EFFECTS OF AESTHETIC VALUE AND COOPERATIVE LEARNING STRATEGIES ON PRIMARY PUPILS MATHEMATICS PERFORMANCE, RETENTION AND APPLICATION IN KANO STATE, NIGERIA

BY

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DECLARATION

I Aminu SADAUKI declare that this thesis titled ‘’ Effects of Aesthetic Value and Cooperative Learning Strategies on Primary Pupils Mathematics Performance, Retention and Application in Kano State, Nigeria’’ has been written by me under the supervision of Prof. Y. K. Kajuru. The information obtained from literature has been acknowledged, text and list of references provided. No part of this work was presented for another degree or diploma elsewhere.

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CERTIFICATION

This research work titled ‘’ Effects of Aesthetic Value and Cooperative Learning Strategies on Primary Pupils Mathematics Performance, Retention and Application in Kano State, Nigeria’’ written by Aminu, SADAUKI meets the regulations governing the award of masters degree in mathematics education, Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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This research is dedicated to my parents Sadauki Abdullahi and Sa'adatu Abdullahi for their prayers, support and concern in my educational pursuit.

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ABSTRACT

This study investigated the Effects of Aesthetic Value and Cooperative Learning Strategies on Primary Pupils Mathematics Performance, Retention and Application in Kano State, Nigeria. Quasi-experimental design involving pretest, post-test 1 post test 2 and post test 3 was used. The population consisted of 17,803 pupils. The sample of 141 pupils was used. Two experimental groups and one control group were used for the study. Pupils in experimental group 1 (EG1) were taught using aesthetic value strategy, pupils in experimental group 2 were taught using cooperative learning strategy and pupils in control group were taught using conventional method. Three instruments were used (mathematics achievement test, test of retention and test of application). The instruments were made reliable using test-retest method with the coefficients 0.68, 0.67 and 0.72 for the three tests respectively. Three hypotheses were tested using analysis of variance (ANOVA) and they were all rejected. Post hoc tests were carried out, which showed that, primary six pupils taught using aesthetic value and cooperative learning strategies performed and applied the acquired knowledge in solving related word problem better than those taught using conventional method. Based on the findings it was recommended that, the two strategies should be used in learning mathematics at the primary school level.

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OPERATIONAL DEFINITIONS OF TERMS

The following terms were peculiar to research work were hereby defined as follows:

Aesthetic Value Strategy: is an interactive strategy that makes teaching interesting and meaningful through the use of motivating activities and interesting relevance instructional materials, such as chart on a cardboard papers and solid shapes made using the card boards papers.

Conventional Method: is the way of teaching that uses chalk-talk and cane approach which is characterized with little involvement of instructional materials.

Cooperative Learning Strategy: is the learning strategy which is characterized by creation of competitive situation and use of ability groupings to help pupils learn among themselves under guidance of the teacher.

Application of Mathematical Concept: this refers to ability of the pupils to use learnt concepts in solving related word problems.

Word Problems: they are mathematical problems that require more abstract thinking to solve them than use of direct procedure such as use of formula directly.

ABBREVIATIONS

AVS:	Aesthetic Value Strategy
CLS:	Cooperative Learning Strategy
MPT:	Mathematics Performance Test
MDGS:	Millennium Development Goals
NEEDS:	National Economic Empowerment and Development Strategy
NERDC:	National Educational Research and Development Council
TOR:	Test of Retention
TOA:	Test of Application.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Federal Ministry of Education as stipulated in National Policy on Education (FME, 2004) describes the primary education as the education given in institution for children of ages 6 to 11 plus, it further states that since the rest of education system is built upon it, the primary level is the key to the success or failure of the whole system". In the light of this, primary school mathematics teachers are supposed to ensure that proper mathematics teaching and learning are assured to improve pupil's achievement in mathematics as a prerequisite for future success in science and technology. In line with this, national policy on education (FME, 2004) states the following as goals of primary education in all states of the federation, which are to:

a. include permanent literacy and numeracy and ability to communicate effectively.
b. lay a sound basis for scientific and reflective thinking.
c. give citizenship education as a basis for effective participation in and contribution to the life of the society.
d. mould the character and develop sound attitude and morals in the child.
e. develop in the child the ability to adapt to the child's changing environment.

f. give the child opportunities for developing manipulative skills that will enable the child function effectively in the society within the limit of the child's capacity.

g. provide the child with basic tools for further educational advancement, including preparation for trades and crafts of the locality.

Besides, the expected and significant role of mathematics in scientific and technological development of the nation, Okafor; (2009) states that performances in mathematics have been consistently low which might have occurred as a result of students inability to retain and transfer the knowledge acquired and the situation in the country is not pleasant". Clear evidence of this assertion is seen from the results of common entrance and WAEC/NECO examinations, which are even worsened by rampant examination malpractices. Perhaps this problem might have emanated from ineffective teaching and learning of mathematics right from the grass root (primary schools) as a result of using inappropriate teaching strategies.

To ensure effective teaching and learning of mathematics, there is need to devise some desirable ways to suit the present demand in the primary school which is what Sharma and Verma (1993) opined as they explained that teaching effectiveness is only achieved if relevant instructional strategies are employed. This idea calls for the use of teaching strategies such as cooperative learning strategies the present study deals with.

Ozokeraha (2009) explains that cooperative learning strategy (CLA) is a successful teaching strategy in which small teams of students with different levels of ability use a variety of learning activities to improve the understanding of a subject. Each member of a team is responsible not only for learning what is taught but also for helping team mates to learn, thus creating a more warming and conducive learning atmosphere. Pupils work through the assignment until all group members successfully comprehend and complete it.

In the light of the above a mathematics teacher is supposed to have some knowledge about the pupils' abilities before employing the strategy as the teams are formed based on the pupils abilities. For instance, when helping pupils to learn how to calculate area of plane shapes in primary three, the teacher can group the pupils into manageable teams, each consisting manageable number of pupils of different learning abilities such as high achievers, moderate achievers and slow learners. Each group can be motivated to work cooperatively together either intrinsically or extrinsically or both to tackle the task given to them. This should be done under close supervision of the pupils in each group by the teacher.

Johnson & John, (1986) in Ozokeraha (2009) recommended that following any cooperative learning activity pupils should have time to discuss how their group performs in completing the mathematics activities their responses could be recorded and discussed with the teacher to determine pupil-teacher

agreement on the group's ability to work collaboratively, thereby enhancing their academic performance in the subject.

Kurumeh (2009) explained Aesthetic Value Strategy (AVS) as an effective strategy that can reduce problem of poor mathematics achievement among pupils and bring alternative to teacher's inability to use modern approaches due to lack of funds to provide the necessary materials in teaching mathematics in classroom. She further explained that AVA is mind on hands-on and activitycentered approach which could reduce the pupils' failure in mathematics to a manageable rate by allowing them to retain and transfer what is learnt.

Eisner (1985) describes Aesthetic Value Strategies (AVS) as fundamental to the activities of a mathematician for it provides coherence to mathematical knowledge, thus increasing learner's appreciation and understanding of mathematics. It is a motivator that moves pupils to a topic they are to learn and doctrine that textbook information has not provided for. It is a way of seeing the big picture of mathematics topics while promoting more meaningful learning. It provides a reward for learning that would be more sustaining than satisfaction from test scores namely the joy of learning. It motivates pupils learning and enjoyment in mathematics. Its experience demystifies mathematics and makes it more accessible to learner. Result of the study conducted by Bolaji (2005) on the attitude of students towards mathematics showed that interest and personal effort in learning mathematics by the students help in a academic achievement

therefore, use of Aesthetic Value Strategy can help in making the pupils develop interest and be willing to learn mathematics at the primary school. This study dealt with three dependent variables among which was performance, generally speaking the aim of research in mathematics education is to find out desirable ways to improve teaching and learning mathematics to go in line with the dynamic nature of the society, whose end result is improvement in performance. Pupils' performance in mathematics is measured through examination and continuous assessment (Harbor-Peters, 1999) Using examination results, pupil's performance can clearly be seen which was the reason for using Mathematics Achievement Test (MAT) by the researcher in order to find out pupils' performance. Continuous assessment as another tool for discovering pupils' achievement (performance) was not used properly as the scores the pupils obtained in daily class work were disregarded. Academic performance was seen by Etukudo(2009) as what the learners are capable of doing as a result of acquired task given to them by their teacher that is to say academic performance in another perspective encompasses the behaviors students exhibit in cognitive affective and psychomotor domains in relation to the received instruction or series of instructions.

In the study, retention was used as second dependent variable, it refers to capacity to retain and remember learnt material in the future as opined by Oyedokun (1998). He further describes what contributes to retention level as

nature of materials to be coded. This was the reason for using the independent variables AVS and CLS to check if they were desirable enough to aid retention.

The study used the term application as the third dependant variable, Nayeiyi (2012) explains application as "the ability to use information and ideas already learnt in new situations". It entails the use of formulas, principles, methods, rules, laws, and theories in solving new problems. The study was aimed at finding out whether the independent variables AVS and CLS could help in applying already learnt materials to solve new related problems in mathematics at primary schools.

1.2 Statement of the Problem

As described by Eniayeju & Azuka (2010), evidence of the failure of the new mathematics curricula to effect any real change in the mathematics classroom has begun to accumulate. There have been reported cases of pupils mass failure in public examinations like West African Senior School Certificate Examination (WASSCE) organized by the WAEC and the National Examination Council (NECO) Senior School Certificate Examination (SSCE). To streamline the situation the whole process of mathematics teaching and learning should be changed to go in line with the dynamism of the society. In contemporary primary schools number of pupils in each class has grown up, the demands of the society have changed; the attitude of people towards education has changed. Forgetfulness has become the order of the day. What is required now regarding

teaching and learning of mathematics is the use of strategies such as Aesthetic Value and Cooperative Learning Strategies that can reduce the degree of forgetfulness and give opportunity to pupils to easily remember and apply mathematics knowledge to solve related problems.

Usman (2010) and Nwoye (2010) state that "Primary Mathematics Learning is the bedrock of mathematics. Therefore, a weak mathematics foundation at primary school level may lead to poor attitude, low participation and achievement in mathematics at secondary schools and tertiary level respectively" This indicates that there is need to improve the quality of teaching and learning mathematics at the primary level so as to improve mathematics performance in the secondary schools and tertiary institutions.

National teachers institute (NTI 2006) point out that, poor performance of students in mathematics is laid on the teachers methods of teaching. The teacher is accused of using inappropriate pedagogical approaches like lecturing, dedication and note coping for a topic that requires interactive techniques in a conducive environment for the development and substance of desirable social skills, attitudes and values. Again the teacher concentrates on only available instructional materials provided by the schools, tests an written assignments for driving achievement measures for evaluations. Mathematics teachers have to employ the use of innovative materials and techniques in order to improve their qualities of teaching and learning.

In the light of the above, the research problem revolved around the following issues as observed by the researcher in the study area:

- Pupils in the study area performed significantly poor in class works and sometimes in assignments/homework.
- Significant growth of negative attitudes of pupils in the study area as well as inadequate motivation from the teachers brought obstacles to the pupils in learning mathematics.
- In the study area insufficient effort was made by the primary school mathematics teachers as the researcher observed while in the classes to motivate the pupils to learn from themselves though forming heterogeneous groups.
- Difficult concept that required the use of instructional materials to explain vividly were taught verbally and many times with little demonstration using blackboard drawn-diagrams
- Use of chalk-talk-and cane approach by many of the primary school mathematics teachers as the conventional method of teaching which the researcher further described as fear-instilling approach.
- Insufficient zeal to provide instructional materials to facilitate teaching and learning mathematics from teacher's side.

Consequently, the research found out effect of aesthetic value and cooperative learning strategies on senior primary pupils mathematics

performance, retention and application of the acquired mathematics knowledge to solve related problems in order to have possible solutions to them.

1.3 Objectives of the Study

The objectives of the study were to:

i. determine usability of Aesthetic Value Strategy (AVS) and Cooperative Learning Strategy (CLS) in mathematics teaching and learning in Senior Primary Schools in Gwale Local Government Kano.
ii. identify the applicability of AVS and CLS by the senior primary school mathematics teachers in Gwale Local Government Kano.
iii. create interest in the minds of Senior Primary Schools mathematics teachers in Gwale Local Government Primary Schools to use the strategies, through involving them in the preparation of lessons and marking of tests to improve the qualities of teaching and learning mathematics.
iv. improve the performance of senior primary school pupils in mathematics Gwale Local Government through the use of AVS and CLS.

1.4 Research Questions

The following research questions were used to guide the Study:

1. What is the difference in performance, among groups of Senior Primary Pupils taught mathematics using Aesthetic Value Strategy, Cooperative Learning Strategy and those taught using Conventional Method?

2. What is the difference in the retentive level of groups of Senior Primary Pupils taught mathematics using Aesthetic Value Strategy (AVS), Cooperative Learning Strategy (CLS) and those taught using Conventional Method?
3. What is the difference in the groups of Senior Primary Pupils' ability to apply mathematics knowledge among those taught using Aesthetic Value Strategy (AVS), Cooperative Learning Strategy (CLS) and those taught using Conventional Method?

1.5 NullHypotheses

The following null hypotheses were tested using proper statistical tools at 0.05 level of significance:

Ho_1: There is no significant difference in the academic performance of the Senior Primary Pupils taught mathematics using Aesthetic Value Strategy (AVS), Cooperative Learning Strategy (CLS) and those taught using Conventional Method (CM).

Ho_2: There is no significant difference in the retention level of senior primary pupils taught mathematics using Aesthetic Value Strategy (AVS), Cooperative Learning Strategy (CLS) and those taught using Conventional Method (CM).

H_{O3}: There is no significant difference in the Senior Primary Pupils ability to apply mathematics knowledge among those taught using Aesthetic Value Strategy (AVS), Cooperative Learning Strategy (CLS) and those taught using Conventional Method (CM).

1.6 Significance of the Study

Research findings revealed that, using Aesthetic Value and Cooperative Learning Strategies in the study area mathematics performance, retention and application would improve thereby helping hopefully in the achievement of Millennium Development Goals (MDGs) and National Economic Empowerment and Development Strategy (NEEDS) as they would only be achieved through technological and scientific development, since mathematics knowledge is indispensable in the technological, scientific, and economic development

The results of the research would hopefully help the parents to see their children performing better in mathematics since as a result of using the strategies AVS and CLS the lessons could be more interesting thereby making the teaching and learning easier.

Finding of the study would hopefully be of use to curriculum designers and implementers such as NERDC, NTI and NCCE as they would suggest to the primary schools mathematics teachers to use some relevant and suitable

teaching/learning strategies to improve pupils performance and make them enjoy the teaching and learning.

Results of the study would hopefully help the primary school mathematics teachers to improve the quality and quantity of learning since the pupils would be well motivated to learn. The result could also be of benefit hopefully to the primary school pupils as they would come to develop keen interest in learning mathematics since use of AVS and CLS could hopefully make the pupils have love for mathematics, mathematics lessons and even mathematics teachers.

Findings of the study would hopefully benefit fellow researchers as they could use it to find which gap was created as a result of using AVS and CLS in order to see what they could do to bridge it. Finding would hopefully help the entire society thereby helping in the development of science and technology since mathematics is considered as prerequisite to the scientific and technological development the world over.

