence, the investigator claimed that the constructivism technique of teaching caused better than traditional technique of teaching.

CHAPTER-V

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Summary

The present study was concerned with the effectiveness of constructivism technique of teaching mathematics at basic level students. This study was intended to answer whether the constructivism technique of teaching affects mathematics achievement of student at Basic level.

For this purpose, the investigator development two achievement test papers and one class observation form. Pilot studies of achievement test were conducted on two different Schools. The reliability coefficient of pre-test and posttest was found to be 0.80 and 0.84 respectively.

A pre-test post-test equivalent group design was adopted for the purpose of this study. Two equivalent groups were established by randomization of sample units and identified as experimental and control groups by tossing a coin. The t-test was applied in order to ascertain the difference between two groups statistically. Both groups were taught by the researcher him on selected units after providing necessary instruction for a period of 4 week the class observation form was filled four times during the instructional period and at last a post test was administered to both groups. The data obtained thus were used for the purpose of analysis and interpretation. The statistical analysis of the data indicated effectiveness of constructivism in teaching mathematics at Basic level.

Findings

The major findings of the study are as follows:

1. Achievement of students taught by constructivism was higher than the achievement of student taught by traditional method.
2. Student taught by constructivism were highly motivated towards learning than the students taught by traditional method.

3. The interaction between students was found more in the group.
4. The interaction between students was found more in the group where the constructivism method was applied than that of traditional method of teaching was applied.
5. There was more teacher–student interaction in the group where the constructivism method was used.
6. The constructivism method was effective of teaching mathematics at basic level.

Conclusions

From this study, the researcher found that the students were more active and highly motivated towards learning in the group where the constructivism technique was used. Similarly, the interaction between student-student and teacher-student were more in this group. Rote memorization was discouraged by teaching mathematics with active participation of students. Students were free to share their problems and ideas and were encouraged to ask questions. These activities of constructivism leaded towards meaningful learning. Hence, it is conducted that the constructivist method can be used in teaching mathematics for effective teaching and learning.

Recommendations

From the result of experimental study, the following recommendations were made:

Recommendations for the improvement on math instruction

1. The class room seating should be so arranged that the entire students could equally and easily participant in the classroom activities.
2. The mathematics teacher should be encouraged to construct he ideas as teaching.
3. Group should be homogenous as for possible in the matter of intelligence and level of achievement.
4. Mathematics teacher should encourage the student's to get actively involved in classroom activities and to attain their own intellectual identity.
5. The purpose of constructivism should be adequately clear to every member in order to ensure equal responsibility and effort.

Constructions should generate spirit of co-operation more than the spirit of completion.

Recommendations for Further Study

1. This study was an experimental study limited to single grade and limited Sample, hence to get broader and valid generation.

    -Similar study should be carried out with a large sample in other branches of school mathematics.

    -Studies of this kind should be conducted at all level of school and in other subject as well.

2. The teacher training institutes most emphasize to constructivism method so that it provides the mathematics classroom will be more effective.

3. It would be worthwhile to study the opinions and attitude of teacher, mathematics educationists, and students towards constructivism technique of teaching.

4. This study about the opinions and attitudes of parents, teachers and students in constructivist method on mathematics should be carried out.

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APPENDIX - A

SPECIFICATION CHART OF PRE-TEST

Area	Cognitive Level				Total
	K	C	S	A	
Arithmetic	2	3	8	9	22
Algebra	1	2	2	3	8
Geometry	1	1	4	4	10
Total	4	6	14	16	40
Percentage	8%	16%	36%	40%	100%

APPENDIX - B

SPECIFICATION CHART OF POST-TEST

Area	Cognitive Level				Total
	K	C	S	A	
Menstruation	3	5	10	12	30
Percentage	8%	16%	36%	40%	100%

Note:

K= Knowledge

C= Comprehension

S= Skill

A= Application

APPENDIX -C

TEACHING EPISODE -1

Mensuration: perimeter of plane figures

Objective: To measure the boundary lines of plane figures

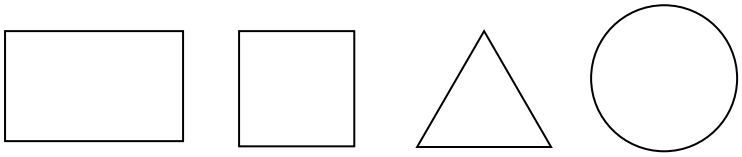
To find the perimeter from boundary lines of the objects.

1. **Introduction tasks :**

   Materials: books, white board, class room, windows, geometry box, tape in meter

   Plane figures: Triangle, Rectangle, Square, Circle, etc

   Figures:



   From the previous knowledge and idea students measure the boundary lines of plane figures which is already available in the class room

2. **Exploration task (Activities):**

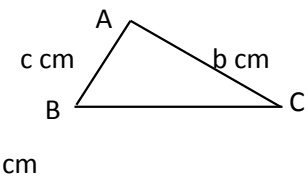
   What is perimeter?

   The total length of boundary lines of plane figure is called its perimeter.

   Students are aware about the perimeter and transfer their knowledge is that measure the length of boundary lines and sum of them is known as perimeter of this objects. Finally students gain knowledge that "The total length of boundary lines of plane figure is called its perimeter."

3. **Extended task**

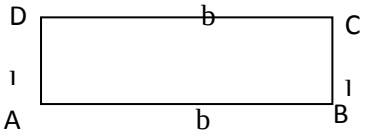
   I give the different triangles each of the group and ask them to find the perimeter for example:



   Perimeter of ΔABC = AB+BC+AC

   = a + b +c

   I give the different materials of rectangle each of the group and ask them to find the perimeter.



   For example:

The opposite sides of a rectangle are equal so the lengths AB = DC = l

The breadths BC = AD = b

The perimeter of the rectangle ABCD

= AB +BC+ CD+ DA

$= l + b + l + b$

$= 2l+2b$

$= 2(l+b)$

Perimeter of rectangle = $2(l+b)$

In the case of square it's perimeter:

$2(l+l) = 2 \times 2l = 4l$

4. Summarize:

Perimeter: Sum of the length of boundary lines of plane figure.

