IMPACT OF ASEI STRATEGY ONMATHEMATICS PERFORMANCE OF PRIMARY SIX PUPILS IN ZARIA LOCAL GOVERNMENT AREA OF KADUNA STATE, NIGERIA

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POST GRADUATE STUDIES AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTERS DEGREE IN MATHEMATICS EDUCATION

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DECLARATION

I, Iliyasu ADAMU (M.Ed/Edu/15587/2011-2012) declared that this dissertation entitled "Impact of ASEI Strategy on mathematics Performance of primary six pupils in Zaria Local Government of Kaduna State, Nigeria" has been conducted by me in the Department of Science Education, Ahmadu Bello University Zaria under the supervision of Prof. Y. K. Kajuru and Prof. M. Musa. The information derived from literature has been duly acknowledged in the text and a list of references provided. No part of the dissertation was directly presented for another degree or diploma at any University.

_____ _____

Iliyasu ADAMU Date
M.Ed/Edu/15587/2011-2012

CERTIFICATION

This dissertation entitled “Impact of ASEI Strategy on mathematicsPerformance of primary six pupils in Zaria Local Government Area of Kaduna State, Nigeria " by Iliyasu ADAMU (M.Ed/Edu/15587/2011-2012), met the regulations governing the award of Master’s Degree in Mathematics Education of the Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This dissertation is dedicated to my mother HafsatYa'akub and to the memory of my late father M. AdamuIliyasu for the encouragement, support and concern they showed in my educational pursuit.

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LIST OF ABBREVIATIONS

ABL: Activity-based Learning

ASEI: Activity, Student Centered, Experiment and Improvisation

CEMASTEA: Center for Mathematics, Science and Technology in Africa

CORI: Concept Oriented Reading Instruction

CRC: Chester Resource Center

DTSE: Department of Technology and Science Education

INSET: In-Service Education and Training

JICA: Japan International Cooperation Agency

LCM: Learner Centered Model

MPT: Mathematics Performance Test

PABIS: Pupil Centered, Activity Based Instructional Strategy

PDSI: Plan, Do, See and Improve

SMASE: Strengthening Mathematics and Science Education

SMASSE: Strengthening Mathematics and Science in Secondary Education

SOC: Science Orientation Course

WECSA: Western, Eastern, Central and Southern Africa

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OPERATIONAL DEFINITION OF TERMS

- **Activity-oriented teaching:**Carefully selected activities to enhance pupils' participation, interest, understanding and retention of knowledge.
- **Student-focused learning:** This refers to the active pupils' involvement in the teaching/learning process.
- **Experiment/Research based approach:** Scaled down, investigative experiments which are simpler, more relevant to specific lesson objectives, and enable pupils to discover reinforce new concepts/ideas; rather than those prescribed in text books.
- **Improvisation:** Teacher innovativeness in designing simple experiments/activities to enhance pupils' interest, participation and learning; drawing from locally available resources and pupils' real life experiences.
- **Plan:** This is the actual preparation of the lesson plan. This is where the teacher identifies the lesson objectives, select materials and appropriate activities which should be well thought-out.
- **Do:** This refers to the actual teaching or implementation of the planned lesson in the classroom.
- **See:** This involves evaluating the lesson as it progresses by the teacher himself/herself, pupils and even a colleague for the sake of further improvement.
- **Improve:** From the comments made or given and the teachers own evaluation, the teacher is supposed to incorporate the changes in future similar lessons and hence make necessary improvement.
- **Pupils' performance:** Assessing the pupils' progress in learning mathematics by measuring their level of attainment of the stated behavioral objectives of mathematics concepts.