1.7 Basic Assumptions

The research was conducted based on the assumptions that:

1. all the primary schools in the study area used the same syllabus and textbooks.
2. all the primary mathematics teachers had teaching qualification.

1.8 Scope/ Delimitation of the Study

The study focused on investigation of effects of Aesthetic Value Strategy (AVS), Cooperative Learning Strategy (CLS) and Conventional Method on senior primary schools mathematics performance, retention and application of acquired knowledge to solve related problems using researcher made testes and experimental lesson plans. The study was delimited to the following:

1. Primary six pupils chosen from three randomly selected government primary schools in Gwale Local Government Area Kano State
2. The topics covered were delimited to perimeters and areas of plane shapes as well as a finding of speed using the formula: speed = $\frac{\text{distance}}{\text{Time}}$
3. The instruments used for the study were delimited to MPT, TOR and TOA
4. The strategies used were AVS and CLS .
5. The topics were drawn from the sub-theme "measurement" of primary six curriculum themes designed by National Educational Research Development Council (NERDC, 2007).
6. The type of researcher-made tests used were essay and objectives.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.01 Introduction

The study was aimed at determining effects of aesthetic value and cooperative learning strategies on senior primary pupils mathematics performance, retention and application in Gwale local government area of Kano state. This chapter focused on the review of related literature that were in line with the key concepts in the topic and objectives of the study. The chapter was presented in the following sub-headings:

2.02 Concept of Teaching and Learning

2.03 Teaching Mathematics in Primary School Level

2.04 Aesthetic Value Strategy in Teaching

2.05 Cooperative Learning Strategy

2.06 Contributions of Learning Theories to Classroom instruction

2.07 Relevance of Learning Theories in Learning Mathematics

2.08 Conventional Methods of Teaching Mathematics

2.09 Relevance of Teaching Methods in Teaching Mathematics

2.10 Contributions of Teaching Strategies to Classroom Instruction

2.11 Empirical Studies on Aesthetic Value and Cooperative Learning Strategies

2.12 Implications of Reviewed Literature

2.02 Concept of Teaching and Learning

Teaching is given a number of definitions by different writers, authors and other experts. Nwagbo (2006) in Obienyem (2009) states that "the task of teaching is not an easy one; it is easier to work with- machines and tools than working with human beings, which requires a lot of care, attention and commitment". Effective teaching of mathematics will not be achieved without the teacher showing concern about the pupils' progress. The teacher supposes to restlessly look for a strategy that will boost the pupils morale, interest and dedication towards learning mathematics.

Research findings of Woolfolk & Nicolick (1980), bring a list of activities that teachers are engaged which among others are to:

i. decide what is important. :
ii. plan learning outcomes
iii. provide teaching materials.
iv. decide on instructional methods to be used.
v. interact with students.
vi. supervise class activities and so on.

The above findings have suggested that, primary school mathematics teachers are supposed to supervise closely the activities of their pupils in the classroom. They should also use interactive approaches so as to make the teaching and learning more meaningful.

The concepts of teaching and learning have been thought to have some factors that constitute them. For instance, Okorie (1992) states that "telling is not teaching, listening is not learning and watching is not also learning but essentially all the three are factors needed to facilitate learning". Therefore, teachers should bear in mind that, when pupils listen with rapt attention, it does not mean they have learnt, but that can aid learning. They should try to use strategies that will involve pupils' active participation in the lesson. Abimbade (1999) opines that,activity is expected to be guided by the curriculum content, pupils' reports and teaching strategies. He even suggested some technique of teaching as team teaching technique problem solving techniques and lecture method. By this opinion, the researcher deduces that, a teacher is supposed to be professionally trained, vast in knowledge with regards to curriculum content, objectives, methodology and evaluation. This will go along with his practical experience to facilitate both teaching and learningtherefore, the researcher here defines teaching as an interactive systematic process of imparting knowledge through professional use of teaching strategies.

Teaching and learning are like two sides of a coin, one can not exist without the other. The term learning has been defined by different professionals and authors. Psychologists like B.F Skinner, Ivan Pavlov, Piaget and Gestalt have defined learning in various ways; however, the definitions are geared towards almost the same meaning. Paul (1994) views learning as a change of behavior due to experience. Also, Usman (2006) sees learning as "a relatively permanent change in behavior due to practice". Considering these definitions, the researcher deduces

that, once there is a change in pupils/students behavior, learning is expected to have taken place. The researcher also explains that, in mathematics teaching learning process, learning can be said to be the ability of pupils/students to assimilate the learning tasks provided by teachers with the help of professionally organized activities.

Therefore, this research focuses on possible improvement of qualities of teaching and learning mathematics in primary schools using Aesthetic Value and Cooperative Learning Strategies to ensure positive performance, good retentive memory and apply acquired mathematics knowledge in solving related problems.

2.03 Teaching Mathematics at Primary School Level

Mathematics as field of study deals with abstract concepts, which provides tools for solving daily problems in the society. Okpala (2008) in Okpala& Anene (2009) opines that science, technology and mathematics are the instruments for national development and every country today craves for their advancement". According to this opinion, mathematics can be considered as inevitable as far as national development is concerned. Therefore, teaching and learning of mathematics are supposed to be improved to achieve proper development of mathematical concepts.

Okpala (2009) observes that, mathematics teaching in Nigerian primary and post primary schools has often been taken the traditional approach. Based on Okpala's observation, the researcher sees that, the traditional approach which is not interactive in

nature has not been well coming as it yields massive failure in examinations and encourages malpractices. Davis (2001) and Vithal (2002) opine that, the methods and approaches used by mathematics teachers in developing unfamiliar mathematical concepts are ineffective and suggested that, mathematics should be taught to fall in line with what are obtained in the current society, that is why federal republic of Nigeria advocates teaching method that is activity oriented, exploratory and experimental. If the citizens of this country will compete favorably with their counterparts in other parts of the world in this age of science, technology and mathematics, the teaching and learning of mathematics of the primary schools level should be repositioned. Since primary education is the foundation upon which other levels of education are built. It becomes necessary that solid foundation in mathematics be laid by teaching effectively using activity oriented methods which are pupil-centered. The researcher conjunctures that, teaching strategies should be developed and used accordingly for the attainment of effective teaching and learning of mathematics at especially primary school level since the national policy on education (2004) considers it as key to the success or failure of other levels. Okolo (2000) states that "teachers instructional strategies especially at the foundation level of teaching and learning is a vital aspect of improving nations productivity and independence." Research reports of Bruner (1996), Darling Hammond and Sunder (1992) in Kolawola. and Popoola (2009) have indicated that "changes are necessary in the way mathematics is being handled. The traditional method of instruction does not relate mathematical problems to the real world, help students think about realistic situations, or help students to generate their solutions. As a result, students may become unmotivated to learn what is unconnected with what the teacher is doing in the

classroom thereby, developing an over all negative attitude towards mathematics." Kolawale & Popoola (2009) state that "at the primaryschool level, there is need for teachers to make learning of mathematics more interesting to the learners (pupils) by using good and varied instructional strategies which will facilitate learning of abstract concepts, helping students to conceptualize ideas, and stimulate the learners imagination. The use of varying instructional strategies in mathematics helps both teachers and learners in understanding each other.

In another context, Okoye (2009) mentions fourteen teaching strategies which are proved relevant as far as teaching and learning mathematics are concerned. This strengthens the need for use of strategies more especially when developing difficult concepts in mathematics. The strategies he mentioned included Cooperative Learning which the present research dealt with. The strategies are as follows:

a. Lecture .
b. Demonstration
c. Individual instruction
d. Competition
e. Cooperative learning in groups
f. Discussion method
g. Guided discovery method
h. Project method
i. Computer assisted instruction

j. Concept mapping

k. Use of analogies

l. Play method

m. Laboratory technique :

n. Problem solving

On the other hand, aesthetic value strategy is seen by some researchers such as Oghwephu (2009) and effective teaching strategy that can be used in Nigerian primary and secondary schools to develop mathematical concepts. This obviously revealed the justification for the use of teaching strategies in mathematics teaching. That was why this research dealt with Aesthetic Value Strategy.

Problems of teaching mathematics in this context refer to all the obstacles that hinder smooth running of teaching of mathematics in Nigeria generally and primary schools specifically. Researchers have found some factors that hinder effective teaching of mathematics in Nigeria. Aiken and Dreger (1961) in Ale (1989) state that attitude is a significant predictor of mathematics achievement". This implies that for proper teaching of mathematics to take place more especially in primary schools, teacher's attitude towards the job should be positive. Therefore, mathematics teachers are supposed to first of all be interested in the job they do as without interest the issue of improvement in quantity will not even come. Ale (1983) reports that students blame their poor performance on three broad areas which are: teaching problem negative attitude and examination difficulties.The researcher sees the Ale's report as still prevalent since learners during common entrance,

WASSCE and NECO examinations exhibit inappropriate behaviors to help them pass which can also be the consequence of negative attitude towards teaching.Obodo (2001) when stating problems of teaching mathematics opines that "teachers' problem is the use of inappropriate method of teaching mathematics by the so-called professional mathematics teachers. He further explains that some teachers use inappropriate and uninspiring methods. Instruction is abstract and usually not related to the child's environment. Teachers do not use instructional materials in teaching neither do they improvise them. Teachers do not consider the psychology of the learners. For example, they may not use concrete materials and motivation where necessary this makes mathematics teaching not related to the real life situation. The researcher deduces four major problems of teaching mathematics from Obodo (2001)'s findings as follows:

i. Use of inappropriate mathematics teaching method
ii. Lack of adequate instructional materials
iii. Teachers failure to improvise instructional materials
iv. Poor usage of psychology in teaching.
v. Refusal to relate mathematics teaching to the real life situation.

These are of course problems that hinder effective teaching of mathematics in Nigerian primary and secondary schools.

Azuka (2003) states that "poor methodology of teaching mathematics in our tertiary institutions discourage students in the study of the subject" the researcher here observes that, since tertiary institutions are where mathematics teachers are trained, poor

mathematics teaching at the tertiary level can tremendously cause poor teaching of mathematics in secondary and primary schools.

Azuka (2003) further states that "there is an acute shortage of teaching facilities and textbooks in mathematics departments of tertiary institutions the researcher sees this as a factor that can hinder smooth running of activities in teaching learning process. Kolawale &Ogiuni (2009) opine that, selection of mathematics topics from the syllabus by the teachers, thereby leaving those ones that are practical, has also got a detrimental effect on the students as they may not have general knowledge of the syllabus. WAEC chief examiners[1] report (2007) gives credence to this, and advises that all mathematics teachers should endeavour to attend workshops and seminars that will enable their better performance in the teaching of the subject. Abstractness attached to the teaching of mathematics by some teachers has scared some students who are supposed to be the best in mathematics. Here the researcher deduces that, selecting mathematics topics and leaving some may be because of insufficient instructional materials or so, as well as inability of mathematics teachers to use ethno-mathematics in teaching thereby abstraction can be reduced significantly are factors that contribute in ensuring poor teaching of mathematics.

Consequently, the present study put into practice AVS and CLS in order to find if they would be used in primary schools in Gwale Local Government, Kano. And if AVS and CLS would be found useful to remedy the idea of teaching some topics and refusing to teach some because of their difficulties.

2.04 Aesthetic Value Strategy

Some researchers describe Aesthetic Value Strategy as a useful strategy inteaching-learning situation. For instance Kurumeh &Iji (2009) states that "Aesthetic Value Strategy (AVS) is an effective strategy to alleviate the problem of poor mathematics achievement among students in algebra and teacher's inability to use modern approaches due to lack of funds to provide the necessary materials in teaching mathematics in the classroom". Aesthetic Value Strategy as described further by him is minds-on, hands-on and students and activity-centered approach which could reduce students' problem of failure in mathematics to a manageable extent. This is the vehicle through which the teacher leads his students in pursuit of educational objectives (Ohuche & Ali, 1998). It is a mode of teaching that allows the learner to experience knowledge and reality in a way different from scientific approach. It allows student to experience the essence of mathematics from a different perspective. It maximizes how one can experience and interpret the world mathematically (Eisner, 1985). This approach gives mathematics, its beauty and elegance. It uses the aesthetic value, beauty and elegance which are the qualities of mathematics to expose topics to the learners in a mathematics classroom (Okolo, 2007). With this approach, the aesthetic experience which students lack in today's classroom will be returned. Such experiences include joy in participating in solving mathematics problems, artistic nature satisfaction, order, beauty/test of beauty and pleasure. This approach leads students to discover mathematics and mathematics topics while engaged in enriched programmed activities (Armshead, 1996; Kurumeh *et al* 2009)

In another perspective, Kurumeh & Iji (2009) opined that, in Aesthetic .Value Strategy students are encouraged to critique and identify patterns in the works of arts and different aspects of mathematics in their daily encounters with nature and situation, especially in works of art. This strategy uses and develops activities to inspire students to explore, understand and calculate values and figure, for instance using fractals to calculate areas of triangles and squares. It makes students product oriented since the activities involved in this approach leads to artistic production in students. For instance, producing their own pictures by hand or using computer technology and producing their own shapes or producing their own mathematics using things around in their environment. It allows and encourages students to critique and perceive mathematics in various works of art. It encourages learners to develop their own criteria for judgments by having learners compare and assign value to mathematics in different works of art. This strategy has the unique function of bridging the gap between mathematical view and popular views by removing the mysteries associated with mathematics and the activities of mathematics thereby making it accessible to every learner. Eisner (1985) sees AVS as fundamental to the activities of mathematicians for it provides coherence to mathematical knowledge, thus increasing learners' appreciation and understanding of mathematics. It is a motivator that moves students to a topic of study challenges the doctrine that text book information is sacred. It is a way of seeing the big picture of mathematics topics and promotes more meaningful learning. It provides a reward for learning that would be more sustaining than satisfaction from test scores namely the joy of learning. It motivates students' learning and brings

enjoyment in mathematics. Its experience demystifies mathematics and makes mathematics accessible to all learners.

In a similar perspective, Horny (2000) in Oghwephu (2009) describes the word aesthetic as the fact that it is concerned with beauty and art as well as the understanding of beautiful things. Thus the words, aesthetics value have beautiful and artistic connotation. From the above works of previous researchers, the present researcher sees AVS as a desirable teaching approach to be employed in teaching mathematics to improve comprehension of some difficult concepts, more especially in primary schools. It is an interactive strategy that is learner friendly used to improve effectiveness of teaching and learning of mathematics more especially in primary schools.It can be viewed as a modern teaching strategy that can facilitate teaching and learning of mathematics despite the contemporary classroom sizes

In the light of above the researcher deduces advantages and disadvantages of AVS as follows:

Advantages of AVS

i) Pupils' interests are aroused

ii) Teachers' creativity is encouraged

iii) The teaching is made rich

Disadvantages of AVS

(i) It is employed by experienced teachers,

(ii) It needs much expenditure of money.