Formula of perimeter of triangle

ΔABC = a+b+c

Formula of perimeter of Rectangle

ABCD = 2(l+b)

The unit of perimeter = cm, m.

APPENDIX -D

TEACHING EPISODE -2

Mensuration: Area of rectangular objects.

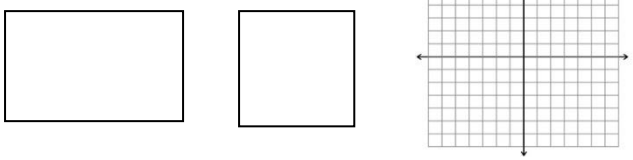
Objective: To measure the length and breadth of rectangular objects.

To find the area from length and breadth of objects.

1. **Introduction tasks :**

   Materials: books, white board, class room, windows, geometry box, tape in meter, graph paper, Rectangle, Square, etc.

   Figures:



From the previous knowledge and idea students measure the length and breadth of given rectangular objects which is already available in the class room.

They start plot the graph (length as x-coordinate and breadth as y- coordinate)

Ask them to count the square unit of graph which is covered by the given length and breadth.

2. **Exploration task (Activities)**

   What is Area?

   The place which is covered by any objects in a surface is called the area of the objects.

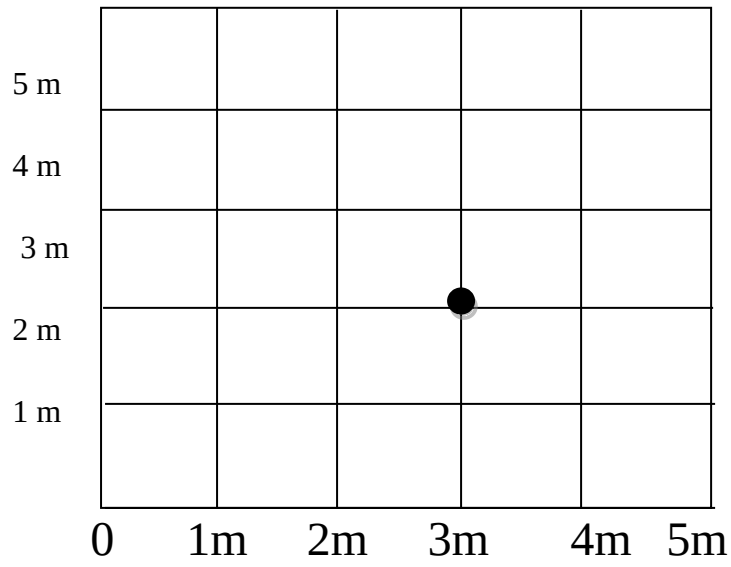
   Students are aware about the area and transfer their knowledge is that "The numbers of square unit which is covered by length and breadth is the total area of this objects, finally students gain knowledge that "Area of rectangular objects is equal to the product of length and breadth of given objects."

3. **Extended task**

   I give the different materials each of the groups and ask them to find the Area.

   For example: Length of a white board = 3 m

Breadth of white board = 2 m



It covers 6 square units in which 3 units along length and two units along breadth. Then they conclude 6 sq. units which is obtained by the length l x b

4. Summarize

Area = length x breadth

Length = long side of an objects

Breadth = short side of the object

The unit of the area = length (m) x breadth (m)

= m x m

= m^2

APPENDIX -E

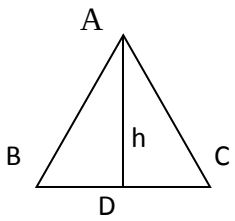
TEACHING EPISODE -3

Mensuration: Area of Triangles

Objective: To find the area of Triangles.

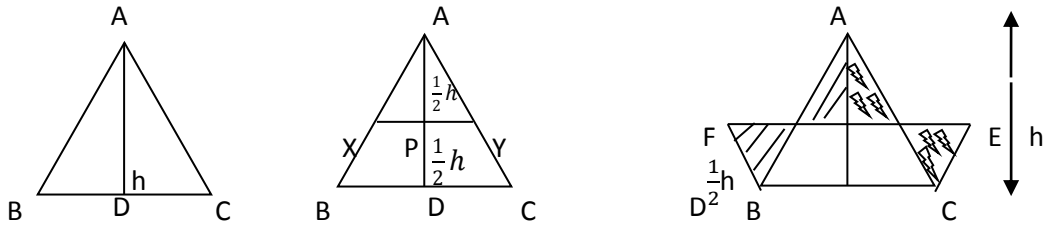
1. **Introduction tasks :**

   Materials: Triangular shape of piece of paper.



   From the previous knowledge and idea students discuss about the given objects and materials.

2. **Exploration task (Activities)**



Take a triangular shape of piece of paper and fold it as shown in the figures.

Now cut the folded edges AP, XP and YP

Place the edge AX along XB and the edge AY along YC. Thus a rectangle BCEF is formed by this arrangement.

Here, area of the triangle ABC =

Area of rectangle BCEF

= length × breadth

=BC× CE

= base × height

= b $\times \frac{1}{2}$h

= $\frac{1}{2}$ b ×h

Area of triangle = $\frac{1}{2}$ b ×h

3. **Extended task :**

   I give the different shape and size triangular figure each of the group and ask them to find the area of triangle.

   For example: Base of triangle is 6 cm and height is 4 cm.

   Find the area of triangle.

4. **Summarize:**

   Area of triangle = $\frac{1}{2}$ b $\times$h

   where, b = base of triangle

   h = height of triangle

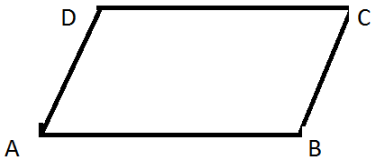
APPENDIX -F

TEACHING EPISODE-4

Mensuration: Area of Parallelograms

Objectives: To find the areas of Parallelograms.