ABSTRACT

This study examined the Impact of ASEI Strategy on mathematics Performance of primary six pupils in Zaria Local Government Area of Kaduna State, Nigeria. The study was guided by three objectives, three research questions and three null hypotheses. A pre-test Post-test quasi experimental research design involving two groups (one experimental and the other control) was used. The population of the study comprised of primary six pupils of 113 public primaryschools with 11,627 pupils (6,028 Males and 5599 Females) in Zaria Local Education Authority of Kaduna State. Four (4) coeducation schools were randomly selected from two educational districts by simple random sampling method, where two hundred (200) pupils wererandomly selected. Mathematics Performance Test 1 (MPT_1) and Mathematics Performance Test 2 (MPT_2) were the instruments used in collecting data as pre-test and post-test respectively. A spearman Brown property of coefficient r = 0.71 was obtained. The data were analyzed using Statistical Package for Social Sciences (S.P.S.S). Descriptive statistics (means and standard deviations) was used to reduce the data while t-test statistics was used to test hypotheses at 5% level of significance. The results obtained revealed that the strategy had significant impact on performance of pupils in the experimental group when compared with that of the control group. However, it was discovered from the study that the strategy had no significant impact on the performance of pupils when comparison was made between male and female pupils. Finally, the study reported insignificant difference in the performance of pupils from rural and urban areas when taught with ASEI strategy. The study concluded that ASEI strategy was effective in teaching mathematical concepts at primary six level in the local government and that ASEI was gender and location friendly. Based on the findings recommendations were made such as mathematics teachers should endeavor to use ASEI strategy during classroom instructions to teach mathematical concepts. Also, pupils should be encouraged by their teachers to carry out hands-on and minds-on activities in every mathematics lessons so as to make learning easy, real and permanent.Finally teachers should update their skills on improvisation by attending workshops on ASEI strategy for teaching mathematical concepts.

CHAPTER ONE

THE PROBLEM

1.1 Introduction.

To face the challenges of the 21st century, each young person needs to have confidence in using mathematical skills and every country needs both specialist mathematicians and a highly numerate population (Boaler, 2002). Mathematics carries with assumption that the knowledge of the subject is essential for all members of the society. According to Okeke (2009), Mathematics competence is a critical determinant of the post-secondary education and carrier options available to young people. Mathematics as a subject has been extremely useful to humanity. It is the tool for understanding science, technology and business. Generally, it is accepted that mathematics is a foundation of science and technology (Okeke, 2009).

Mathematics is a compulsory subject at primary and secondary school levels of Nigerian educational system as stated in the National Policy on Education (FRN, 2004). It has been a subject that many students have developed negative attitude towards and this leads to the poor performance in the subject as justified by Carnine (2006). Jones (2007) states that even though students fail in mathematics, but the reason for that could be linked to curriculum and methods of teaching rather than the students' lack of capacity to learn. Kajuru (2006) also reported additional challenges from the learners and poor learning environment. Granstrom (2006) shows that different teaching approaches in classrooms influence the outcomes for students in different ways. In Nigeria, studies show that large number of students seem to

learn very little mathematics and science in schools, learning tend to be rote and pupils find learning mathematics and science to be difficult. Teachers read from the textbooks, interspersed with a few explanations while pupils copy as their teachers dubs textbooks or old notes (Uzoechi, 2006). In Nigeria, Ifegbo, (2012) found that lack of adequate instructional materials and human resources contributes to poor performance in primary mathematics and science, hence low achievement of pupils in the subject.

Associations such as Western Eastern Central and Southern Africa (WECSA) have been formed to strengthen science and mathematics education and enhance learners ability through improved teacher mastery of content, pedagogical skills, enhancing teachers and learners attitude towards mathematics and science through in-service education and training of teachers, thus, SMASE-WECSA (Nui &Wahome, 2006).The overall goal of the SMASE program is to upgrade the capabilities of young Nigerians in mathematics and science education. The program identified Activity, Student, Experiment and Improvisation (ASEI) and Plan, Do, See, Improve (PDSI) strategies for enhancement of classroom practices for quality teaching and learning of mathematics.

Mc Combs & Miller (2006), defined student-centered learning as "ways of thinking about teaching and learning that emphasize student responsibility and activity in learning rather than content or what the teachers are doing". The conventional teacher centered approach is focused on the teacher where the teacher talks and the student just listen while student-centered approach the students are exposed to hands-on activities thus they will gain first-hand experience and they will also know how to use all their senses. Students will be able to make keen and reliable observations and develop the skill in employing the steps of scientific approach. Learners' performance is improved if the learning process is relevant to the learners

as advocated by the principle of ASEI/PDSI. ASEI movement is important in the teaching method that SMASE- program disseminates to the teachers through INSET- training (CEMASTEA, 2010). When the learner –centered approaches are well used in classroom practices, there will be positive effect on learners performance in mathematics.