2.05 Cooperative Learning Strategy

Learning strategy has received considerable attention from some researchers. For example Ozokeraha (2009) defines cooperative learning strategy as a "strategy in which small teams each with students of different levels of ability use a variety of learning activities to improve the understanding of a subject. Each member of a team is responsible not only for learning what is taught but also for helping team mates to learn thus creating an atmosphere for achievements". National council of teachers of mathematics view that, what should be created to promote active learning and teaching include classroom discussion and individual small group and whole group learning. Ozokeraha (2009) adds that cooperative learning is one example of ,an instructional arrangement that can be used to foster active students' learning. This is an important dimension of mathematics learning. Students can be given tasks to discuss, solve and accomplish. Cooperative learning can be used to promote classroom discussion and oral development. Wiig and Semel (1984), describe mathematics as conceptually dense. That is, students must understand the language and symbols of mathematics because contextual clues, like those found in reading are lacking in mathematics. Cooperative learning activities can be used to supplement text book instructions by providing students with opportunities to practice or review newly introduced skills and concepts.

Some researchers such as Ozokeraha (2009) explain that cooperative learning strategy is used for handling large classes. He uses the term "cooperative learning" to refer to dividing

a large group into small group of two to six and assigning specific tasks to them. He further explains that, in mathematics cooperative work can be used in conjunction with practicing skills, doing investigation, collecting data, discussing concepts and principles or solving mathematical problems. Choosing the task for teaching and learning a topic in mathematics influences what and how we expect the students to learn that topic. Teaching is most effective when the teacher understands what the learner knows and has the tools, task and techniques to challenge and support the learner to move forward by learning mathematics with understanding. For ensuring small group learning, Solberg and Berry (2002) in Ozokeraha (2009) opine that small groups are beneficial for developing mathematics problem-solving skills.

A research conducted by Ozokeraha (2009) reveals that, in cooperative learning strategy, the teacher moves around as a supervisor of the on going activities. For the purpose of effective teaching, control and supervision students canbe grouped on the basis of academic achievements, age, sex, the nature of the activity to be performed and the sociability of the group. However, groups must be heterogeneous. That is intelligent versus dull, boys versus girls etc. It is good to make the weak students the heads of the groups. Cooperative learning strategy enables two or more students to interact with the common goal of mastering academic materials. He further explains that, cooperative learning calls for easy analysis and the method generalized to more complicated group learning approaches.

The researcher observes that, the restructuring of the learners into groups is done accordingly so that no group should contain only bright or dull learners; rather there is need for forming heterogeneous groups. And the number of the groups to be formed supposes to be relative depending on the sizes of the whole classes.In a research, Ozokeraha (2009) lists five benefits of CLS and from where the researcher deduces advantages and disadvantages of CLS as follows:

Advantages of CLS

1) Cooperation and teamwork are highly encouraged among pupils

2) It is pupil centered

3) The learning is made very interesting as each group uses relevant instructional materials

4) The learning is made more meaningful and permanent.

Disadvantages of CLS

i. It is employed only by experienced teacher

ii. It is time consuming,

iii. It requires many facilities.

iv. If care is not taken, slow learners can easily be hindered.

In the preparation of mathematics lessons, teachers are expected to have a teaching strategy to be used to ensure effective teaching. Ahmed (2000) states that "effective and efficient learning of mathematics do not just happen at once, rather they take time and must

be planned". This opinion calls for proper planning of lesson for achievement of effective learning. Therefore, planning for classroom instruction can be considered inevitable. Abdullahi (1998) states that "when a teacher is planning a lesson his first step is to ask himself these two questions: what do I want the students to know, understand or do and how will I determine if the students know, understand or do? With these in mind, the teacher will design a sequential lesson plan which will enable his students demonstrate in several different performances, that they have learned the materials". Considering the above, one can deduce that, once a teacher is to go to a class to teach, he must have in mind what is to be learnt and as such he should start planning of how the learning will take place thereby choosing the suitable strategy or strategies as the case may be to ensure effective learning.

Furthermore, Mohammed (1997) defines lesson plan as "a complete outline of the objectives, contents and procedures for teaching a single or double period lesson". According to this definition, planning of lessons involves planning of procedures for teaching that embody selection of relevant teaching strategies to improve the teaching and learning, Mohammed (1997) brings what he calls "rational for lesson planning" after stating that the best teaching is mostly achieved by careful planning and preparation as follows:

a. Lesson planning offers organization and direction to the teacher's efforts.
b. Lesson planning helps teachers to visualize a clear logical sequence of increments of knowledge leading to a comprehensive coverage of the subject matter.
c. Lesson planning can help teachers avoid covering too much at a time, and can save them

from not having enough to do in a lesson, etc.

Different modes of lesson plan have been developed by experts, for instance, Uchenna (2001) brings a mode of lesson plan which includes: topics, class, duration, instructional objectives, instructional techniques, pre-requisite knowledge, instructional materials and instructional procedures (in steps). The researcher sees this model as appropriate as it creates rooms for using teaching strategies. The lesson plan model appears modern and relevant, however, this does not mean the best model, it can be used accordingly.As a result of this the researcher used experimental lesson plans and conventional lesson plans. Continuous assessment is not a new concept in Nigerian schools. The concept was ushered in by the National Policy on Education (1998) and the national curriculum conference held in Lagos in September, 1969. This system replaced the previous method of classroom assessment which was a one-shot examination (Okpala, Onocha & Oyedehi, 1993 & Nwana, (1997). Even though, Azikiwe (1998) states that "the system is criticized to have some inadequacies and abnormalities". Hence, the federal government of Nigeria adopted continuous assessment practice as the mode of educational assessment at all levels of education (Popoola, 2009). According to the above, continuous assessment has been in practice in the Nigerian schools for long time. Ohuche (1988) stated that, implementation of continuous assessment in Nigeria was done through two agents. One is evaluation unit of federal ministry of education, science and technology in mid 1979 and the other is the activities of the National Teachers Institute in October in 1984. It is used in grading students' achievement at the end of a term or semester, A good teacher "can use it to motivate the learners to put more efforts in learning. Despite its importance, it has some

short comings which make it to be criticized according to Azikiwe (1998). These shortcomings include favoritism, using invalid test items and use of inappropriate technique of getting information about a pupil.

Popoola (2009) defines continuous assessment as a classroom strategy implemented by teachers to ascertain the knowledge, understanding and skills attained by students". According to this definition, CA is used to ascertain the extent to which learning materials are assimilated or not. However, many primary school teachers do not use this strategy accordingly (Popoola, 2009).

Owotabi *et' al* (2009) opined that, mathematics CA score relates positively and significantly with mathematics performance test and also contributes significantly to the variance of students performance in mathematics. The researcher sees scoring of CA test or CA assignment as very important since it plays significant role in discovering improvement or otherwise in the pupils knowledge. The scoring should be done objectively and the feed back to be given to the pupils.

Assessment as seen by Nikko (1996),'in Owolabi & Etuk- Iren (2009) "is a process of obtaining information that is used for making decisions about students' curricula programmes and educational policy". Popoola (2009) recommends that continuous assessment could be undertaken as at when due. Adequate CA materials should be provided to schools for effective practice. CA unit should be established to monitor uniformity and practice of CA in schools. Lastly classroom teachers should be minded to go for re-training courses on CA. Considering the recommendations made by Popoola above,

the researcher suggests that, since adequate funds will not be provided, teachers are supposed to be encouraged to devise some practicable and manageable ways to employ CA to improve teaching and learning of mathematics. The researcher further suggests the following ways that he sees as practicable and manageable:

1. Through improvising relevant instructional materials using available local materials.
2. Through sacrificing of time and money for benefit of humanity having in mind that such deeds do not go in vain.

Therefore, the researcher used assignments and classroom activities which are parts of CA to strengthen the understanding of the pupils in all the three classes. Which were taught using different strategies.

2.06 Contributions of Learning Theories to Classroom Instruction

In order to review the theoretical framework some learning theories are hereby reviewed under the following sub-headings :

2.06.1 Behaviorally Oriented Theory

2.06.2 Cognitively Oriented Theory

2.06.1 Behaviorally Oriented Theory

Psychologists have developed different learning theories to explain how learning takes place. For instance, Robert et al (1983) opines that "central to all behaviorally oriented theories is the definition of learning as a change in overt behavior. The child is born empty of

psychological content. Behaviorists rely exclusively on behavioral change as an indication of learning. Overt behavioral acts such as staring pointing, writing and demonstrating are used as examples of knowledge that has been acquired and can be measured. Perhaps the most descriptive term in behaviorists learning theory is Stimulus Response (S-R).

Another psychologist, Gagne (1985) advocates that, before learning specific skills a teacher should identify the prerequisite skills and make sure the learners possess them. He specifies list of building blocks as a learning hierarchy. He classifies learning into eight and presents them in hierarchical order as:

a. Signal learning
b. Stimulus response learning
c. Chain Learning
d. Chain (verbal association)
e. Multiple discrimination learning
f. Concept learning (Principle or rule learning)
g. Problem solving.

To strengthen Gagne's point of view about learning, Onyeargwu (2009) states that "stimulus response learning is seen as the function of the strength of the bond or connection or association between a given stimulus and given response (example. Thorndikean S-R conditioning experiment). Here the reinforcement is necessary if the response becomes more precise". In light of what Onyeargwu opines, the researcher sees reinforcement as relevant to be employed in teaching using AVS and CIS in order to

improve academic performance of primary pupils as well as to improve their retentive levels and the ability to apply the already learnt materials to solve related problems through praising the pupils or group of the pupils for work well done.

2.06.2 Cognitively Oriented Theory

Some psychologists such as Robert, Martins, John and Wilmer (1983) have defined learning as an internal act, not as a simple change in overt behavior such definition admits that although overt behavior can indicate that learning hasoccurred, much has been learnt that is not outwardly expressible. Central to this theory is the influence of factors such as environment and experience upon the development of cognitive structures in humans. Jean Piaget ( ) identifies major stages of development through deliberate and extensive research.

Considering the above, the researcher deduces that many psychologists have defined learning in different perspectives. The psychologists formulate theories oflearning which can be grouped broadly as:

a. Behaviorally Oriented Theory (BOT).

b. Cognitively Oriented Theory (COT).

According to BOT which is opined by Ivan Pavlov and others ( ), learning isthe change of behavior due to practice and experience while COT which is opined by

jean Piaget and others ( ) believes that "even though learning can be seen as behavioral change, much can be learnt which may not be seen behaviorally. A learner can fail test because of some factors such as healthy condition. Therefore, both theories (BOT and COT) need to be combined by a primary school mathematics teacher to improve both teaching and learning of mathematics.Having seen what learning is as well as what constitutes it, this research willinvestigate whether the senior primary pupils taught mathematics using AVS and CLS will have better understanding than those taught using Conventional Method.

2.07 Relevance of Learning Theories in Learning Mathematics

Learning theories have been confirmed to have implications in classroom processes by some researchers. Onyeagwu (2009) identifies five classroom implications of S-R learning as:

a. The child must be matured physiologically and neurologically before being engaged in learning activities.
b. Teachers should motivate learners through the agency of rewards rather than punishment.
c. Learning task presented to learners should be meaningful and should be within the reach and capability of the learners.
d. Teachers should teach from simple to complex and from known to unknown.
e. Class activities should be pleasurable to learners and opportunities should be provided to learners for rehearsals and periodic review of learned tasks.

The researcher considers the learning theories and comes up with the following as the general classroom implications:

i. Teacher should know thoroughly the subject matter.
ii. Teacher should understand the psychology of his learners.
iii. The learning tasks should be arranged sequentially from simple to complex.
iv. Before a child (learner) learns something he must have reached maturational level of learning it. Therefore the learning tasks should be within the reach of the learners.
v. Lessons objectives should be stated in behavioral terms that can be measured.
vi. Classroom should be made conducive for learning.
vii. Relevant and suitable tools can be employed to evaluate lessons.
viii. Use of rewards for good doings and punishment for bad ones should be employed in teaching-learning processes.
ix. Suitable materials can be used to aid teaching and learning of mathematics.
x. Strategies should be developed to improve teaching and learning of mathematics in accordance with the social changes. Here the theories have regarded the use of teaching strategies even though they are developed long ago.

Having seen the definitions of learning, the learning theories and the relevance of learning theories in classrooms, the researcher opines that learning mathematics in Nigeria is surrounded by many obstacles that can hinder smooth teaching, characterized by pupils/students' fear of mathematics and remarkable failure of mathematics in Common Entrance Examination, WASSCE and NECO examinations as well as considerable attempt to

commit examination malpractices during the examinations.Ale (1989) when mentioning students' problems in learning mathematics states the following:

a. General poor background
b. Poor teaching
c. Inadequate text
d. Fear of mathematics
e. Lack of interest
f. Psychological barrier.
g. Lack of planning
h. Inspectorate inadequacies
i. Public ignorance on the use of mathematics

Sule (1991) in Sule (2009) ensures that there are some general problems of learning mathematics in the Nigerian school environment. These include:

a. Lack of or inadequate supply of resources materials.
b. Unavailability's of curriculum guides in classrooms.
c. The low status of the teachers.
d. Ineffective teaching methods.
e. Poor supervision of instruction.

Ukuje (1991) in Sule (2009) states that "a lot of students in our school systems, particularly female students, run away or shy away from mathematics on the traditional belief that it is very difficult subject and this is derived from the way most of the teachers present the subject to the students.

Considering what the researchers cited here, it can be confirmed that many of the problems of learning mathematics found, still exist, and what is appealing to the mathematics teachers are to devise ways out to improve the situation. Ale (2006) opines that students' performance in mathematics in public examination leaves much to desire. There have been constant lamentations on the poor outing of senior secondary schools students in public examinations particularly, West African Examination Council (WAEC) and National Examination Council WAEC (1997) notes that many students fail to answer questions relating to quadratic and inequality graphs which can greatly affect their performance. Obodo (1991) in Udegbe (2009) lists some topics that have no cultural bearings in our locality and because of which students find them difficult. They include vectors, correlation, polynomial, standard scores, partial fractions, determinants, matrix multiplications etc. Lawal et al., (2009) has extracted fromreturned questionnaire designed for students which reveals the topics plane and solid menstruation, rational numbers, commercial and financial arithmetic, construction and locus, approximation and estimation geometry and uses of graphs as not well covered by their teachers while teachers cover topics like logarithm, probability, numbers system and trigonometry. NERDC (2007) in 9-years basic mathematics curriculum mentions six major focal themes which include

number and numeration, basic operations, measurement, algebraic process, geometry, menstruation and every day statistics.

The researcher opines that, since the topics learnt at senior secondary schools have some bearing at primary school then, the areas or rather topics that trouble students in SSCE examinations may have their prerequisite not satisfactorily assimilated at the primary school level. Therefore, this study will endeavor to determine among others the usability of AVS and CLS in primary schools mathematics teaching whose success in the key to the success in the secondary schools and tertiary institutions mathematics taking into account the topics plane and solid menstruation, geometry and measurement in primary six which Lawal (2009) investigated as not well covered.

2.08 Conventional Methods of Teaching Mathematics

There are several methods of teaching mathematics. Africa Social and Environmental Studies Programme (1994) sees teaching method as the general approach to conducting a lesson" therefore, teaching methods can be deduced from the above definition as a suitable way by which a teacher can achieve teaching objectives. Different methods have been developed and none is the best. Mathematics teachers at primary and secondary schools should be very considerate when selecting teaching method.