1. Introduction Task:



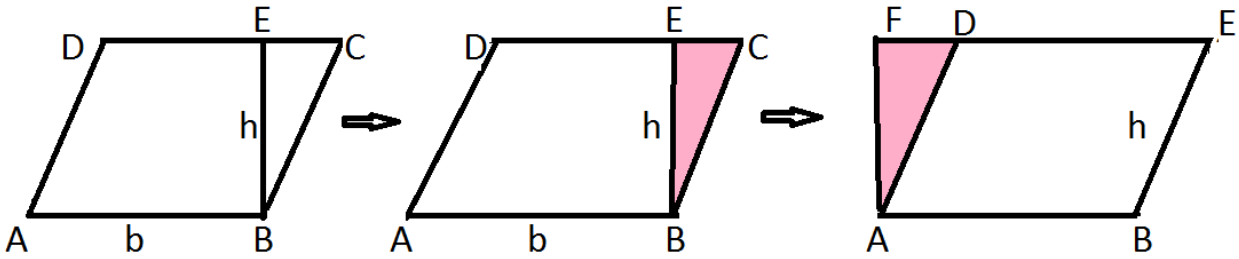
Materials:-

By the previous knowledge and idea students discuss about the given objects and transform their knowledge.

2. Exploration Task:

Let's do the following activities to find the formula of area of parallelograms.

Take a parallelogram shape of piece of paper and fold it as shown in the figures



Cut the folded edge BE. Now place the edge BC of BCE along the edge AD Thus a rectangle ABEF is formed by this arranement.

Here, area of the parallelogram ABCD

= Area of the rectangele ABEF

= length × breadth

= AB × BE

= base × height = b × h

Thus, area of paraellelogram = base × height.

= b × h

3. Extended Task:

I give the different parallelogram each of the group and ask them to find the area of parallelogram.

For example: Base of a parallelogram is 10 cm and height is 5 cm.

Find the area of parallelogram.

4. Summarize:

Area of parallelogram = $b \times h$

where, b = base of parallelogram

h = height of parallelogram

APPENDIX -G

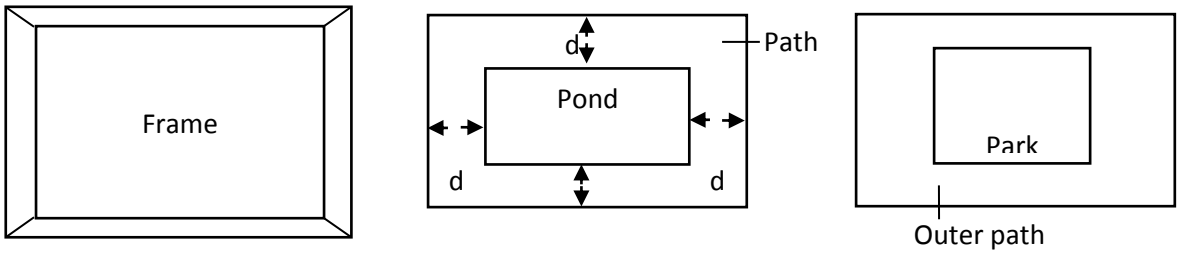
TEACHING EPISODE-5

Mensuration: Area of path which runs outside a rectangular field.

Objectives: To find the areas of path which runs outside a rectangular field?

1. Introduction Task:

Materials:



(I) (II) (III)

From the previous knowledge and idea students discuss about the given objects and materials. i.e.

To measure the area of inner part of the objects.

To find the length of outer part of given rectangle.

To calculate the Area of outer rectangle.

Finally they conclude that; [*outer area - inner area*]

2. Exploration task

A path of 0.5 wide runs round outside a rectangular garden of length 16m and breadth 12m. Find the Area of path.

From the previous idea and knowledge students find Area of garden

i.e. $A_1=192m^2$

They add 0.5 in both side to find the outer length and breadth

L = $16+2\times0.5=17$ m, b=$12+0.5\times2=13$ m.

Therefore $\boldsymbol{A}_2 = 221m^2$

Finally Area of path = A_2-A_1 = 221-192 $=29m^2$

3. Extended task:

I give the different materials each of the group & ask them to find the Area of outer path or Edge.

4. Summarize: Area of outer path of rectangular garden

$$A=A_2-A_1=2d\ (l+b+2d)$$

Where,

l= length of inner garden

b= breadth of inner garden

d= wide of path

APPENDIX -H

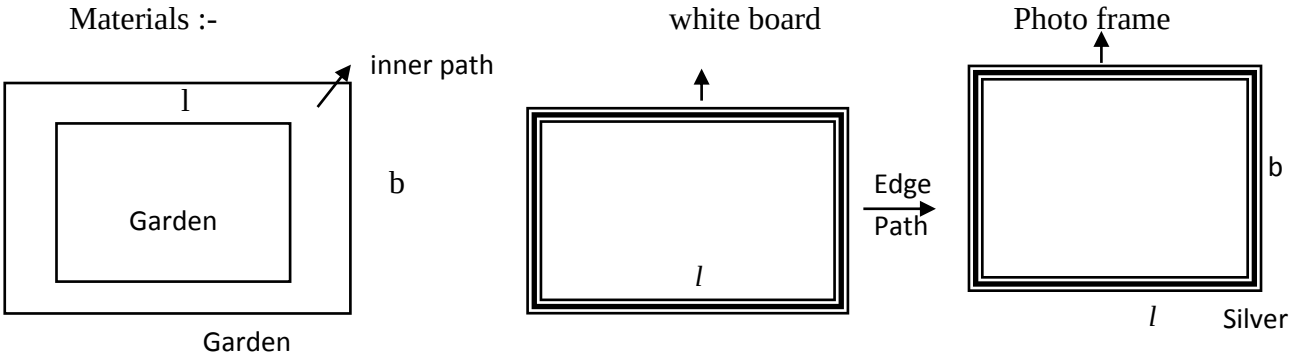
TEACHING EPISODE -6

Mensuration: Area of path which runs inside a rectangular field.

Objective: To find the Area of path which runs inside a rectangular field

1) Introduction task:

Materials :-



(I) (II) (III)

By the previous knowledge and idea (skill) students discuss about the given objects for materials & transform their Knowledge.

- Students Active to measure the Area of whole objects by the help of graph paper & its length & breadth.
- They will find length & breadth of inner part by subtracting the 2 times wide of edge (Path).
- They measure the Area of inner part of the objects.
- Finally they conclude that Area of path= whole Area- inner Area.