Therefore, the problem of this study is to investigate the impact of ASEI strategy on mathematics performance of primary six pupils in Zaria Local Government Area of Kaduna State, Nigeria.The important position occupied by mathematics and science in the curriculum of the basic and senior secondary school levels of the educational system is borne out of the role of mathematics and science in nation building. It is in recognition of this that the Federal Ministry of Education spelt out the goals of science education (as stated in the NPE 2004) as:

- To produce scientists for national development.
- Cultivate inquiring, knowing and rational mind for the conduct of a good life and democracy.
- Service studies in technology and the cause of technological development.
- Provide knowledge and understanding of the complexity of the physical world.

The teacher should be able to direct the pupil's attention towards matters which are significant to him as well as the society. If his creative thinking is awakened or developed, he can also harness or manipulate many things in the environment to his advantage and the society at large. The pupils can be made to begin to learn the processes of mathematics upon which the pupil is expected to build his/her mathematics concepts later in life. For mathematics to be able to do this to the pupils, the aims and objectives must be clearly and suitably stated for the teacher to comprehend. For example, mathematical operations are very useful in our daily life such as addition and subtraction.

If our educational system is mathematically oriented, each pupil will possess fundamental knowledge that will enable him/her explain some of the natural events and forces around him. There are other social values that are by-products of mathematics education. These are open-mindedness, curiosity and an optimistic approach to failure.The study of mathematics can bring some educational advantages that will foster intellectual and emotional growth. Nigeria needs engineers, doctors, architects, geologists and science teachers. These professionals could only be produced through the teaching of mathematics in our schools. Individuals need to perform well in mathematics because it is so important in daily life and achieving goals in the future. There is no doubt that mathematics play a crucial role in attaining success in life.Now, how do we teach our pupils at primary school level this important subject (mathematics) well, arouse their interest during instruction so that they appreciate the subject and apply the concepts learnt to real life situations? In order to achieve this aim, ASEI principles should be used so as to improve the pupils' performance in mathematics.

Consequently, Strengthening Mathematics and Science Education (SMASE) survey was carried out in three pilot states namely; Niger, Kaduna and Plateau. The base line survey was essentially to ascertain the state of mathematics and science education in the primary schools in Nigeria.The survey came up with the result that the current obvious situation in mathematics and science is the staggering decline in the performances of learners at all levels of our education system (Simon, 2000). For this reason, the Federal Government of Nigeria (FGN) officially joined the SMASE in 2004 and subsequently became interested in adopting/adapting and promoting student- centered methods of teaching through the ASEI approach. The FGN's decision to adopt/adapt an in-service Education and training (INSET)

system based on ASEI movement and PDSI approach was based on the premise that such INSET system will help in making mathematics and science teaching activity based.

Furthermore, from the survey four (4) major teaching strategies/methods, namely; Demonstration, Lecture, Group and project methods were found to be in use in teaching mathematics and science by the teachers in the schools visited. Specifically, 81.0% of the teachers use lecture method, 91.0% group method, 85.7% play method and 83.3% use questioning method. Majority of the teachers engaged on what could be called "chalk and talk" delivery as they do not give room for pupils' active participation in the class room activities. Based on this result, it shows that it is high time the policy provision that "teacher education shall continue to take cognizance of chances in methodology and in the curriculum". However, some teachers that were contacted through oral interview argued that these methods do not ensure effectiveness and efficiency in teaching and learning of mathematics.The result of the survey also shows that the difficulties encountered in the teaching and learning of mathematics can be grouped into six major problems, namely; attitudinal problems, cognitive competence and socio-economic problems, teaching and learning resource materials, pedagogy, and administrative problems of policy makers and lack of capacity building (Simon, 2000).The attitudinal problems start from lukewarm attitude of pupils to mathematics and science and lack of commitment on the parts of the teachers to nonchalant attitude of the parents to the education of their wards. This caliber of teachers needs to be equipped to teach the subjects they are deficient in through INSET. On the issue of pedagogy, the survey shows that there was a need for a shift from a pedagogy that is teacher-centered to the one that is pupil-centered. In terms of teaching/learning materials used in schools, the survey shows that there was general dearth of teaching/learning materials.