National Commission for Colleges of Education (NCCE) (2009) mentions mathematics teaching methods at primary schools as follows: discussion method, demonstration method, discovery method, assignment method and so on. The researcher

sees the conventionality of these methods when they are used without inclusion of any relevant instructional materials and (or) disregarding any relevant activity of interest to the pupils as well as colorfulness of explanation, demonstration or discussion. In other words, when these methods are employed using chalk-talk-and-cane approach, the researcher sees them as conventional. The researcher also opines that conventional teaching can instill fear in minds of the pupils.

2.09 Relevance of Teaching Methods in Teaching Mathematics

NCCE (2002) in Okeke opines that teachers are to use several teaching methods when effective teaching and learning are desired" here the researcher deduces that for effective teaching and learning of mathematics to take place, mathematics teachers should employ varieties of teaching methods accordingly some situation may demand the use of a single teaching method while others may require more than that. Josiah and Okebukola,(2001) in Okeke (2009) are on the view that "use of inappropriate teaching method and instructional materials lead to mass failure in public examination" NTI (2006) states that "there is a movement away from the behavior method of direct teaching as in lecture method, note coping and dictations, where the learners are given solved mathematics solutions to ,memorize and regurgitate to constructive instructional models where the learners are required to produce and use knowledge". Josiah (2000) points out that, teacher's poor teaching methods lead to mass failure in mathematics. Madu (2004) observes that the present instructional methods used in teaching mathematics and sciences in our schools do not augur well for acquisition of mathematics and science.

2.10 Contributions of Teaching Strategies to Classroom Instructions

Teaching strategies according to some research findings are found useful in improving teaching and learning mathematics. Ololobou (2008) opines that teaching strategies are plans for success in classroom instruction, Ahmed (2000) when describing teaching strategy points out that "effective and efficient learning of mathematics do not just happen at once rather it takes time and must be planned". In light of the above, well planned activities designed to improve both teaching and learning of mathematics are considered as teaching strategies. This is the reason for the researcher to use the three packages for the two experimental groups and one control group.

2.11 Empirical Studies on Aesthetic Value and Cooperative Learning Strategies

Empirical studies have been conducted on Aesthetic Value and Cooperative Learning Strategies regarding their suitability and usability in teaching mathematics in secondary schools and the findings showed that the strategies could be tried in improving performance of pupils in mathematics as well as their abilities for retention and transfer.For instance, Kurumeh& Iji (2009) carried out a research on improving students achievement in solving algebraic word problems using Aesthetic Value Strategy and found out that:

i) Students taught using AVS had better performance than their counterparts taught using conventional strategy. This shows that AVS can be employed in Gwale Local Government Primary Schools in teaching mathematics to confirm whether pupils performance can be improved thereby reducing degree of mathematics phobia as well as the rate of malpractice

in mathematics classwork assignment and even during common entrance mathematics examination.

ii) It was also discovered that AVS was male pupils friendly even though this findingcan be relative.

Okolo (2007) in Kurumeh& Iji (2009) suggested that, the use of AVS in teaching mathematics could go along way to capture students' interests. Therefore if AVS is applied skillfully pupil's interest could be aroused, thereby improving their performance.

Eisner (1985) and Nelson (2000) in Kurumeh et. 'al (2009) discovered that if students are allowed to enjoy the beauty and elegance found in mathematics as the mathematics itself is aesthetic and beauty, then students interests towards learning mathematics will be improved and their attitudes changed which can improve performance and ensure retention and ability to transfer knowledge.

Ozocheraha (2009) found out that despite the complex nature of problem solving in mathematics, Cooperative Learning Strategy (CLS) was able to simplify it. This goes on to say that, no matter the difficulty of a concept it can be developed using CLS so long as it is applied skillfully. He further discovered that students retention ability can be improved using this strategy.

Considering the empirical findings of both AVS and CLS by more especially Kurumeh *et a/,* (2009) and Ozocheraha (2009) the researcher reviews that, both the strategies are good to be employed in teaching mathematics. Even though the studies were carried out

in secondary schools, the researcher now intends to carry out the studies in primary schools to see their applicability and usability as well as their differential effects in improving teaching and learning of mathematics.

2.12 Implications of Reviewed Literature on the Present Study

It had been discovered that, the reviewed literature had considerable implication on the present study in the following ways:

- The research topics used by Kurumeh Iji (2009) and Ozocheraha (2009) dealt with Aesthetic Value and Cooperative Learning Strategies separately in relationto Conventional Methods. However, the present topic combined the two strategies to find their deferential effect.

The population used by Kurumeh &Iji (2009), Ozocheraha (2009), Akimbobola(2009) Nicolas (2002), Slavin (1990) and Udousuro (1991) were secondary school students but the present research used primary school pupils to determine relevance or otherwise of the AVS and CLS. The instruments used by Ozocheraha (2009) were observation technique and group processing which he defined as self-evaluation, Kurumeh& Iji (2009) used conventional lesson plans, experimental lesson plans as well as test of achievement and Slavin (1990) used computer. However, the present research used experimental lesson plans, Test of Performance (MPT), Test of Application (TOA) and Test of Retention (TOR).

The research design the present research used was quasi–experimental of randomized pre-test, post test design while Kurumeh & Iji (2009) used quasi-experiment of non equivalent control group to source valid and reliable data. Analysis of co-variance (ANCOVA) was used by Kurumeh &Iji (2009) while the present research used analysis of variance (ANOVA) to determine deferential effects among the independent variable AVS, CLS and CM.

The strategies AVS and CLS were used in secondary schools and proved relevant in improving quality and quantity of mathematics teaching and learning. However, the present study was conducted in primary schools in Gwale Local Government Kano. Teaching and learning mathematics in Nigeria were reviewed to have problems that contribute in making mathematics difficult subject. The researcher hoped that findings of the present study would possibly provide some improvements in the teaching and learning in the primary school mathematics. It was reviewed that learning theories contributed significantly in teaching and learning mathematics at all education levels in Nigeria and if the theories were used along side with AVS and CLS teaching mathematics of more especially difficult concepts which did not have cultural bearing would hopefully be made possible with ease and better performance.

It was reviewed that, teaching methods are indispensable in teaching and learning mathematics and brought the justification for the use of teaching strategies. Therefore, the present research used AVS and CLS with the hope to

make the teaching –learning process very lively to bring about positive change in performance, retention and application.

Mathematics was reviewed to be inevitable for scientific and technological development and needed to be taught effectively at more especially primary school level(Okpala, 2009). Since the other levels of education depend upon the foundation laid at the primary. This made the researcher, to conduct the study at the primary school with the hope to improve qualities of performance, retention and application. Understanding mathematics at the higher levels could hopefully be made easy and more quantitative as well as more qualitative.

CHAPTER THREE

RESEARCH METHODOLOGY

3.01Introduction

This study aimed at investigating the Effects of Aesthetic Value and Cooperative Learning Strategies on Primary Pupils Mathematics Performance, Retention and Application in Kano state, Nigeria. Therefore, this chapter dealt with research design, population of the study, drawing of sample for the study, instruments for data collection, validation and reliability of the instruments, pilot study, administration of treatment, data analysis procedure and data analysis. The chapter was presented in the following sub-headings:

3.02 Research Design

3.03 Enrolment of Kano State Public Primary Schools

3.04 Population of the Study

3.02 Research Design

The study used quasi-experimental design with pe-test, post-test 1, post-test2, post-test 3, experimental group 1 (EG1), experimental group 2 (EG2), and group (CG). In the design, both the experimental groups and control group were pretested to ensure equivalence in their ability, after which they were exposed to treatment for six weeks at the end of each post-test 1 was administered to

determine the primary pupils performance in MPT. One Week later, the post-test2 was administered to determine primary School pupils ability to apply the acquired knowledge. Two weeks later the post-test 3 was administered to determine the primary school pupil's retention ability. The research design was illustrated in figure 3.1 below:

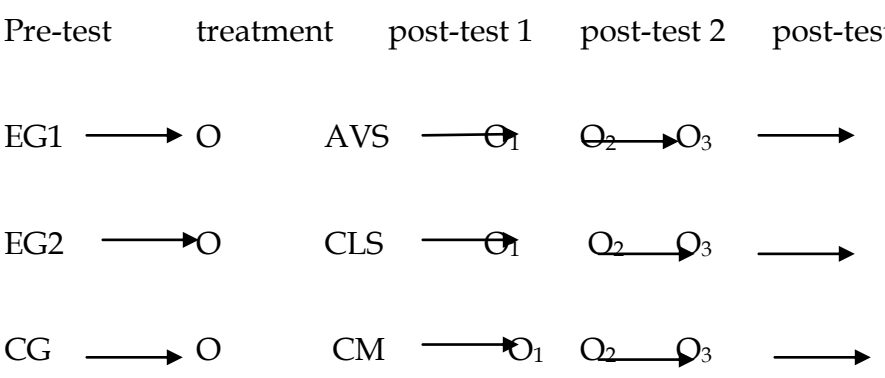


Figure 3.1 Research Design Illustration

EG1 –Experimental Group1 O- Pretest

EG2 –Experimental Group2 O_1-Post test1

C- Control Group O_2- Post test2,

O_3- Post Test3

3.03 Enrolment of Kano State Public Primary Schools by Sex and L.G.E.A 2011

This study investigated effects of aesthetic value and cooperative learning strategies on primary pupils mathematics performance, retention and application

in kano state. Below is the list of all primary schools and senior primary pupils in kano state

S/N	L.G.E.A.	No. of Schools	Male	Female	Total
1.	Ajingi	12	2120	1950	4070
2.	Albasu	13	1130	1019	2149
3.	Bagwai	19	1634	1013	2647
4.	Bebeji	13	2747	2381	5128
5.	Bichi	15	5563	5007	10570
6.	Bunkure	19	4446	3615	8061
7.	Dala	22	11382	3110	16492
8.	Danbatta	18	2832	2521	5353
9.	D/Kudu	15	3200	2600	5800
10.	D/Tofa	13	3090	2350	5440
11.	Doguwa	29	3133	2998	6131
12.	Fagge	18	2100	2212	4312
13.	Gabasawa	13	6527	5221	11748
14.	Garko	10	2452	1969	4421
15.	G/Malam	10	2005	2188	4193
16.	Gaya	17	3394	2925	6319
17.	Gezawa	15	3486	3244	6730
18.	Gwale	19	9293	9293	8510

19.	Gwarzo	17	3919	3832	7751
20.	Kabo	10	2558	2135	4693
21.	Kano Municipal	24	12070	11792	22862
22.	Karaye	12	1975	907	2882
23.	Kibiya	10	213	224	437
24.	Kiru	11	3054	3048	6102
25.	Kumbotso	24	8918	13205	22123
26.	Kunchi	9	1223	1206	2429
27.	Kura	9	2531	2910	5441
28.	Madobi	10	2312	2307	4619
29.	Makoda	8	1358	1232	2790
30.	Minjibir	13	3711	3453	7166
31.	Nassarawa	22	15770	17762	33532
32.	Rano	9	1888	1625	3513
33.	R/Gado	8	1260	485	1745
34.	Rogo	13	3392	2695	6087
35.	Shanono	12	2815	2421	5236
36.	Sumaila	14	1483	1572	3055
37.	Takai	9	3201	2658	5859
38.	Tarauni	20	1947	1727	3674
39.	Tofa	8	1692	1703	3395
40.	Tsanyawa	12	2614	2381	4995

41.	T/Wada	17	3153	1939	5092
42.	Ungogo	24	6698	7810	14508
43.	Warawa	13	2272	2298	4570
44.	Wudil	10	3484	3378	6862
	Total		**144231**	**335378**	**143373**

3.04 Populationof the Study

The population of this study consisted of all senior primary pupils of 19 government primary schools which comprised of 9,293 boys and 8,521 girls as shown in the table below;

Table 3.1: population

S/N	Names of schools	No. of Pupils	Male	Female
A1	Dandago Special Primary School	1,031	517	514

A2	Warure Special Primary School	1,273	752	521
A3	Sani mai Nagge Special Primary School	083	548	436
A4	Tudun Yola Special Primary School	1,202	598	604
A5	Mai Tasa Special Primary School	893	450	443
A6	Muhd Rabi'u Special Primary School	728	376	352
B7	Gwale Special Primary School	1,341	720	621
B8	Kofar Kabuga Special Primary School	957	554	403
B9	Kofar Waika Special Primary School	888	481	407
B10	Abdu na Liti Special Primary School	724	313	411
B11	Dukawuya Special Primary School	1,222	592	630
C12	K/Naisa Special Primary School	1,415	608	807
C13	Dorayi Special Primary School	826	409	417
C14	Muhd mai gadon kaya Special Pri. Schl.	518	207	311
C15	Ja'en Special Primary School	797	448	349
C16	Jambulo Special Primary School	689	339	350
C17	Gidan Galadima Special Primary School	592		592
C18	Sabon Gida Special Primary School	715	274	441

C19	Dorayi Babba Special Primary School	1,008	515	493
	Grand total	**17,803**	**9,293**	**8,510**

Source: Gwale Local Education Authority Kano, (2011)

3.05 Sample and Sampling Procedure

The study used quasi-experimental design which dealt with experimental and control groups. The researcher intended to randomly form the groups through combining pupils of different classes and found it practically impossible due to lack of extra classes to accommodate two artificial sets of experimental groups and one artificial set of control groups. Consequently, intact classes were used. Also to avoid interaction of the senior primary pupils after administration of treatments which could affect their achievement the 19 government primary schools were grouped into three clusters and labeled A, B, and C on the basis of proximity. From each cluster one primary school was randomly selected using raffled draw. The researcher cut cardboard paper into 19 pieces of the same shapes and sizes. On each piece of the cardboard paper, the name of a school was written. The researcher asked 19 mathematics students of Federal College of Education (F.C.E) Kano to pick one card each. The students were grouped into three clusters. Cluster A, B, and C consisting 6, 6 and 7 primary schools respectively. Sample of the study for each cluster was drawn separately. For cluster A, the researcher used six pieces of papers, on one the word 'yes' was

written on the remaining five the word 'no' was written. The six students in the cluster A, were asked to pick one piece of paper each from a Milo tin after shaking. The students holding the card on which Sani Mai Nagge Special Primary School was written took the one piece of paper on which 'yes' was written as a result, the school formed part of the sample. The same procedure was used to draw sample from the other two clusters B and C. Primary six pupils of three (3) primary schools served as the sample of the study with the total 141 pupils consisting 71 male and 70 female which is reliable to the study in line with control limit theory which recommended minimum of 30 study subject being viable for experimental study (Tuckman, 1975). The table 3.2 below shows the sample of the study:

Table 3.2 Sample of the Study

Name of Schools	Cluster	No. of Pupils	Male	Female
1. Sani mai Nagge Special Primary School	A.	49	26	23
2. Dukawuya Special Primary School	B	45	20	25
3. K/Na'isa Special Primary School	C	47	25	22
GRAND TOTAL		**141**	**71**	**70**

3.06 Instrumentation:

Three Instruments:Mathematics Performance Test (MPT), Test of Retention (TOR) and Test of Application (TOA) were used to collect data for the study, which were developed by the researcher on the topics: perimeter and areas of place shapes and speed. The topics were derived from the sub-theme of 9-year Basic Mathematics Curriculum and they were chosen because Lawal (2009) listed them as difficult in a research titled "Coverage Pattern of Post Basic Mathematics Topics for Attainment of Millennium Development Goals". Below was how the three instruments were used:

a. Mathematics Performance Test (MPT) was used in each school for pre-test and post test 1 to determine the equivalence and achievement of the two treatment groups and the control group. There were ten items in objective part and only two items in essay part set for the three classes. The instruction demanded the respondentsto answer all questions in the objective part and only one in the essay part.

b. Test of Retention (TOR) was made equivalent to MPT and was administered to the two treatments and one control groups in each school three weeks after the MPT to determine retention ability of the pupils but the items were made to look different from those of MPT through re-shufflement and change of some words. The number of items were the same as the ones in MPT.

c. Test of application (TOA) was designed to determine whether the two experimental groups and the control group had the same ability to apply the

acquired intellectual skills to solve other related problems by using words problems. There were two word problem questions derived from the already administered MPT.