2) Exploration task:

- A path of 2m wide runs round inside a rectangular garden of length 20m and breadth 12m. Find the Area of path.
- From the previous Knowledge & idea, students find the total (whole) Area of the gardens by using graph paper.
  i.e. $A_1=240m^2$
- They find the length & breadth of inner part i.e,

$$L_2=20-2\times2=15m$$

$$b_2=12-2\times2=8m$$

i.e, $A_2=128m^2$

- Finally, they understand the area of path $A=A_1-A_2$

  $= 240-128 \quad =112m^2$

3) Extended task:- I give the different materials each of the group and ask them to find the Area of inner path or Edge.

4) Summarize:- Area of inner path of rectangular garden

$A = A_1-A_2 \quad = 2d(l+b-2d)$

APPENDXI-I

ACHIEVEMENT TEST PAPER-1

(pre- test)

Name: Full Mark:40

Grade:

Subject:

School:

1. A={seven days of a week}which method of describing a set.

a. description method b. listing method

c. Set – builder method d. no one of the above.

2. W= {whole number less than 10}is a

a. null set b. singleton set

c. finite set d. infinite set

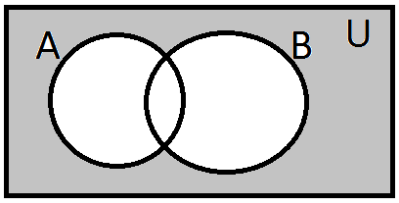
3. write the notation of the shaded region from the given venn-diagram .

a. $\overline{A \cap B}$

b. $\overline{A \cup B}$

c. $\overline{A - B}$

d. $\overline{B - A}$



4.If A={1,2,3,4,5}and B={2,4,6,8,10] find A-B.

a{1,2,3} b{1,3,5} c{2,3,4} d {6,8,10}

5. If U={1,2,3,4,5,6,7,8} A={1,2,3,4}and B={3,4,5,6} find……..

a) {1 ,2} b) {5,6} c) {6,7} d) {7 8}

6. Find the H.C.F of 12 and 18.

a) 2 b) 3 c) 4 d) 6

7. Find the square root of 144.

a) 9 b) 12 c) 13 d) 14

8. which one is not perfect cube.

a) 432 b) 343 c) 255 d) 64

9. find the cube root of 0.064.

a) 0.2 b) 0.3 c) 0.4 d) 0.5

10. Simplify: $12-5\times3+24\div4$

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

11.Add ;0.8+0.736

a) 1.536 b) 0.1536 c) 0.01536 d) 135.6

12.If the cost of 81 kg potato is Rs20 , find the cost of 4 kg potato.

a) 75 b) 80 c) 85 d) 100

13.If the cost of 8 kg tomato is Rs 280. find the cost of 5 kg.

a) Rs 150 b) Rs 175 c) Rs 200 d) Rs 225

14.10 works take 12 days to do a work how many working days will 15 workers take to do same work.

a) 6 days b) 8 days c) 10 days d) 12 days

15.How much rupees will be 20% of Rs 300?

a. Rs 40 b. Rs 50 c. Rs 60 d. Rs 70

16. The ratio of the ages of father and song is 9:4. If the son is 24 years old, find the father's age.

a. 50 b.52 c. 54 d) 56

17. Two numbers are in the ration 5:3. If the smaller number is 24, find the greater one.

a. 30 b. 40 c. 45 d. 50

18. If the terms 2, 3 and 14 are in proportion, find the fourth proportional.

a. 18 b. 20 c. 21 d. 22

19. A shopkeeper buys a watch for Rs 350 and sells it for Rs 378. Find his profit percent.

a. 6% b. 8% c. 10% d.12%

20. A retailer makes a profit of 5% by selling a fan for Rs 735. At what price did he purchase the fan?

a) 550 b) 600 c) 650 d) 700

21. A man purchased a camera for Rs 750 and sold it at profit of 20%, find his profit amount.

a) 100 b) 150 c) 200 d) 250

22. If P= Rs 2500, T = 5 years R= 7% per year then find the simple interest.

a) Rs 750 b) Rs 775 c) Rs 850 d) Rs 875

23. Factories the number 81 and express in exponential form.

a) 3^3 b) 3^4 c) 4^3 d) 4^4

24. Which one is product law of indices.

a) $a^m \times a^n = a^{m+n}$ c) $a^m \div a^n = a^{m-n}$

b) $(a^m)^n = a^{m \times n}$ d) $a^0 = 1$

25. Find the quotient of $9^5 \div 3^5$ in exponential form.

a) 3^3 b) 3^4 c) 3^5 d)3^6

26. Find the value of $\left(\frac{16}{81}\right)^{\frac{1}{4}}$

a) $\frac{2}{3}$ b) $\frac{2}{4}$ c) $\frac{1}{3}$ d) $\frac{1}{4}$

27. Factorize $4x^2 - 9y^2$

a) $(2x-3y)^2$ c) $(2x+3y)^2$

b) $(2x+3y)(2x+3y)$ d) $(2x-3y)(2x+9y)$

28. If $x+y = 5$ and $xy = 4$. Find the value of x^2+y^2

a) 15 b) 16 c) 17 d) 18

29. Find the product of (a+b) & (a-b)

a) a^2+b^2 c) a^2-b^2

b) a^3+b^3 d) $a^3- b^3$

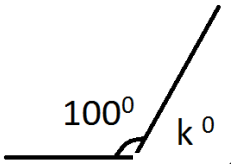
30. If $x= 2^0+3$ then find out the value of x.

a) 2 b) 3 c) 4 d0 5

31. What is the supplement of 95^0?

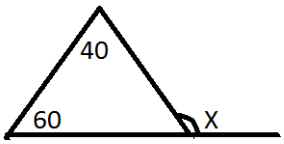
a) 70^0 b) 75^0 c) 80^0 d) 85^0

32. Find the value of K from the given figure.



a) 60^0 b) 70^0 c) 80^0 d) 90^0

33. Find the value of x from the given figure.

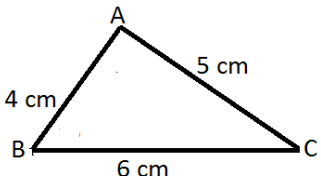


a) 45^0 b) 65^0 c) 100^0 d)120^0

34. If the sum of two angles is 180^0, what are the angle called?

a) Acute angle c) Right angle

b) Complementary angle d) Supplementary angle

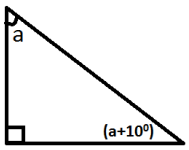


35. Which angle is great angle?

a) < A b) <B c) < C

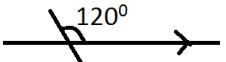
36. If a^0 and 55^0 are pair of alternate angles then, find the value of a^0.