Even the available ones were found to be obsolete (outdated) and grossly inadequate. Teachers also were not competent in the improvisation of resource materials. On the issue of lack of teaching resources, teachers should be exposed to the ways of improvising teaching materials through a system of INSET. They were however positively disposed to attend any form of training that will make them competent in teaching resource mobilization and utilization. On the classroom observations carried out during the study, results show that:

i. Quality of teaching was generally poor because there was poor time management,

ii. poor resource utilization and most classroom interactions were teacher-centered.

iii. Although the teachers had good communication skills, many of the pupils did not make any attempt to ask questions or seek clarifications on the topic for the day. This often resulted to poor classroom interaction during mathematics lessons.

iv. Teaching/learning resources were not properly utilized to achieve the stated objectives of the lessons in most of the lessons observed. Teachers made little or no effort to improvise materials where the standard ones were not available or inadequate.

1.2 Statement of the Problem

Despite the significance attached to mathematics, poor performance in the subject has been a perennial problem. The poor performance has been attributed to negative attitude among students towards mathematics and sciences; poor mastery of teaching and learning content on the part of teachers; teacher-centered teaching methodology; lack of interactive fora for teachers; failure to develop teaching and learning materials; and administrative factors. To upgrade the quality of mathematics and science education in primary schools and address the

problem of poor performance, the Federal Ministry of Education (FME) in collaboration with the Japan International Co-operation Agency (JICA) initiated SMASE, INSET Project in August, 2006 on a pilot basis, and later as a nationwide program. Activity, Student, Experiment and Improvisation (ASEI) approach has been one of the strategies usually embarked upon to deal with the problems mentioned.

A lot of resources, both financial and material have been invested in the program. However, since the conclusion of the third cycle, not much is known about the extent of pupils' performance when ASEI strategy was used in teaching mathematical concepts.One will hence ask the question: To what extent is the strategy improves the pupils' achievement in mathematics? Thus, it is against this background that the researcher was motivated to investigate the impact of the ASEI strategy onmathematics performance of primary six pupils in Zaria Local Government Area of Kaduna state,Nigeria with the purpose of making suggestions that will help bring about positive change in the performance of pupils in mathematics.

1.3Objectives of the Study

The specific objectives of the study were to:

1. determine the impact of ASEI strategy on the performance of pupils in some mathematical concepts.
2. compare the impact of ASEI strategy on male and female pupils in some mathematical concepts.
3. compare the impact of ASEI strategy on urban and rural pupils in some mathematical concepts.

1.4 Research questions

Based on the above objectives, the following questions were formulated for answering:

1. What is the difference between the mean scores of pupils exposed to ASEI strategy and conventional method in some mathematical concepts?
2. What is the difference between the mean scores of male and female pupils exposed to ASEI strategy in some mathematical concepts?
3. What is the difference between the mean scores of urban and rural pupils exposed to ASEI strategy in some mathematical concepts?

1.5 Research Hypotheses

From the research questions, the following null hypotheses were formulated and tested at 5% level of significance.

1.There is no significant difference between the mean scores of pupils exposed to ASEI approach and conventional method in some mathematical concepts.

2.There is no significant difference between the mean scores of male and female pupils exposed to ASEI approach in some mathematical concepts.

3. There is no significant difference between the mean scores of urban and rural pupils exposed to ASEI in some mathematical concepts.

1.6 Significance of the study

The study investigated the impact of ASEI strategy on mathematics performance of primary six pupils in Zaria Local Government area of Kaduna State, Nigeria. The findings of this study would be of benefit to pupils, mathematics teachers, curriculum planners, textbook publishers, school administrators, researchers and professional bodies by means of the following:

The outcome of this study could provide insight into the factors responsible for poor performance of pupils in some identified difficult mathematical concepts which when ASEI strategy is used effectively by teachers would facilitate positive achievement because of the pupils' full participation and engagement in hands-on and minds-on activities.

The result of the study could provide mathematics teachers with improvisation skills as it facilitates learning and make it real, easy and permanent.

Curriculum planners could benefit from the findings of the study by understanding that the use of general curriculum could no longer meet the need of the other learners. The study revealed that pupils performed better in learning mathematical concepts when they were exposed to ASEI strategy. Hence, provides necessary information to curriculum planners in making good policies.

The outcome of the study would encourage textbook publishers to reframe their books on difficult mathematical concepts so that new textbooks would be activity-based and more of worksheet for hands-on and minds-on activities that promote thinking and discourage rote learning.