3.06.1 Validation of the Instruments

The content of the Mathematics Performance Test (MPT), the Test of Retention (TOR), and the Test of Application (TOA), were made valid by the following experts:

4 Two senior lecturers from Science Education Department with Ph.D in Mathematics Education Faculty of Education, Ahmadu Bello University, Zaria.

5 Three mathematics teachers at the senior primary school level with degree in mathematics and more than five years working experience. These experts examined instructional materials and the vocabulary used in making the three tests looked different, relevant and useful.

3.06.2 Reliability of the Instruments

The instruments MPT, TOR and TOA were used for data collection during pilot study conducted at Maitasa Special Primary School, Abdu na Liti Special Primary School and Sabon Gida Special Primary School. To ascertain the reliability of the instruments, test-retest method was used with interval of two weeks. The reliability coefficients obtained were 0.68, 0.67 and 0.72 for the MPT, TOR and TOA respectively, thereby establishing reliability of the instruments.

According to Olayiwola (2007) the higher the reliability coefficient, the better the reliability.

3.07 Development and Validation of Content of Aesthetic Value Strategy Package

The researcher developed an Aesthetic Value Strategy Package which containedten activities as presented in the appendix ii on the topics perimeters of plane shapes, areas of plane shapes and speed. The activities were planned in such a way that, they could arouse interest of the pupils. They included:

Activity 1: Drawing of triangle and trapezium as well as measuring oftheir perimeters using threads and meter rule.

Activity 2:

a. Draw a rectangle of length 6cm and breath 4cm
b. Draw a circle of radius 6cm
c. Use thread and ruler to measure the perimeter of your mat at home.

Activity 3: find perimeter of rectangle whose length is 7cm and breadth 4cm (using formula)

For the development of the activities, the mathematics curriculum for Basic 6 was used. Some of the activities were drawn from the activities suggested by the curriculum. The face and content validity were made by the two senior

lecturers from Science Education Department with Ph.D in Mathematics Education and one mathematics teacher at the senior primary school level, with Degree in Mathematics and more than five years working experience. The wordings were made to be within the rich of the pupils.

3.08 Development and Validation of Content of Cooperative Strategy Package

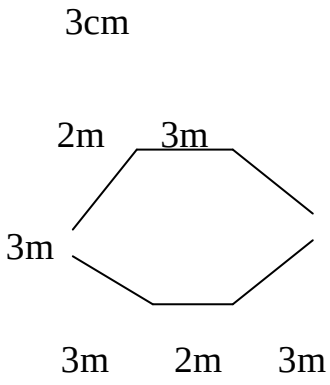
The researcher developed cooperative learning strategy package which contained eight activities as presented in appendix ii on the topics perimeters of plane shapes, areas of plane shapes and speed. The topics were drawn directly from the basic six mathematics curriculum. The activities designed went in line with the ones in the curriculum. The activities included the following

Activity 1: a) find perimeters of the following shapes without using formula:

ii) 2cm

i) 5cm 4cm

iii) 

iv) 

b) Draw a circle of radius of your choice and use meter rule and thread to measure its perimeter

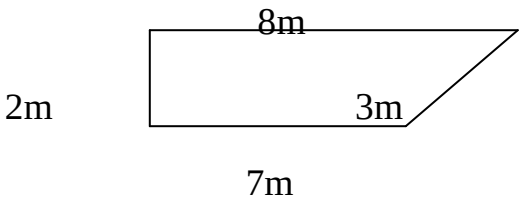
(do in your exercise book)

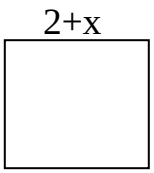
Activity 2: Use ruler and thread to measure the perimeter of the floor of your room at home

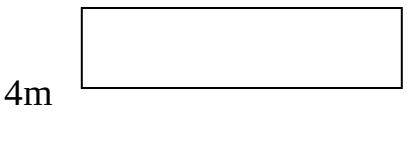
Activity 3: Use formula to find perimeter of

i. rectangle of length 7^{th} and breadth 4m.

ii. trapezium



III. 

iv 

6m

3.09 Development and Validation of Content of Conventional Method Package

The researcher developed Conventional Method Package which consisted of ten activities as presented in appendix iv on the topics perimeters of plane shapes, areas of plane shapes and speed. The topics were drawn directly from basic six mathematics curriculum. The activities designed went in line with the ones in the curriculum. They included the following:

Activity 1: Drawing of triangle and trapezium, and measuring of their perimeters using threads and meter rule.

Activity 2: a. Draw a triangle of length 5cm and breadth 3cm.

b. Draw a circle of radius 5cm.

c. Use thread and ruler to measure the perimeter of your mat at home.

Activity 3: 1.Use your words to say what perimeter of a plane shape is.

2. Draw any five plane shapes of lengths your choice and find their perimeters using or without using formulae.

3.10 Administration of Treatment

In the course of the research, the primary six pupils in school A, were taught using Aesthetic Value Strategy (AVS), the primary six pupils in school B, were taught using Cooperative Learning Strategy (CLS) and the primary six pupils in school C, were taught using Conventional Method (CM).

3.10.1 Experimental Group 1

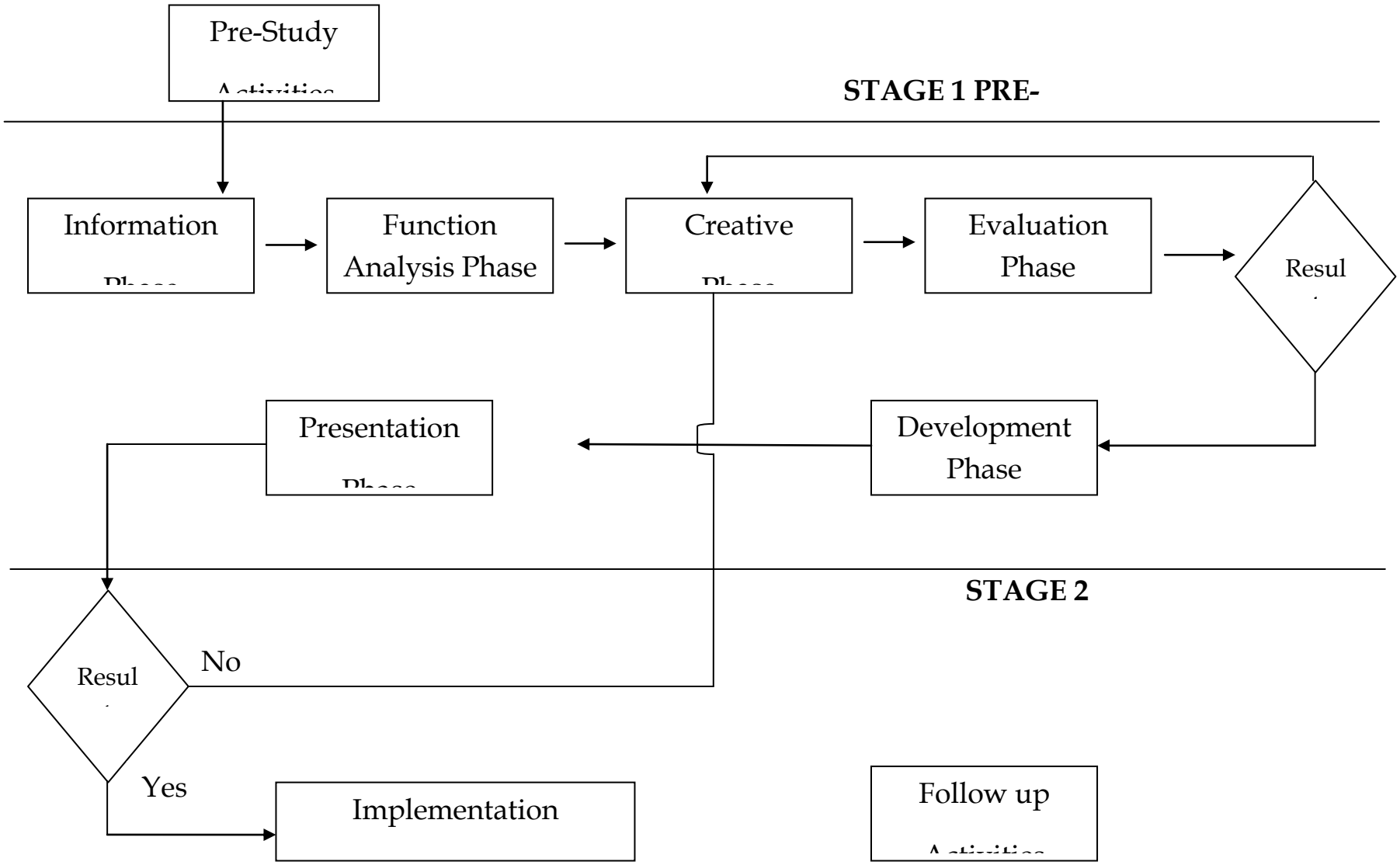
This group was drawn from cluster A. which comprises 49 primary six pupils of the school A taught using AVS and the topic were drawn from the sub-theme measurement which was also drawn from mathematics curriculum for primary six level.

The administration lasted for six weeks the following were the procedures used for the collection of data:

1. Three days training of two research assistants who were also mathematics teachers in the school.
2. Orientation on the Aesthetic Value Strategy class concerning the skills used to benefit from instruction such as: listening, asking questions, carrying out activities, using instructional materials etc
3. Exposing experimental group 1 to pretest to determine equivalence in their academic abilities in relation to other pupils in the other two schools.

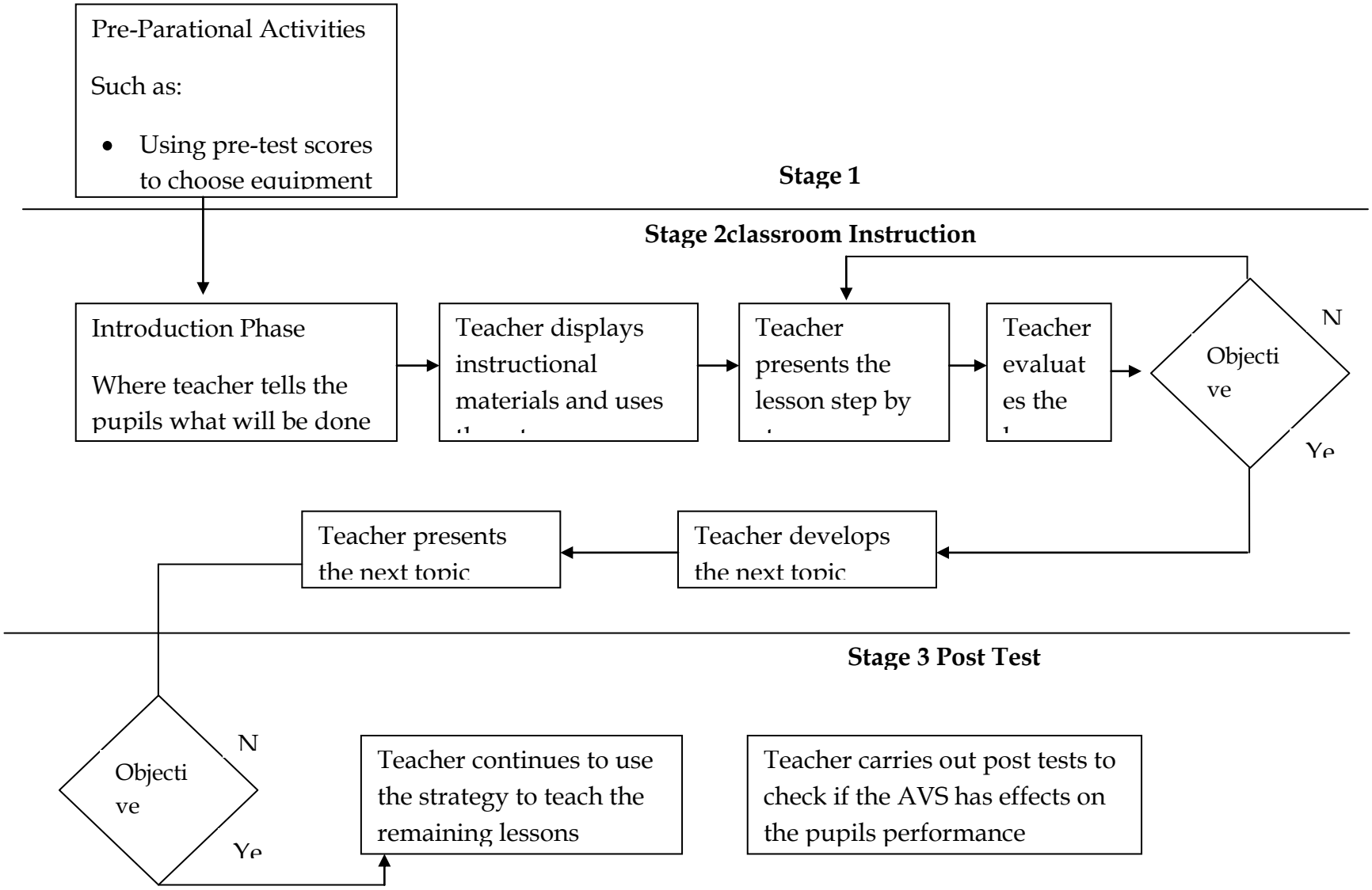
4. Exposing experimental group 1 to the treatment using AVS lesson plans and AVS package
5. Exposing experimental group 1 to the post test 1 post test 2 and post test 3. (MPT, TOT and TOA) to determine the pupils performance, retention abilities and ability to apply the acquired mathematics knowledge to solve related word problems.