a) 45^0 b) 55^0 c) 65^0 d)125^0



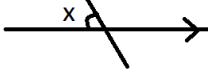
37. Find the value of a^0.

a. 35^0 b) 40^0 c) 45^0 d) 50^0



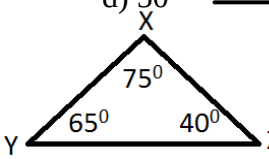
38. Find the value of < x.

a. 35^0 b) 40^0 c) 45^0 d) 50^0



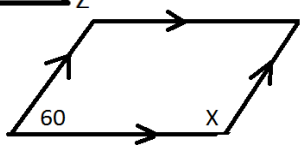
39. Which side is longest side?

a. XY b) YZ c) ZX



40. Find the value of X^0.

a. 60^0 b) 80^0 c) 100^0 d) 120^0



APPENDIX-J

ACHIEVEMENT TEST PAPER II

(POST- TEST)

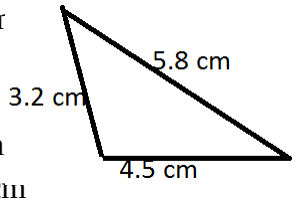
Name: Full mars: 30

Grade:

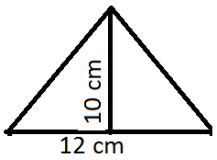
Subject:

School:

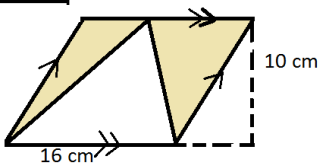
1. If the perimeter of a rectangular field of length 25 cm is 86 m find its breadth.
   a. 16m b. 17 m c. 18 m
2. Find the perimeter of given figure.



   a. 13.5 m b. 14.5 m c. 15.5 m
3. Find the perimeter of circle in which radius r= 7 cm
   a. 42 cm b. 44 cm c. 46 cm
4. Find the perimeter of a square garden is 25 m long.
   a. 50 cm b. 100 m c. 150 cm
5. If the perimeter of a circular ground is 352 m. Find its radius.
   a. 52 m b. 54 m c. 56 m
6. A boy is running a square ground of length 35 m. Find the distance covered by him at the end of his fifth round.
   a. 250 m b. 300 m c. 350 m
7. Find the area of given triangle.



   a. 50 cm^2 b. 55 cm^2 c. 60 cm^2
8. Find the area of shaded regions I given figures.



   a. 70 cm^2 b. 80 cm^2 c. 90 cm^2
9. The perimeter of a square field is 96 m, find its length.
   a. 22m b. 24 m c. 26 m
10. If the perimeter of a circular ground is 220 m. Find its area.
    a. 3550 m^2 b. 3650 m^2 c. 3850 m^2
11. Find the area of triangle in which base 8 cm and height 5.5 cm.
    a. 22 cm^2 b. 26 cm^2 c. 28 cm^2
12. Find the area of circles in which radius 14 cm.
    a. 615 cm^2 b. 616 cm^2 c. 617 cm^2
13. A rectangular field is 40 m long and its area is 2120 m^2 than find its perimeter.
    a. 136 m b. 138 m c. 140 m
14. If the perimeter of a circle is 44 cm find its radius.
    a. 6 cm b. 7 cm c. 8 cm
15. The number of faces of hexahedron is
    a. 4 b. 6 c. 8

16. The number of vertices of tetrahedron is

a. 4 b. 8 c. 12

17. The number of edges of octahedron is

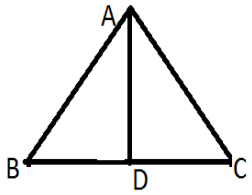
a. 8 b. 10 c.12

18. Which one is true.

a. F- V+E = 2 b. F + V - E = 2

c. F + V + E = 2

19. Area of given triangle is equal to

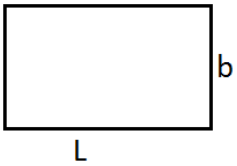


a. $\frac{1}{2}$x AC x AB

b. $\frac{1}{2}$x AB x BC

c. $\frac{1}{2}$x BC x AD

20. Perimeter of the given rectangle is



a. 2 (l+b) b) 2l + b c) L+2b

21. What is the area of cuboid?

a. 2lb + bh + 2lh b. lb + bh + lh

c. 2(lb + bh + lh)

22. Find the area of cube whose side is 4 cm.

a. 16 cm^2 b. 64 cm^2 c) 96 cm^2

23. If the area of square field is equal to 441 m^2. What will be its perimeter?

a. 84 m b. 94 m c. 104 m

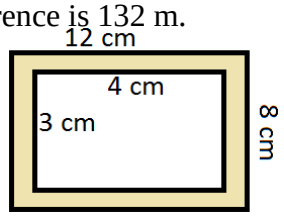
24. A path of 0.5 m wide runs round outside a squared garden of side 18 m find the area of path.

a. 17m^2 b. 27 m^2 c. 37 m^2

25. Find the diameter of a circular field whose circumference is 132 m.

a. 40m b. 41 m c. 42 m

26. Calculate the area of shaded portion.



a. 80cm^2 b. 82 cm^2 c. 84 cm^2

27. A path of 0.5 m wide runs round within a square garden of side 15 m. Find the area of the path.

a. 19m^2 b. 29 m^2 c. 39m^2

28. A rectangular block is 18 cm long 12 cm board and 8 cm thick. Find its volume.

a. 1728 cm^3 b. 1828cm^3 c. 1928 cm^3

29. If the surface area of a cubical block is 96 cm^2. Find the length of its each edge.

a. 3cm b. 4 cm c. 5 cm

30. A rectangular room contains 600m^3 of air and its height is 5 m. Find the area of its floor.

a. 115 cm^2 b. 120 cm^2 c. 125 cm^2

APPENDIX-K

PRETEST RESULTS OF THE STUDENTS OF EXPERIMENTAL & CONTROL GROUP

S.N	Experimental group (E_1)	Control group (C_2)
1	33	38
2	32	24
3	22	21
4	31	28
5	16	27
6	27	34
7	21	32
8	20	10
9	20	14
10	17	21
11	13	31
12	8	23s
13	20	20
14	36	15
15	14	13
	Total students = 15	Total students =15
	Mean=22 Variance =67=0 Std. Deviation=8.18	Mean=23.4 Variance = 68.68 Std. Deviation=8.29