The findings of this study would also help the school administrators and policy makers to encourage mathematics teachers to adopt ASEI strategy when teaching mathematical concepts in order to improve the performance of pupils in mathematics.

It was hoped that the result of the study would be an eye opener for further research as it adds new information to the existing literature, hence the researchers can use the findings of this study for further studies.

The findings of this study may be of much benefit to professional bodies such as Mathematics Association of Nigeria (MAN), Science Teachers Association of Nigeria (STAN) and others

to organize seminars and workshops for mathematics teachers on the use of ASEI strategy in teaching mathematical concepts.

1.7 Scope/ Delimitation of the Study.

The study was delimited to public primary schools in Zaria Local Government Area, Kaduna state. It was not possible to investigate all the aspects that constitute pupils' poor performance in mathematics, but most importantly the method by which the teacher will impart the knowledge as he /she examines the classroom situation. Therefore this study was also delimited to ASEI and conventional methods.

Due to the geographical spread of the schools in the local government, it was not easy for the researcher to cover all the target population. Therefore, the study covered four primary schools from Rafin Albasa ,and Tudun Wada districts. In each sampled school one intact class was used to take part in the study, since the study was quasi experimental. In addition, the content area of the study covered some concepts which includes ratio, plane shapes (properties, perimeter and area), number bases, fraction, statistics, sequence, angles and capacity. These concepts are within the mathematics curriculum for primary six pupils and were the topics identified difficult to teach by teachers during SMASE (2006) baseline survey. This was what made the researcher possible to select the concepts as the content area of this study.

The instruments used in this study were Mathematics Performance Test 1 & 2 for pretest and posttest respectively, which comprised 30 items of multiple choice objective questions with four alternative options all drawn from the primary leaving school certificate examination past question papers.

1.8 Basic Assumptions.

The following assumptions were made towards the conduct of this research.

1. The primary schools under this study wereassumed to be homogenous on regulations and syllabus used.
2. Mathematics teachers were assumed to be qualified to teach mathematics at primary school level.
3. The sample size was sufficient to provide information with regards to the use of ASEI strategy meaningful and relevant to stakeholders.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This study examined the impact of ASEI strategy onmathematics performance of primary six pupils in Zaria Local Government Area of Kaduna State, Nigeria. In chapter one of this report, attempt was made to discuss on the statement of the problem, objectives, research questions, hypotheses, significance, basic assumptions as well as the scope/delimitation of the study. This chapter reviewed literature related to the study under the following sub-headings:

2.2 Theoretical Framework

2.3 Conceptual Framework

2.4 Concept of ASEI

2.5 Japan-Nigeria SMASE Project and Findings

2.6 Concept of Academic Performance

2.7 Methods of Practice for Teaching and Learning Approaches

2.8 Nature of Mathematics Teaching and Learning in Nigeria

2.9 Related Studies on Activity-based Learning

2.10 Implications of the Reviewed Literature

2.2 Theoretical Framework

The research study is based on constructivist learning theory. Constructivism is a learner-centered educational theory that contends that to learn anything, learner must construct his or her own understanding by tying new information to prior experiences (Moyer and Jones, 2004).

The researcher has adopted this constructivist theory because SMASE program advocates for learner-centered approaches and learners being active participants in learning process. The SMASE program encourages teachers to plan their lesson putting in mind learner's prior knowledge experiences on the topic and built new concept on it. The same applies to the theory which acknowledges prior experience on which learners construct new knowledge.

According to Christie, Kim (2005), constructivism is an instructional strategy that encourages teachers to provide each student's preferred learning style, rate of learning and personal interaction with other students. The theorists believed that each of us generates our own mental models, which we use to make sense of our experiences. We resolve conflicts between ideas and reflect on theoretical explanations. Learning therefore is simply the process of adjusting our mental models to accommodate our new experiences (Adams and Brown, 2001). This theory is used to focus on preparing people to problem solving. Therefore, to be successful, the learner needs a significant base of knowledge upon which to interpret and create ideas. Additionally, with constructivism, outcomes are not always predictable because learners are constructing their own knowledge. Thus, constructivism does not work when the results always need to be consistent. The constructivist view on teaching and learning is that

education should be student-centered and that the teacher's role is not to transmit information. They further stated that constructivist classrooms are areas of discovery by the students, where they are learning mathematics by manipulating figures and forms. Moyer and Jones (2004) expose the same idea of instruction in the mathematics classrooms.