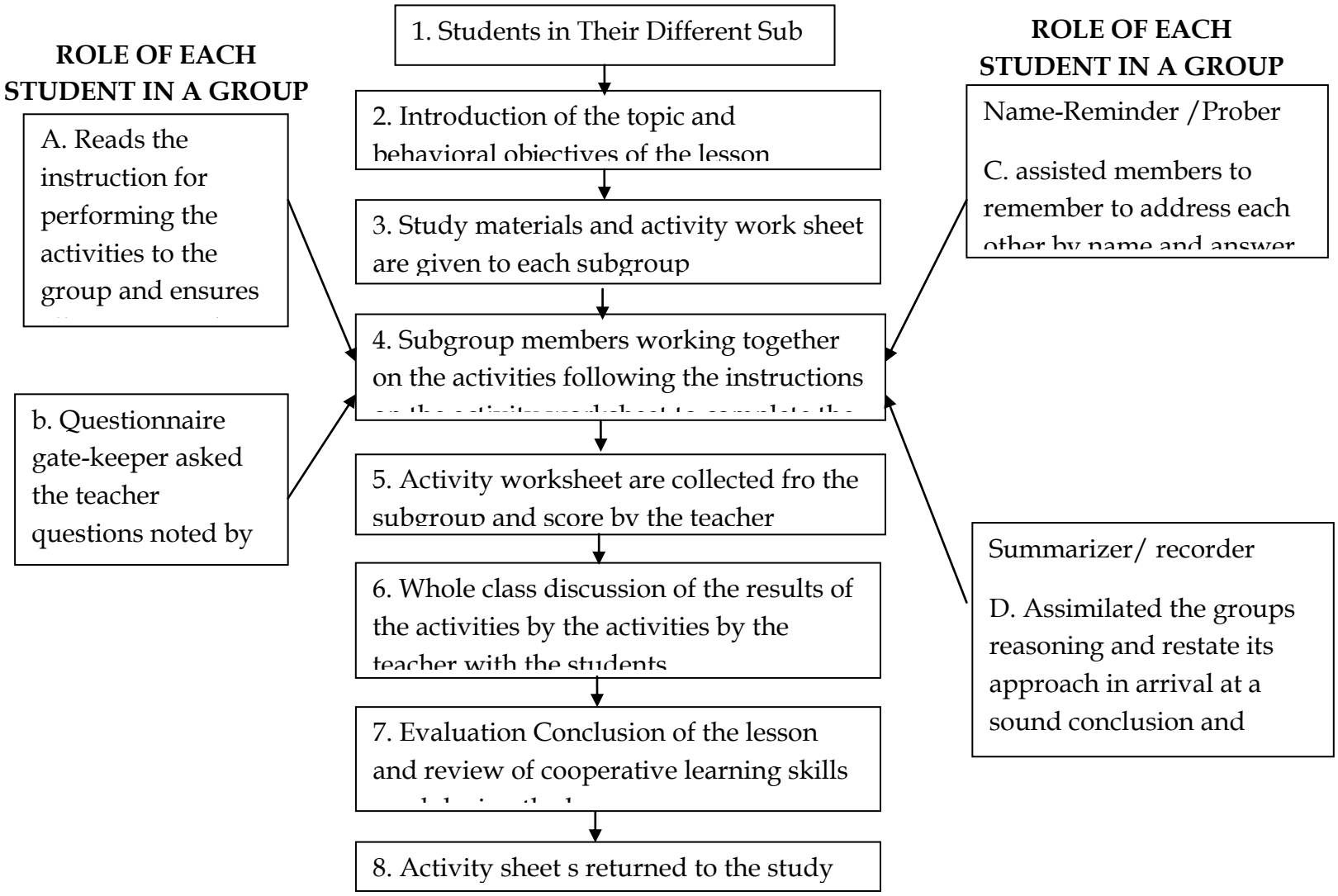
Below is the flow chart of Aesthetics Value Strategy adopted for the study



Value Study Flow Diagram Developed by International Value Standard, 2007 Edition

For the Purpose of Execution of AVS in Classroom Situation Researcher Modified the Above Flow Chart As:





Source: Adapted Johnson (1975) Model by Olorukooba, (2001)

3.10.2 Experimental Group 2

This group was drawn from cluster B, which consisted of 40 primary six pupils of the school B taught using cooperative learning strategies (CLS), the primary six pupils were taught measurement. The treatment administration lasted for six weeks and was done using the following procedures planned carefully to collect relevant data:

1. Three days training of two research assistants who were teachers in the school as they knew the pupils' academic abilities better as well as their conduct. This helped in the formation of heterogeneous academic ability groups.
2. Orientation of the Cooperative Learning Strategy class on the grouping and how they would behave in terms of obedience, discipline, cooperation participation, patience and hard work.
3. Exposing experimental group2 to pretest to determine the present status with regard to topics under consideration and the results helped in choosing the class used for the study.
4. Exposing experimental group 2 to the treatment using CLS lesson plan and CLS package.
5. Exposing experimental group2 to post test 1, post test2 and post test3, (MPT, TOT and TOA) in order to determine the pupils' performance retention abilities and ability to apply acquired skill to solve related word problems.

The researcher adopted the flow chart of Cooperative Learning Strategy Model presented below:

3.10.3 Control Group

This group was drawn from cluster C, which consisted of 48 primary six pupils of school C, the pupils were taught using conventional method (CM). This method allowed for using explanatory approach where the teacher held cane and the teaching was teacher-centered. This was what the researcher observed before the research topic was proposed.

3.11 Procedure for Data Analysis

For analysis of the data collected, using MPT, TOT and TOA descriptive statistics, mean and standard deviation were used to answer the research questions while for testing the null hypotheses, Ho_1, Ho_2, Ho_3 F-ratio was used at 0.05 level of significance and the null hypotheses were rejected at 0.05 probability value, Scheffe tests were employed to locate where the significant differences actually existed.

3.12 Pilot Study

In order to ascertain the feasibility and reliability coefficients of the instruments of the study, a pilot study was conducted at Mai Tasa Special Primary School, Abdu na Liti Special Primary School and Sabon Gida Special Primary School where intact classes of primary VI were used.

Each school was treated separately. At Maitasa Special Primary School, the pupils were taught using AVS, (constituting experimental group1) and at Abdu na Liti Special Primary School, the primary six pupils were taught using CLS (constituting experimental group2) while the primary six pupils of Sabon Gida Special Primary School, were taught using conventional method (constituting control group). The study lasted for three weeks and MPT, TOR and TOA, where administered TOR was employed two weeks after the administration of MPT while for TOA, it was administered a week after the administrationof MPT. ANOVA was used to test Ho1,Ho2 and Ho3 which were all rejected at 0.05 level of significance. Scheffer tests were later carried out and the results confirmed significant difference between experimental group 2 and control group in the first test, significant difference between experimental groups and control group was confirmed in the second test while in the third test, significant difference between the two experimental groups and the control group was confirmed. And means as well as standard deviations were used to answer the three research questions.

The following were discovered during the pilot study:

6 Determining further the validity and usability of the instruments

7 Determining the reliability coefficients of the instruments.

8 Determining the proper way of administration of the instrument,

9 Making proper estimate of the amount to be spent for the production of the

instruments.

10 Checking the approp/he statistical instruments to be used for the analysis.

11 Estimation of time to be used for conduct of the treatments (i.e. Periods)

12 Checking the usability of experimental lesson plans.

13 Checking the appropriateness of the research design.

14 Confirming equivalence in the three packages used for the AVS, CLS and CM.

CHAPTER FOUR

RESULTS, ANALYSES AND DISCUSSIONS

4.1 Introduction

This study focused on investigation of Effects of Aesthetic Value and Cooperative Learning Strategies on Upper Primary Pupils Mathematics Performance, Retention and Application in Kano, Nigeria. This chapter presented analysis of data, summary of the results and discussions of the findings. The chapter was presented in the following subheadings:

4.2 Data Analyses and Null Hypotheses Testing

4.3 Summary of the Major Findings

4.4 Discussions

4.2 Data Analyses and Null Hypotheses Testing

For the purpose of data analysis, the research hypotheses were re-stated for testing at significant level 0.05. The results obtained from testing the null hypotheses and discussions of the results were presented below:

4.2.1 Results for Testing Null Hypothesis 1 Using Analysis of Variance

H_{01}: There is no significant difference in the academic performance of the upper primary pupils taught mathematics using Aesthetic Values Strategy (AVS), Cooperative Learning Strategy (CLS) and those taught using Conventional Method (CM).

The data generated through administration of Mathematics Performance Test (MPT) to the two experimental groups (EG 1 and EG 2) and one control group were subjected to F-ratio (analysis of variance; ANOVA). Summary of the analysis was given in the Table 4.1.1.

TABLE 4.1.1:Summary of Analysis of Variance for Mathematics Performance of Pupils in Three Primary Six Classes.

Source	**Sum of Squares**	**DF**	**Mean Square**	**F**	**Sig**
Between Groups	34.88	2	17.44		
Within Groups	614.39	139	4.42	3.95	0.02
Total	649.28	141			

Table 4.1.1 shows the test of significant difference among the performance of pupils in Mathematics Performance Test (MPT) in the three primary six classes labeled primary six A(EG 1), primary six B(EG 2) and primary six C(CG) at the alpha level 0.05 and with degrees of freedom (df) 2, 139, and 141 for between

groups, within groups and residual respectively, the F-test stood at 3.95and the probability value was 0.02.The decision is if obtained probability value is greater than or equal to the significance level 0.05, the null hypotheses is rejected. Therefore, going by the decision rule, the null hypothesis was rejected which implies that, there exists significant difference in the mathematics performance of pupils from the three primary six classes (two experimental groups and one control group).

With the result from hypothesis 1 above, it becomes necessary to verify where the difference lies. Here, there is need to re-subject the data on the three primary six classes to a post Hoc analysis, in this case the researcher decided to use Scheffe for the analysis and the result is presented as follows in table 4.1.2

TABLE 4.1.2: Summary of Scheffe Pairwise Comparison for Difference in Mathematics Performance of Pupils in the Three Primary six Classes.

Primary Six Classes	**Mean Difference**	**Std. Error**	**Sig**	**95%Confidence Interval**	
				Lower Bound	**Upper Bound**
Scheffe EG 2	-0.21	0.43	0.89	-1.29	0.86
EG 1					
CG	0.93	0.43	0.10	-0.13	1.99
EG1	0.21 04.3	0.89	0.86	1.29	
EG 2					

CG1.14* 0.44 0.04 0.06 2.2

EG 1-0.93 0.43 0.10 -1.99 0.13

CG

EG 2-1.14* 0.44 0.04 -2.22 -0.06

The mean difference is significant at the 0.05 level.

The Table 4.1.2 above is necessitated by the need to locate where the significant difference lies among the three classes. It was discovered that there is a significant difference between primary six B (experimental group2, taught using CLS) and primary Six C (control group, taught using conventional method) which is 1.14 and the mean difference is significant with probability value 0.04. However, mean differences of primary six A in relation to primary six B and primary six C are not significant (0.21and 0.93) with probability values 0.89 and0.10 respectively.

4.2.2 Results for Testing Null Hypothesis 2 Using Analysis of Variance

H_{02}: There is no significant difference in the retention level of pupils taught mathematics using Aesthetic Value Strategy, Cooperative Learning Strategy and those taught using Conventional Method.

The data generated through administration of TOR to three groups (EG1, EG2 and CG) was analyzed using analysis of variance as follows:

TABLE 4.2.1:Summary of the Analysis of Variance for Mathematics Retentive Ability of Pupils in the Three Primary Six Classes

Source	**Sum of Squares**	**DF**	**Mean Square**	**F**	**Sig**
Between Groups	23.41	2	11.70		
Within Groups	462.19	134	3.45	3.39	0.04
Total	485.59	136			

The Table 4.2.1 shows that, the Test of Retention (TOR) indicates that, there exists significant difference in the retentive ability of pupils in the three groups taught mathematics using AVS, CLS and those taught using conventional method with degree of freedom (df) 2, 134 and 136 for the between groups, within groups and residual respectively, the F-ratio stood at 3.393 and the probability value 0.04. And as 0.04<0.05, the null hypothesis was rejected.

However, where the difference lies can not be shown by the table 4.2.1, this necessitates the use of post Hoc test to find where the difference lies as presented in the table below:

TABLE 4.2.2: Summary Scheffe Pairwise Comparison for Difference in Mathematics Retentive Ability of Pupils in Three Primary Six Classes

Primary Six Classes	Mean Difference	Std. Error	Sig	95%Confidence Interval Lower Bound	Upper Bound
Scheffe EG 2	0.24	0.38	0.82	-0.71	1.19
EG 1					
CG	0.98*	0.39	0.050.02		1.94
EG1	-0.240.38	0.82	-1.190.71		
EG 2					
CG	0.74	0.40	0.05-0.241.72		
EG 1	-0.98*0.39	0.45	-1.94-0.02		
CG					
EG 2	-0.74	0.400.18	-1.72	-0.24	

The mean difference is significant at the 0.05 level.

The post Hoc table 4.2.2 above shows that, the mean difference in the retention of the pupils in the three groups lies between primary six A(EG) and primary six C(CG) which is .97912 with significance level .045 having .0185 and 1.9397 lower and uppers bounds. The difference is in the Favour of Experimental Group

4.2.3: Results for Testing Null Hypothesis 3 Using Analysis of Variance

$H0_3$: There is no significant difference in the pupils' ability to apply mathematics knowledge between those taught mathematics using AVS, CLS and those taught using conventional method.

The data generated through administration of Test of Application (TOA) was summarized in the table below:

Table 4.3.1 Summary of Analysis of Variance for Mathematics ApplicationAbility of Pupils in Three Primary Six Classes.

Source	**Sum of Squares**	**DF**	**Mean Square**	**F**	**Sig**
Between Groups	123.31	2	61.66		
Within Groups	566.39	139	4.08	15.13	0.00
Total	689.70	141			

The Table 4.3.1 above, shows that, significant mean difference among the three primary six classes exists with the degrees of freedom 2,139 and 141 for the between groups, within groups and residual respectively. The F-ratio stood at 15.13 and the probability value 0.00. This showed that since 0.00 < 0.05 the null hypothesis was rejected. This necessitated the use of post Hoc analysis for multiple comparisons in order to find where the significant mean difference lies as presented in the table below:

TABLE 4.3.2: Summary of Scheffe Pairwise Comparison for Difference in Mathematics Application Ability of Pupils in Three Primary Six Classes.

Primary Six	**Mean Difference**	**Std. Error**	**Sig**	**95%Confidence Interval**

Classes				Lower Bound	Upper Bound
Scheffe	EG 2	-0.03	0.42	1.00	-1.06	1.01
	EG 1					
	CG	1.96*	0.41	0.00	0.94	2.97
	EG1	0.026	0.42	1.00	-1.01	1.06
	EG 2					
	CG	1.98*	0.42	0.00	-0.94	3.02
	EG 1	-0.96*	0.41	0.00	-2.97	-0.94
	CG					
	EG 2	-1.98*	0.42	0.00	-3.02	-0.95

The mean difference is significant at 0.05

The Table 4.3.2 above indicates that, the significant difference lies between primary six A(EG 1) primary six C(CG) in favour of primary six A with mean difference 1.96 and probability level 0.00 Also significant difference exists between primary six B and primary six C in favour of primary six B with mean difference 1.98333 and probability level 0.00.