APPANDIX -L

POST TEST RESULTS OF THE STUDENTS OF EXPERIMENTAL GROUP AND CONTROL GROUP

S.N	Experimental group (E_1)	Control Group (C_2)
1	34	33
2	33	21
3	28	18
4	29	27
5	23	26
6	32	33
7	30	32
8	31	11
9	25	19
10	27	20
11	20	28
12	12	22
13	28	15
14	34	12
15	19	12
	Total Students =15	Total Students =15
	Mean =27 Variance=39.0 Std. Deviation=6.24	Mean =22 Variance=66.70 Std. Deviation=8.16

APPANDIX -M

SPLIT HALF RELIABILITY TEST (FOR PRETEST)

S.N	X	Y	X^2	Y^2	XY
1	17	16	289	256	272
2	17	15	289	225	255
3	14	8	196	64	112
4	16	15	256	225	240
5	7	9	49	81	63
6	16	11	256	121	176
7	13	9	169	81	117
8	11	9	121	81	99
9	12	8	144	64	96
10	7	10	49	100	70
11	6	7	36	49	42
12	4	4	16	16	16
13	13	7	169	49	91
14	19	15	361	225	285
15	5	9	25	81	45
16	16	22	256	484	352
17	11	13	121	169	143
18	10	11	100	121	110
19	18	10	324	100	180
20	15	12	225	144	180
21	16	18	256	324	288
22	15	17	225	289	255
23	6	4	36	16	24
24	9	5	81	25	45
25	10	11	100	121	110
26	13	18	169	324	234
27	14	9	196	81	126
28	12	8	144	64	96
29	10	5	100	25	50
30	6	7	36	49	42
Total	358	322	4794	4054	4214

Where, *x* = Odd correct answers and y=even correct answers

APPENDIX -N

SPLIT HALF RELIABILITY TEST (FOR POSTTEST)

S.N	X	Y	X^2	Y^2	XY
1	19	15	361	225	285
2	17	16	289	256	272
3	16	12	256	144	192
4	15	14	225	196	210
5	13	10	169	100	130
6	20	12	400	144	240
7	14	16	196	256	224
8	14	17	196	289	238
9	15	10	225	100	150
10	14	13.	196	169	182
11	5	11	25	121	55
12	7	5	49	25	35
13	15	13	225	169	195
14	18	16	324	256	288
15	9	10	81	100	90
16	16	17	256	289	272
17	11	10	121	100	110
18	9	9	81	81	81
19	14	13	196	169	182
20	15	11	225	121	165
21	20	13	400	169	260
22	17	15	289	225	255
23	6	5	36	25	30
24	12	7	144	49	84
25	9	11	81	121	99
26	18	10	324	100	180
27	12	10	144	100	120
28	7	8	49	64	56
29	8	4	64	16	32
30	9	3	81	9	27
Total	394	336	5708	4188	4739

Where,

x = Odd correct answers and

y = even correct answers

APPENDIX O

ITEMS ANALYSIS OF PRE-TEST

No. of Item	Cognitive level	Upper 27% students making correct response											Upper 27% students making correct response											P%	D-value	Remarks
		1	2	3	4	5	6	7	8	9	10	11	30	31	32	33	34	35	36	37	38	39	40			
1	Knowledge	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	1	0	0	0	0	63.63	0.54	Accepted
2	Comp	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	86.00	-0.09	Rejected
3	Comp	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	1	0	1	1	0	1	1	72.72	0.36	Accepted
4	Skill	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0	54.54	0.81	Accepted
5	Skill	1	1	0	1	1	1	1	1	1	1	1	0	0	1	1	0	0	0	1	0	0	1	59.29	0.64	Accepted
6	Skill	0	1	1	0	1	1	0	0	0	1	1	0	0	0	1	1	1	1	0	1	0	0	50.00	0.09	Accepted
7	Appli	1	1	0	1	1	1	1	1	1	0	1	1	1	0	0	0	0	0	1	0	1	0	59.09	0.82	Accepted
8	Appli	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	59.09	0.82	Accepted
9	Appli	1	1	1	0	1	1	1	1	1	0	0	1	0	1	0	0	0	1	0	0	1	0	54.54	0.36	Accepted
10	Knowledge	1	1	1	0	1	1	1	1	1	1	1	0	0	0	0	1	0	0	0	1	0	0	54.54	0.36	Accepted
11	Comp	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	1	1	0	0	0	0	0	54.54	0.45	Accepted
12	Comp	1	1	1	0	1	0	1	1	1	1	1	0	0	1	0	1	0	0	0	0	0	0	45.45	0.54	Accepted
13	Skill	1	1	1	1	1	1	1	0	1	0	0	1	1	1	1	0	0	1	0	1	0	1	68.18	0.09	Accepted
14	Skill	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	90.90	0	Rejected
15	Skill	1	1	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	45.45	0.55	Accepted
16	App	1	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	1	0	45.45	0.72	Accepted
17	App	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	0	1	0	0	1	68.18	0.64	Accepted