Agneta (2015) in Jerome Bruner (1966); stated that learning is an active process in which learner construct new ideas or concept based upon their current and past knowledge. The learner select and transforms information, constructs hypotheses and makes decisions relying on a cognitive structure.

In practice, the teacher should encourage students to discover principles by themselves and also the teacher should engage learners in an active participation in learning process rather than being passive receivers of knowledge. Learners should be involved in physical action, hands-on-experience which engages mind. The learner is allowed to make mistakes and learn from them. Learning is more meaningful if the child is allowed to experience on his own rather than listening to the lecture. The teacher should present learners with materials, situations that allow them to discover new learning. In this case the teacher becomes a facilitator of knowledge that is he guides and stimulates the learners (Decco and Craford, 2001).

The strength of constructivist theory is that the children learn more and enjoy learning more when they are actively involved rather than on note memorization. Constructivism gives learners ownership of what they learn, since learning is based on pupils' questions and explorations and often the students have a hand in designing the assessment as well.

The weakness of constructivism theory is that it removes grading in the traditional way and instead places more value on students evaluating their own progress which may lead to

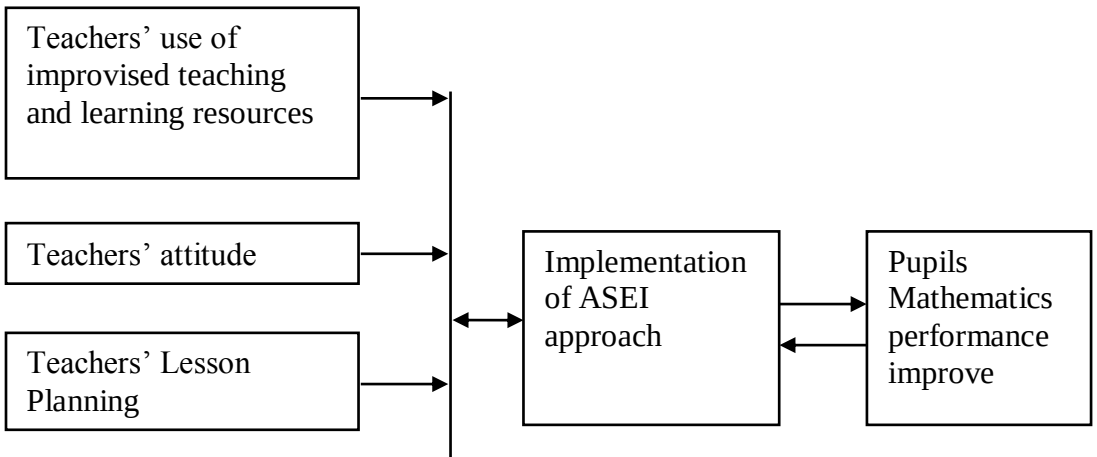
students falling behind but without standardized grading and evaluation teacher may not know that the learner is struggling (Agneta, 2015). Another disadvantage is that it can lead students to be confused and frustrated because they may not have ability to form relationships and abstracts between the knowledge they already have and the knowledge they are learning for themselves. Despite these problems, the theory is based on construction of learners' own perspectives of the world through individual experience and scheme (Agneta, 2015).

In summary, the constructivist theory supports the significant role played by hands-on-activities in making connections in mathematics. It considers students' learning styles, focuses on knowledge construction and not reproduction, and uses authentic tasks/activities to engage students. Constructivism also provides meaningful problem-based thinking, requires reflection of prior and new knowledge and extends beyond the content that is presented to them. The learners' world, and their developed schema within that world, necessitates that connection are made in brain patterns in order for them to internalize mathematics concepts. It is the hands-on activities that help to make these connections.

2.3 Conceptual Framework.

Orodho (2004), defines conceptual framework as a model of presentation where a researcher presents the relationship between variables in the study and show the relationship diagrammatically.

Figure 2.1 Conceptual Framework Showing the Relationship between ASEI Teaching Strategy and Expected Change in Pupils' Achievement.