4.3 Summary of the Major Findings

The study was conducted to find Effects of Aesthetic Value and Cooperative Learning Strategies on Primary Pupils Mathematics Performance, Retention and Application in Kano, State Nigeria Three (3) primary schools were

used. The schools were labeled A, B and C. in each school, one primary six class was used in order to avoid interactions of the pupils that could affect the findings. Each class was taught mathematics using different strategy. After administration of the treatment, each class was tested. The following were findings of the research:

1. It was revealled that academic performance of upper primary school pupils taught mathematics using AVS and CLS was better than the academic performance of upper primary school pupils taught mathematics using conventional teaching method considering the three means (4.41, 4.62 and 3.48) and three standard deviations (1.91, 2.46 and 1.91) for the EG1, EG2 and CG respectively.
2. It was also revealed that, there was no significant differential effect between the upper primary school pupils taught mathematics using AVS and those taught using CLS. The findings indicated that both AVS and CLS were good to be used in teaching upper primary school pupils mathematics.
3. It was revealed that the retention level of upper primary school pupils taught mathematics using AVS and CLS was better than that of their counterparts taught mathematics using conventional teaching strategy by considering the three means (3.82, 3.58 and 2.84) and the three standard deviations (1.78, 2.04 and 1.74) for the EG1, EG2 and CG respectively.
4. Considering the abilities of the upper primary school pupils to apply the acquired mathematics knowledge to solve related problems, it was indicated that the pupils taught mathematics using

AVS and CLS performed better than the pupils taught using conventional teaching method considering the three means (6.04, 6.07 and 4.08) and standard deviations (2.15, 1.96 and 1.93) for the EG1, EG2 and CG respectively.

4.4 Discussions

The aim of this research was to investigate the effects of AVS and CLS on upper primary mathematics pupils' performance, transfer and application in Gwale local government primary schools. To achieve this, two experimental groups and one control group were used. The experimental groups: EG1 and EG2 were taught mathematics using AVS and CLS respectively while the control group (CG) was taught using conventional method (chalk-talk-and-cane approach).The pupils in the experimental and control groups were pre-tested and results revealled equivalence among the three classes chosen from the three schools. The pupils were also post-tested (to determine levels of achievement), post-post-tested (to determine ability to transfer) and post post-post-tested to determine ability of the pupils to apply the knowledge acquired to solve related word problems. It was found that, pupils in -the experimental groups EG1 and EG2 were significantly higher on academic performance, retention and application than those in control groups. It was also found that, there was no differential effects between the two experimental groups taught mathematics using AVS and CLS.

Null Hypothesis 1 (H_{01}): Results obtained from testing null hypothesis 1 using ANOVA indicated that, pupils in the two experimental groups performed significantly different compared with the control groups in Test of Achievement (MAT) with F-value 3.946 and the probability value .022 which revealed that the null hypothesis 1 was rejected. This indicated that, teaching mathematics using the strategies improved upper primary pupils academic performance. This result agreed to what Kurumeh et al (2009) obtained when AVS was used and Ozokeraha (2009), when he used CLS to teach secondary school students mathematics. Both of them found the strategies effective. The findings agreed to what Okolo (2007) observed, as the use of AVS captured students' interest. The post hoc table 4.1.2 indicated that, the significant difference lied between experimental group 2 and the control group which were taught using AVS and CM respectively.

Null Hypothesis 2 (H_{02}): The results obtained from testing null hypothesis 2 using ANOVA indicated that, the retention ability of the pupils in EG1, EG2 and CG were significantly different. The difference was in favour of the experimental group 1 as revealed by post hoc table 4.2.2. This tried to improve the quality of mathematics education which was discovered by Ale (1989) as in a story situation. Even performance in common entrance examination could be improved. The findings also could help to improve the pupils ability to remember what was taught during examinations in common entrance

examination as their performance was described as poor by Usman, K.O and Nwoye M.N (2010). The findings agreed to what Slavin (1990) observed, as the use of CLS improved retention ability of students.

Null Hypothesis 3 (H_{03}): The null hypothesis 3 was tested using ANOVA and the results obtained indicated rejection of the hypothesis thereby accepting the alternative hypothesis as the F-value was 15.13 and the probability value was 0.00. This demanded the use of post Hoc table 4.3.2 which revealled that the significant difference lied between the two experimental groups and the control group in favour of the experimental groups. The Ale's report about examination difficulties could change if the AVS and CLS were used in teaching upper primary school pupils. This result could also supply a remedy to what Obodo (2001) investigated as a problem of teaching mathematics, when discovered that, teachers' problem was the use of inappropriate methods of teaching mathematics. The findings agreed to what Nelson (2000) discovered that the use of AVS would improve students' ability to apply acquired knowledge to solve related word problems. The findings also agreed to what Eniayeju A.A. & Azuka B.F (2010) discovered when they conducted research on the impediments of mathematics teaching at the universal basic education which found the use of inappropriate pedagogical methods to teach mathematics hindered smooth teaching and learning mathematics.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This study investigated the Effects of Aesthetic Value and Cooperative Learning Strategies on Upper Primary Pupils Mathematics Performance, Retention and Application in Kano State, Nigeria. This chapter dealt with summary of the study, conclusion, recommendations, suggestions for further studies and limitations of the study. As such it was presented under the following sub-headings:

5.2 Summary

5.3 Conclusions

5.4 Recommendations

5.5 Suggestion for Further Studies

5.6 Limitations

5.2 Summary

At the beginning of chapter one, it was discovered that National policy on education stressed the need for laying sound foundation at the primary school level to ensure effective teaching and teaming mathematics at higher levels. The use of Aesthetic Value and Coordinative Learning Strategies in teaching

mathematics were encouraged by some researchers such as Ozocheraha (2009) and Kurumeh (2009). There were many reported cases of malpractices in mathematics examinations at all levels of education in Nigeria. For that reason, the study was set to achieve four objectives which included "to determine usability of Aesthetic Value Strategy (AVS) and Cooperative Learning Strategy (CLS) in mathematics teaching and learning in Senior Primary Schools in Gwale Local Government, Kano. Four research questions were formulated to be answered using descriptive statistics. Also three research hypotheses were formulated to be tested using ANOVA. The beneficiaries of the study were discovered to include curriculum designers and implementers. The research was conducted based on some assumptions which included "all the primary schools in the study area used the same syllabus and text books" for thorough investigation, the study covered three government primary schools in the study area. Related literature was reviewed on variables appeared in the topics such as Aesthetic Value Strategy (AVS), Cooperative Learning Strategy (CIS), teaching, learning and other related topics. The study was aimed at investigating Effects of AVS and CLS on Upper Primary Pupils Mathematics Performance, Retention and Application in Gwale Local Government, Kano State. Two experimental groups and one control group were used. The study investigated difference in academic performance retention and application of the Upper Primary Pupils taught mathematics using AVS and CLS and those taught using CM. It also

investigated differential effects of AVS and CLS regarding the academic performance.

Population of the study comprised 9,293 boys and 8,510 girls. The sample was drawn from three primary schools in Gwale local government, Kano. The three hypotheses were tested using ANOVA and in each case there was need to carry out multiple comparisons using post Hoc analysis as the three hypotheses were rejected at level of significance 0.05. The data of the study was collected using three instruments MPT, TOR and TOA which were administered as post-test 1, post-test 2 and post-test 3 respectively. The results obtained were presented, summarized and discussed in chapter four. The data obtained were used in answering research questions using descriptive statistics, means and standard deviations while the three hypotheses were tested using ANOVA in each case, the alternative hypothesis was not rejected and the areas where significant mean difference existed were located using post Hoc analysis through Scheffe method. At the end of the study, the following findings were made:

i. There is significant difference in the academic performance of upper primary school pupils-taught mathematics using AVS, CLS and those taught using conventional method.
ii. There is significant difference in the retention ability of upper primary school pupils taught mathematics using AVS, CLS and those taught using conventional method.

iii. There is significant difference in the ability of upper primary school pupils to apply acquired mathematics knowledge to solve related word problems between the EG 1, EG 2 and CG taught mathematics using AVS, CLS and CM respectively.

iv. There is no significant difference in the academic performance of EG 1 and EG 2.

5.3 Conclusion

The following were conclusions drawn from the findings mentioned in 5.2.

i. Teaching strategies employed by Primary Six School teachers have significant effects on the pupils performance as well as their ability to retain and apply acquired mathematics knowledge.

ii. Aesthetic Value Strategy facilitates effective teaching and learning of primary six mathematics.

iii. Cooperative Learning Strategy facilitates effective mathematics teaching and learning in primary classes.

iv. Primary Six School Pupils taught mathematics using AVS and CLS retain and apply acquired knowledge significantly better than those taught using Conventional Method.

v. Using Chalk-Talk-and-Cane Approach is not effective for teaching mathematics at primary six school level.

vi. There is no significant differential effect in academic performance of Primary six Pupils taught mathematics using AVS and those taught using CLS. How ever there was difference in timing, CLS required more time than AVS in the present research.

5.4 Recommendations

Based on the findings of this study, it was recommended that:

i. Current mathematics instructional materials should be provided in the primary schools to ensure effective teaching and learning.

ii. Workshops should be organized for primary school mathematics teachers to strengthen the need for using teaching strategies so as to do away with the Chalk-Talk-and-Cane Approach that is teacher-centered, un-interactive and fear-instilling.

iii. Teacher training institutions should review their mathematics curriculum for teacher training by strengthening the use of modern teaching strategies.

iv. Primary mathematics teachers should receive feedback from pupils at regular intervals to portray the effectiveness or otherwise of the instructional procedures.

v. Colleges and NCCE should fashion out effective strategies for supervision and monitoring of classroom instruction so as to ensure quality delivery of instruction.

5.5 Suggestions for Further Studies

In order to widen the scope of the present study the following suggestions were given:

i. The study was conducted in senior primary schools sections of Gwale Local Government, Kano. A similar study supposes to be conducted in Junior Primary School section in the study area to confirm or disconfirm the "Relevance of Aesthetic Value and Cooperative Learning Strategies on Pupils Mathematics Performance and Retention".

ii. Research may be conducted on "Differential Effects of Aesthetic Value and Cooperative Learning Strategies on Senior Primary Pupils' Mathematics Performance, Retention, Application and Perception".

iii. It may be relevant to carry out a research on "Effects of Aesthetic Value and Cooperative Learning Strategies on Senior Primary School Pupils' Mathematics Performance, Transfer and Application in Primary School".

iv. It will be of interest to investigate "Primary Mathematics Teachers Perception and Interest on Use of Aesthetic Value and Cooperative Learning Strategies in the Development of Difficult Concepts in Mathematics".

v. It may also be of interest to investigate "Attitude of Primary Mathematics Teachers Towards Application of Aesthetic Value and Cooperative Learning Strategies in Classroom Instruction".

5.6 Limitations

The following were the limitations of the study:

i. The study was limited to use only schools which were chosen randomly from 19 schools. The three classes were drawn from three different schools to avoid interactions of the pupils after treatments were administered as that could affect the study findings.

ii. The cane, the researcher used in teaching control group was not properly used as the schools mathematics teachers did because of which the researcher termed the approach as talk-chalk-and-cane approach.
iii. The instruments used were limited to Mathematics Performance Test(MPT), Test of Retention(TOR), and Test of Application(TOA).
iv. The strategies used for the study were Aesthetic Value Strategy(AVS), Cooperative Learning Strategy(CLS) and Conventional Method.

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APPENDIX I

Primary Six Mathematics Curriculum Themes

- Number and Numeration
- Basic Operation
- Measurement

- Algebraic Processes
- Geometry and Mensuration
- Everyday Statistics

Primary Six Topics were Drawn from the Theme Measurement:

a. Length (Pythagorean rule)

b. Perimeter

c. Area

d. Volume

e. Capacity

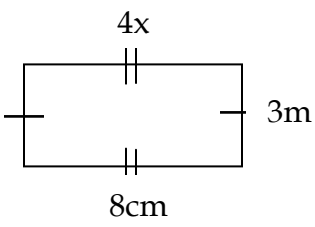
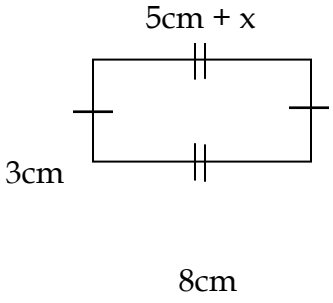
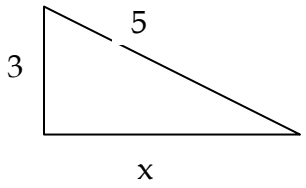
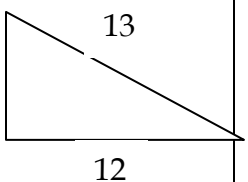
f. Speed

APPENDIX II

Aesthetic Value Strategy Package

Classifications of Activities

ACTIVITY	ACTIVITY NUMBER
Drawing of triangle and trapezium, and measuring of their perimeters using threads and meter rule	01
a. Drawing a triangle of length 6cm and breadth 4cm b. Draw a cycle of radium 6cm c. Use thread and ruler to measure the perimeter of your mat at home	02
1. Find perimeter of rectangle whose length is 7cm and breadth 4cm. 2. Find primary of the regular pentagon whose length of one side is 3m. 3. Find the perimeter of a square of length of one side 2m.	03
1. Use your words to say what perimeter of a plane shape is 2. Draw any five shapes of lengths of your choice and find their perimeter using or without using formulae	04

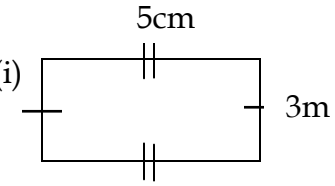
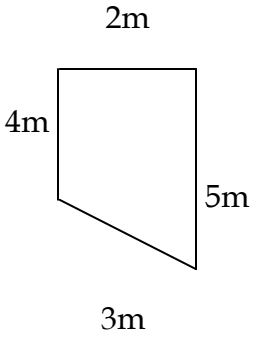
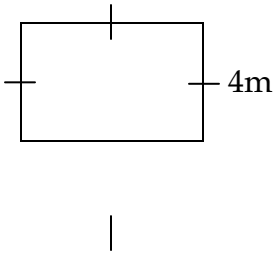
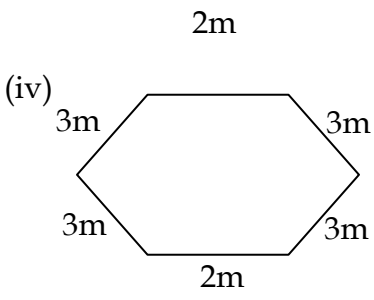
1. Find area of triangle of base 5m and height 6m. 2. Find area of rectangle whose length is 6m and breadth 5m. 3. Obtain area of trapezium whose lengths of parallel sides are 5m and 7m if the distance between them is 3m.	05
1. Find area of the figure   2. Find the area of the trapezium	06
1. Draw any right-angled triangle and show its hypotenuse, adjacent and opposite 2. Given the triangle  find x	07
1. Given the right-angled triangle b  find b	08

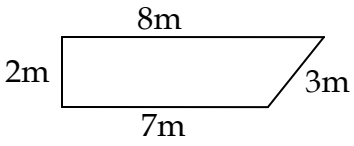
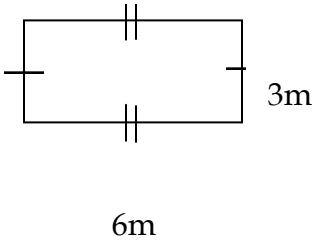
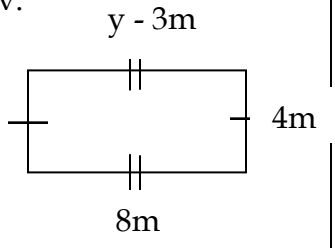
1. A motor cyclist covered 10km in 2hours calculated the speed used. 2. If a man drove for 7 hours at 60km per hour, find the distance covered.	09
If a driver traveled from town A to town B in 6 hours and returned from town B to town A in 5 hours find the speed used in the two journeys.	10