No. of Item	Cognitive level	Upper 27% students making correct response											Upper 27% students making correct response											P%	D-value	Remarks
		1	2	3	4	5	6	7	8	9	10	11	30	31	32	33	34	35	36	37	38	39	40			
18	Knowledge	0	1	1	0	1	1	1	1	0	0	0	0	0	1	0	0	0	0	1	0	1	1	50.00	0.27	Accepted
19	Comp	1	1	1	1	0	1	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	40.90	0.45	Accepted
20	Skill	1	1	1	0	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	1	54.54	0.91	Accepted
21	Skill	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	1	0	0	0	0	59.09	0.82	Accepted
22	Skill	1	1	0	1	1	0	1	0	0	1	1	0	1	0	1	0	0	0	0	0	0	1	40.90	0.45	Accepted
23	Skill	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	0	1	1	0	1	77.00	0.27	Rejected
24	App	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	54.54	0.91	Accepted
25	App	0	1	1	1	0	1	1	1	1	1	1	1	0	1	0	1	0	0	0	0	0	0	50.00	0.27	Accepted
26	App	1	0	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0	0	1	50.00	0.82	Accepted
27	App	1	1	1	0	1	0	0	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	50.00	0.27	Accepted
28	App	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	59.09	0.82	Accepted
29	App	1	1	0	1	1	1	1	0	0	1	0	1	0	1	0	0	0	1	0	0	0	0	45.45	0.72	Accepted
30	App	1	1	1	1	0	0	1	1	1	1	1	0	0	0	1	1	0	0	0	0	0	0	50.00	0.64	Accepted
31	App	1	1	1	1	1	1	0	1	1	0	0	1	1	0	0	0	1	0	1	1	0	0	59.09	0.27	Accepted
32	Knowledge	1	1	1	1	0	1	1	1	1	1	1	0	0	0	1	0	0	0	1	1	0	0	54.55	0.72	Accepted
33	Comp	1	1	1	1	1	1	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	86.36	-0.27	Rejected
34	Skill	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	0	68.18	0.63	Accepted
35	Skill	1	1	1	1	1	0	0	1	0	1	1	1	1	1	1	0	0	1	0	0	0	0	59.09	0.27	Accepted
36	Skill	1	1	1	1	1	1	0	1	0	0	1	1	0	0	0	0	1	0	1	1	1	0	63.63	0.28	Accepted

No. of Item	Cognitive level	Upper 27% students making correct response											Upper 27% students making correct response											P%	D-value	Remarks
		1	2	3	4	5	6	7	8	9	10	11	30	31	32	33	34	35	36	37	38	39	40			
37	App	1	1	1	1	0	1	0	0	1	1	0	1	1	0	0	0	0	1	1	1	1	0	50.00	0.45	Accepted
38	App	1	1	1	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	1	1	1	0	81.81	0.02	Accepted
39	App	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	1	1	0	0	0	0	68.18	0.45	Accepted
40	App	0	1	1	1	0	0	1	0	1	0	1	1	0	0	0	1	1	0	0	0	0	0	40.90	0.09	Accepted
41	App	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1	1	0	0	0	0	0	0	54.54	0.55	Accepted
42	App	1	1	1	1	0	1	1	0	1	1	1	0	1	1	0	0	0	1	0	0	0	0	54.54	0.55	Accepted
43	Knowledge	1	0	1	1	1	0	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	63.63	0.55	Accepted
44	Skill	1	0	1	1	1	1	1	0	1	1	1	1	0	0	1	1	0	0	0	1	0	1	63.63	0.36	Accepted
45	Comp	1	1	1	0	1	0	1	1	1	1	1	0	1	0	1	0	1	0	1	0	0	0	59.09	0.45	Accepted
	Total	41	39	40	37	37	35	37	33	35	35	33	23	20	18	19	17	15	15	15	14	13	14			

APPENDIX P

ITEM ANALYSIS OF POSTTEST

No. of Item	Cognitive level	Upper 27% students making correct response											Upper 27% students making correct response											P%	D-value	Remarks
		1	2	3	4	5	6	7	8	9	10	11	30	31	32	33	34	35	36	37	38	39	40			
1	Comp	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	0	0	1	1	1	0	0	68.180	0.45	Accepted
2	Comp	1	1	1	1	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	1	0	1	72.730	0.18	Accepted
3	Skill	1	0	1	1	1	1	1	1	1	1	1	0	0	1	0	0	1	0	1	1	0	0	63.640	0.55	Accepted
4	Knowledge	1	1	1	1	1	1	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1	0	63.640	0.36	Accepted
5	App	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	0	0	1	77.270	0.45	Accepted
6	Skill	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	90.910	0.18	Rejected
7	Skill	1	0	1	1	0	0	1	0	1	1	0	0	0	1	0	1	1	1	0	0	0	0	45.450	0.18	Accepted
8	App	1	1	0	0	0	1	1	1	0	1	1	0	1	0	1	1	0	0	0	0	1	0	50.000	0.27	Accepted
9	Comp	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	0	0	0	68.180	0.45	Accepted
10	Skill	1	0	1	0	1	1	1	0	0	1	0	0	0	1	0	1	0	1	0	0	1	0	45.450	0.18	Accepted
11	Skill	1	1	1	1	1	0	0	1	1	1	1	1	1	0	1	1	0	1	1	1	0	0	72.730	0.18	Accepted
12	App	1	1	1	1	1	0	1	1	1	1	1	0	1	0	0	0	0	1	0	0	0	0	74.550	0.73	Accepted
13	App	1	1	0	0	0	1	1	1	0	0	0	0	0	1	0	0	1	1	0	0	0	0	36.360	0.18	Accepted
14	App	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	9.909	0.00	Rejected
15	App	1	0	1	0	1	1	0	0	1	1	1	0	1	0	0	1	1	0	0	0	0	0	40.910	0.45	Accepted
16	App	1	0	1	0	1	1	0	0	1	0	1	1	0	0	1	0	0	0	1	0	1	0	45.450	0.18	Accepted
17	Skill	1	1	0	1	1	1	0	0	1	1	1	1	0	1	1	1	1	1	0	0	1	0	72.730	0.18	Accepted