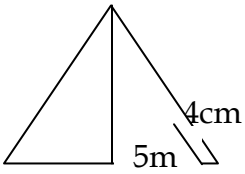
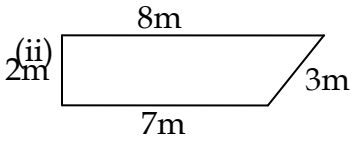
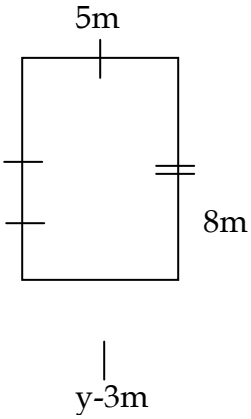
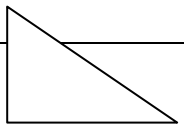
APPENDIX III

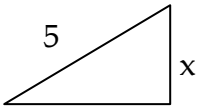
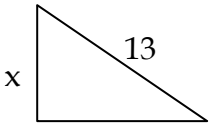
Cooperative Learning Strategy Package

Classifications of Activities

EXERCISE	**ACTIVITY NUMBER**
a. Find perimeters of the following shapes without using formulae (i)  (ii)  (iii)  (iv) 	01

b. Draw a cycle of radius of your choice and use meter rule and thread to measure its perimeter. (write the answer in your exercise book).	
Use formulae to find perimeter of: i. Rectangle of length 7m and breadth 4m ii. Trapezium  iii.  iv. 	02
1. Obtain perimeter of a rectangle whose length is 4m more than the breadth if the breadth is 4m. 2. Use your own words to define perimeter of a shape.	03

1. Use your own words to define area of a plane shape. 2. Find area of a triangle whose base is 7cm and height 6cm. 3. Obtain area of rectangle whose length is 8m and breadth 6m 4. Find area of trapezium whose lengths of the two parallel sides are 8m and 10m if the distance between them is 4m.	04
Find area of the following figures: (i)  (ii)  (iii) 	05
A 	

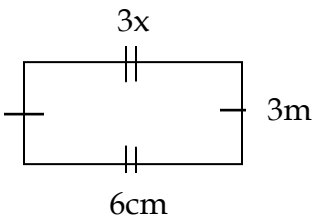
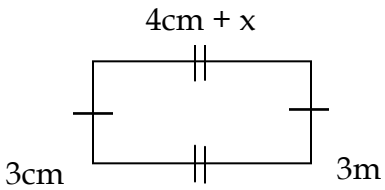
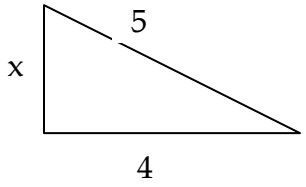
1. Given the right angled triangle C B Indicate hypotenuse, opposite and adjacent.  2. Given find the value of x 4  3. Given find x 12	06
1. A man traveled from Gwale to Dala in 2 hours, if the distance covered is 20km find the speed used. 2. A taxi driver covered 20km using the speed $10kmh^{-1}$, find the time taken for the journey.	07
If a driver traveled from town A to town B in 6 hours and returned from town B to town A in 5 hours using the same car, find the speed used in the tow journies.	08

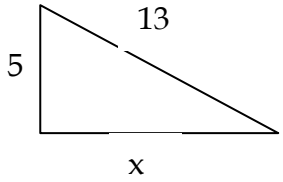
APPENDIX IV

Conventional Method Package

Classifications of Activities

ACTIVITY	ACTIVITY NUMBER
Drawing of triangle and trapezium, and measuring of their perimeters using threads and meter rule	01
a. Drawing a triangle of length 5cm and breadth 3cm b. Draw a circle of radius 5cm c. Use thread and ruler to measure the perimeter of your mat at home	02
1. Find perimeter of rectangle whose length is 6cm and breadth 3cm. 2. Find primary of the regular pentagon whose length of one side is 4m. 3. Find the perimeter of a square of length of one side 2m.	03
1. Use your words to say what perimeter of a plane shape is 2. Draw any five shapes of lengths of your choice and find their perimeter using or without	04

using formulae	
1. Find area of triangle of base 4m and height 7m. 2. Find area of rectangle whose length is 6m and breadth 5m. 3. Obtain area of trapezium whose lengths of parallel sides are 5m and 7m if the distance between them is 3m.	05
1. Find area of the figure   7cm 2. Find the area of the trapezium	06
1. Draw any right-angled triangle and show its hypotenuse, adjacent and opposite 2. Given the triangle  find x	07

1. Given the right-angled triangle find b  	08
1. A motor cyclist covered 10km in 2hours calculated the speed used. 2. If a man drove for 7 hours at 60km per hour, find the distance covered.	09
If a driver traveled from town A to town B in 6 hours and returned from town B to town A in 5 hours find the speed used in the two journeys.	10

APPENDIX V

Mathematics Achievement Test (MAT) for Primary Six pupils

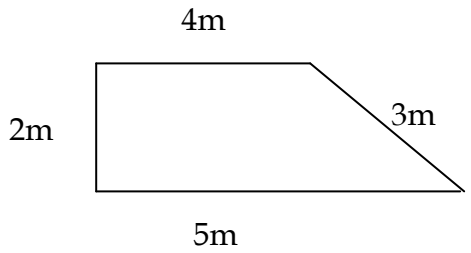
Time: 1 hour

Serial No.: _____Boy_____Girl_____Class_____

Instruction: Answer all questions in section A and only one in section B

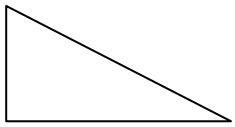
SECTION A[Objective]

1. Find perimeter of a triangle its lengths or its three sides are 3m, 4m and 6m (a) $12m^2$ (b) 13m (c) $13m^2$ (d) $13m^2$
2. Find perimeter of the trapezium below:



(a) $9m^2$ (b) 13m (c) $13m^2$ (d) 14m

3. The measure of lengths of sides that enclose a shape is (a) Volume (b) Area (c) Perimeter (d) Capacity

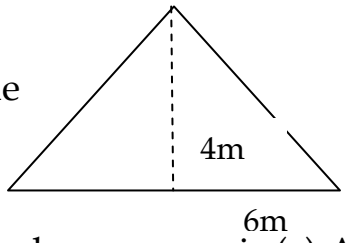


3 x

4. Find x in $\frac{x}{4} = \frac{5}{2}$ (a) 5 (b) 10 (c) 25 (d) 7

5. Find area of rectangle of length 5m and breath 3m (a) $16m^2$ (b) $4m^2$ (c) $15m^2$ (d) $20m^2$

6. Find area of the triangle



(a) $2m^2$ (b) $10m^2$ (c) $20m^2$ (d) $24m^2$

7. The measure of space a shape covers is (a) Area (b) Perimeter (c) Capacity (d) Volume

8. Pythagoras's rule is (a) $a^2 - b^2 = c^2$ (b) $a^2 + b^2 = c^2$ (c) $a^2 + c^2 = b^2$ (d) $a^2 - c^2 = b^2$

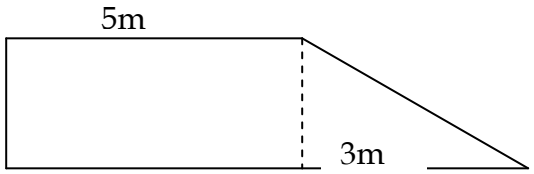
9. Which of the following is solid shape (a) rectangle (b) square (c) cube (d) triangle.

10. Which formula is for speed? (a) Speed = $\frac{Time}{Distance}$ (b) Speed = $\frac{Distance}{Time}$ (c) Speed = $\frac{Hour}{Time}$ (d) Speed = $\frac{Hour}{Distance}$

SECTION B [Essay]

1. (a) If cyclist traveled for 60km in 10hours. Calculate the speed used

(b) A trapezium



Find its area using;

i. (L x H) + $\left(\frac{B \times H}{2}\right)$

ii. ½ (a + b)h

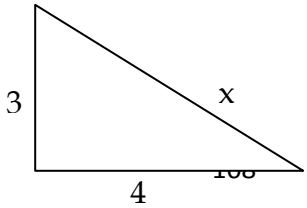
APPENDIX VI

Mathematics Test of Retention (TOR) for Primary Six Pupils

Time: 1hour

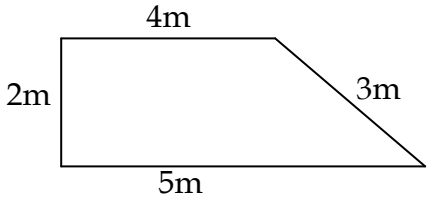
SerialNo.: _____ Boy_____ Girl_____ Class_____

Instruction: Answer all questions in section A and only one Question in Section B



1. Find x given

2. What is the perimeter of the trapezium below?



3. Which of the following given Pythagoras's rule?

(a) $a^2–b^2$ (b) $a^2 + b^2 = c^2$ (c) $a^2 + c^2 = b^2$ (d) $a^2–c^2 = b^2$

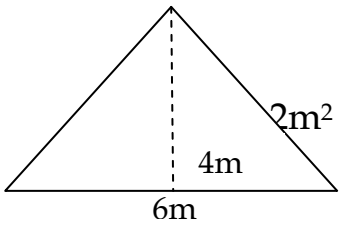
4. The formula for finding speed is (a) Speed = $\frac{Time}{Distance}$ (b) Speed = $\frac{Distance}{Time}$

   (c) Speed = $\frac{Hour}{Time}$ (d) Speed = $\frac{Hour}{Distance}$

5. Which of the following is solid? (a) rectangle (b) square (c) cube (d) triangle

6. Obtain perimeter of a triangle if its lengths of the three sides are 3m, 4m and 6m. (a) $12m^2$ (b) 13m (c) $13m^2$ (d) $13m^3$

7. The measure of lengths of sides that enclose a shape is (a) Volume (b) area (c) perimeter (d) capacity

8. Find area of the triangle 

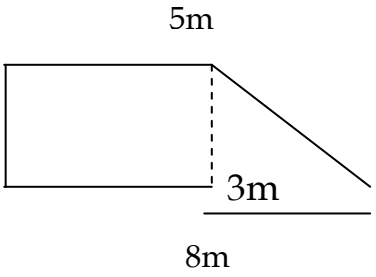
$2m^2$ (b) $10m^2$ (c) $20m^2$ (d) $24m^2$

9. The measure of space a shape covers is (a) area (b) perimeter (c) Capacity (d) Volume

10. What is the area of a rectangle of length 5m and breath 3m? (a) $16m^2$ (b) $4m^2$ (c) $15m^2$ (d) $20m^2$

SECTION B[Essay]

1. (a) A cyclist traveled for 600km in 10 hours. Find the speed used.

(b) Given the trapezium 

calculate its area using

a. (L x H) + $\frac{BxH}{2}$

b. ½ (a + b)h

APPENDIX VII

Mathematics Test of Application (TOA) for Primary Six Pupils

Serial No.: _____ Boy_____Girl_____Class _____

Time: 30minutes

Instructions: Answer all Questions

1. (a) (i) If perimeter of a triangle is 13cm. find length of one side when the other sides are 3cm and 6cm.

(ii) Find perimeter of the rectangle

(b) If the length of parallel sides of a trapezium are 4m and 7cm. Find its area when the distance between the parallel sides is 3cm.

2. (a) A motorist traveled for 50km in one hour and then traveled for 40km in one hour. Find the total speed used.

(b) In a write angled-triangle find longest side if the other two sides are 3cm and 4cm.

APPENDIX VIII

SCORES OF PRIMARY SIX PUPILS OBTAINED FROM MAT, TOA AND TOR

Scores of Primary six A Pupils Taught Mathematics Using Aesthetic Value Strategy in Mathematics Achievement Test (MAT).

7	5	4	6	9	5	10	6	3	9
2	7	8	7	10	4	5	7	8	10
4	8	7	8	5	3	4	5	4	6
5	2	8	5	4	2	6	8	4	5
7	4	7	7	8	8	6	9	5	

Scores of Primary Six B Pupils Taught Mathematics Using Co-operative Learning Strategy in Mathematics Achievement Test (MAT).

7	8	8	4	5	7	5	5	2
8	10	7	3	8	8	6	8	6
5	4	7	7	9	9	7	5	5

4	8	6	5	4	7	6	2	5
7	7	7	10	5	3	5	4	5

Scores of Primary Six C Pupils Taught Mathematics Using Conventional Method in Mathematics Achievement Test (MAT).

5	7	3	4	4	0	5	6	7	6
2	3	4	3	4	2	2	7	5	6
3	4	5	3	5	3	7	3	1	5
4	5	6	4	2	4	2	10	4	
1	4	3	5	1	2	5	4	6	

Scores of Primary Six A Pupils Taught Mathematics Using Aesthetic Value Strategies in Test of Application (TOA).

4	3	0	6	3	6	8	4	5	4
3	4	10	4	2	5	3	5	4	3

3	5	2	4	3	4	3	3	6	0
4	2	4	3	2	3	4	4	3	2
1	3	5	4	4	7	5	4	4	

Scores of Primary Six B Pupils Taught Mathematics Using Co-operative Learning Strategies in Test of Application (TOA).

3	3	5	6	4	4	10	5
4	1	6	4	5	3	2	4
5	2	3	3	4	2	3	3
6	0	6	4	2	1	4	4
2	4	2	5	3	0	5	5

Scores of Primary Six Pupils Taught Mathematics Using Conventional Method in Test of Application (TOA).

8	4	0	1	1	2	1	5	2	2
2	2	3	8	2	3	2	4	3	2

3	1	4	4	3	1	8	4	1	3
4	3	5	5	1	3	3	4	0	
3	2	2	2	2	0	4	4	0	

Scores of Primary Six A Pupils Taught Mathematics Using Aesthetic Value Strategies in Test of Retention (TOR).

1	6	4	5	6	2	3	5	4	3
2	3	4	5	8	4	5	6	3	2
5	4	7	5	10	7	4	5	6	6
3	3	8	4	2	4	3	4	5	1
4	2	6	7	1	5	5	4	5	

Scores of Primary Six B Pupils Taught Mathematics Using Co-operative Learning Strategies in Test Of Retention (TOR).

5	3	2	5	7	10	6	5	3

2	2	4	5	3	9	6	3	2
7	0	7	6	10	8	6	1	4
8	2	6	2	9	4	5	2	5
4	3	5	3	4	5	6	1	4

Scores of Primary Six C Pupils Taught Mathematics Using Conventional Method in Test Of Retention (TOR).

8	2	3	5	1	4	3	5	6	0
4	2	2	4	2	5	7	2	2	0
3	3	1	3	3	2	4	4	1	4
4	3	2	8	4	6	3	4	3	
1	4	4	2	2	4	2	4	2	