No. of Item	Cognitive level	Upper 27% students making correct response											Upper 27% students making correct response											P%	D-value	Remarks
		1	2	3	4	5	6	7	8	9	10	11	30	31	32	33	34	35	36	37	38	39	40			
18	Skill	1	1	1	1	0	1	1	1	1	1	1	0	0	1	0	0	1	0	0	0	0	0	54.550	0.73	Accepted
19	Knowledge	1	0	1	0	1	1	0	1	0	0	0	0	1	0	0	1	0	0	1	0	0	0	36.360	0.18	Accepted
20	Skill	0	0	1	0	1	0	1	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	36.360	0.36	Accepted
21	Skill	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	0	0	1	1	0	72.730	0.55	Accepted
22	Knowledge	0	1	0	1	1	1	1	1	1	0	0	1	1	0	1	0	1	1	1	0	0	1	54.550	0.18	Accepted
23	App	1	1	0	0	1	1	1	1	0	1	1	0	0	0	1	1	1	0	0	0	0	0	40.910	0.64	Accepted
24	Comp	1	0	0	0	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0	0	0	0	54.550	0.18	Accepted
25	Comp	0	1	1	1	0	0	1	1	1	1	1	0	0	1	1	0	1	1	0	0	1	1	68.180	0.27	Accepted
26	App	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	0	1	1	0	0	68.180	0.64	Accepted
27	App	1	1	0	1	1	1	1	1	1	1	1	0	0	1	1	0	1	0	0	0	1	1	63.640	0.55	Accepted
28	Knowledge	0	0	0	0	1	0	1	0	0	0	0	1	1	0	1	1	1	1	1	0	0	0	31.810	0.27	Accepted
29	App	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	0	0	0	68.180	0.64	Accepted
30	Skill	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	82.000	0.02	Rejected
31	Comp	1	1	1	1	1	0	1	1	1	1	1	0	1	0	1	1	1	1	0	1	0	1	68.180	0.45	Accepted
32	App	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0	0	0	0	0	54.550	0.91	Accepted
33	Skill	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0	0	0	0	0	50.000	0.82	Accepted
34	Skill	1	1	0	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0	1	1	0	0	59.090	0.64	Accepted
35	App	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0	0	0	0	0	59.090	0.82	Accepted
36	App	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	0	1	0	0	0	0	0	54.550	0.73	Accepted

No. of Item	Cognitive level	Upper 27% students making correct response											Upper 27% students making correct response											P%	D-value	Remarks
		1	2	3	4	5	6	7	8	9	10	11	30	31	32	33	34	35	36	37	38	39	40			
37	Skill	0	1	1	1	0	1	1	1	1	1	1	0	0	1	1	0	1	0	0	1	0	1	59.090	0.45	Accepted
38	App	0	0	0	0	0	1	1	0	1	1	0	0	0	0	1	0	1	0	0	0	0	0	18.180	0.09	Rejected
39	App	0	1	1	0	1	1	0	1	0	1	0	1	1	0	1	1	1	0	0	0	1	0	45.450	0.18	Accepted
40	Skill	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	0	1	1	0	0	68.180	0.64	Accepted
	Total	32	30	31	31	36	37	39	41	41	44	38	44	42	48	47	55	55	53	52	52	49	49			

APPENDIX -Q

STATISTICAL FORMULAE USE FOR DATA ANALYSIS

a. mean($\bar{X}$)=z

b. Sample Variance (S^2)=$\frac{\sum(x-\bar{x})^2}{N-1}$

c. Standard Deviation of Statistics (S)=$\sqrt{\frac{\sum(x_1-\overline{x_1})^2}{N_1-1}}$

d. f- Statistics$\frac{S^{2}1(Largest\ Variance)}{S^{2}2(Smallest\ Variance)}$, where ${S_1}^2$=$\frac{\sum(x_1-\overline{x_1})^2}{N_1-1}$ and

${S_2}^2$= $\frac{\sum(x_2-\overline{x_2})^2}{N_1-1}$

e. t- Statistics= $\frac{\overline{X_1}-\overline{X_2}}{S_p\sqrt{\frac{1}{N_1}+\frac{1}{N_2}}}$

Where as, S_p = $\sqrt{\frac{(N_1-1){S_1}^2+(N_2-1){S_2}^2}{N_1+N_2-2}}$, with degree of freedom N_1+N_2-2

$\overline{X_1}$ = Mean of Experimental Group

$\overline{X_2}$ = Mean of Control Group

${S_1}^2$ = Variance of Experimental of Group

${S_2}^2$ = Variance of the Control Group

N_1 = Number of the student in Experimental Group

N_2 = Number of the students in Control Group

f. Karl Pearsom's formula

$r_{\frac{1}{2}}$ = $\frac{N\sum xy-\sum x\sum y}{\sqrt{N\sum x^2-(\sum x)^2}\sqrt{\sqrt{N\sum y^2-(\sum y)^2}}}$

g. Spearman Brown's Formula

R = $\frac{2r_{\frac{1}{2}}}{1+r_{\frac{1}{2}}}$

h. Item difficulty leve : (P) = $\frac{R}{T}\times 100\%$

Where R = Total no. of correct responses from 27 percent of both upper and lower scoring students

T= Total no of students from 27 percent of both upper and lower scoring studtns.

i. Discriminating index: (D) = $\frac{U_R - L_R}{\frac{1}{2}N}$

Where, U_R= Number of correct responses from 27 percent of upper scoring students.

L_R= Number of correct responses from 27 percent of Lower scoring students.

N=Total no. of students from 27 percent of both upper and lower scoring students.

Class Observation Form

APPENDIX R

CLASS OBSERVATION FORM

Direction : Put a tick mark (✓) in correct column.

Excellent=5, Good=4, Average=3, General=2, Poor=1

1.	**Student-Student interaction**	5	4	3	2	1
	a. Student works in group					
	b. Students request for help					
	c. Students Discuss in group					
	d. Students share their problem					
	e. Students follow direction of expert					
	f. Students solve the problem by their own idea					
	g. Students engaged in learning					
2.	**Teacher Student interaction**					
	a. Teacher motivates students					
	b. Teacher encourages students					
	c. Teacher gives feed back on class work					
	d. Teacher gives specific help to weak student					
	e. Teacher encourages to express their idea					
	f. Relation between teacher and student					
	g. Teacher receives student question					
3.	**Motivation of students**					
	a. Students are interested in learning					
	b. Students are curious in learning					
	c. Stimulate learning activities					
	d. Sustain interest in learning					
	e. Students co-operates their friends					
	f. The condition of self actualization					
	g. Students participates in helping					