Source: SMASE, (2006)

Figure 2.1 highlighted the relationship between variables influencing performance of pupils in mathematics. Proper improvisation of teaching and learning resources as required by SMASE-INSET will influence pupils' performance in mathematics. Positive attitude by teachers in facilitating lessons will influence performance. Sizeable workload by teachers lead to close interaction with pupils, hence improves performance. Teachers' use of learner centered approaches as required by SMASE encourages step by step learning by pupils.

2.4Concept of ASEI.

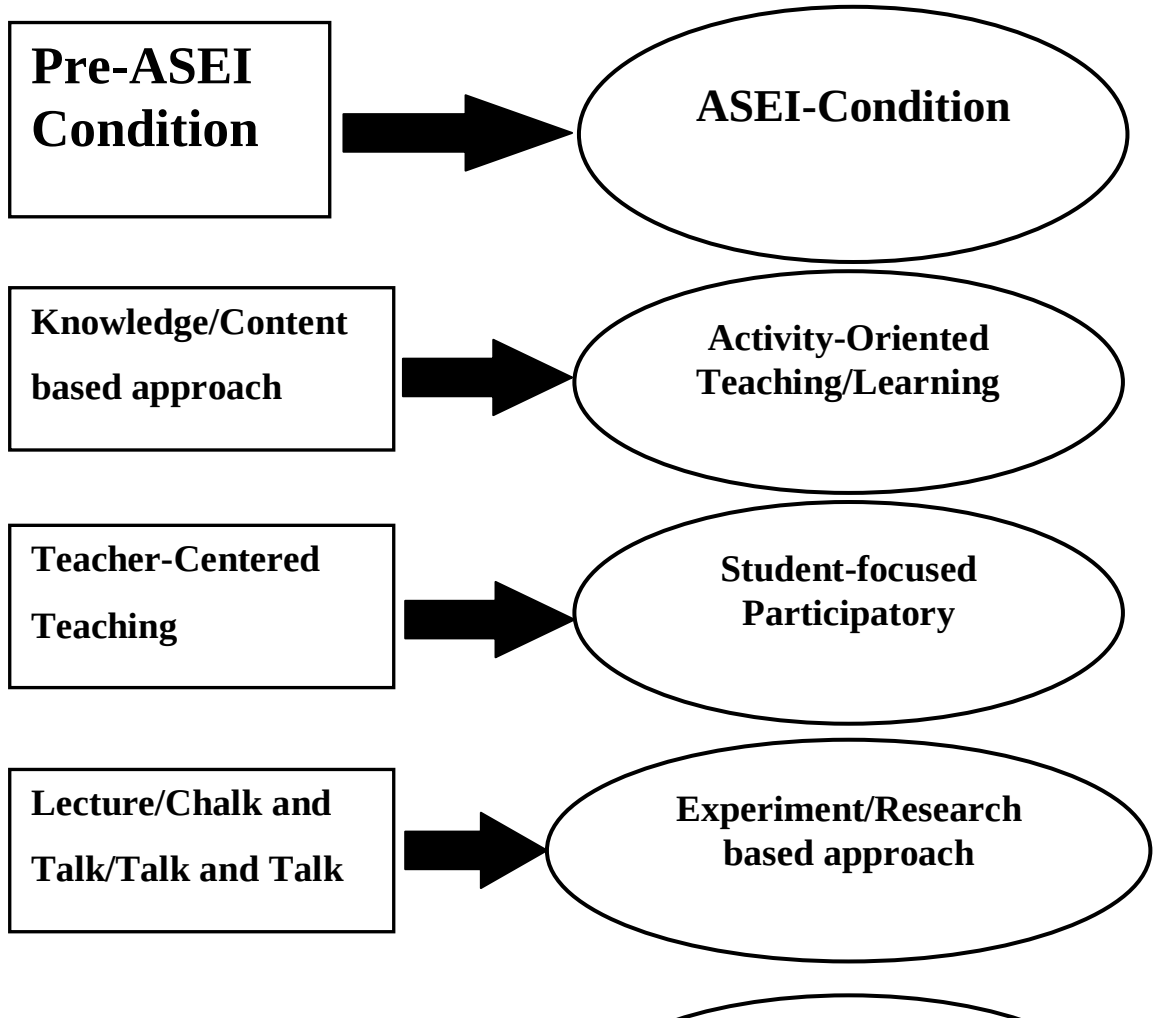
According to SMASE Nigeria (2006) ASEI is an acronym for **A**ctivity, **S**tudent-centered, **E**xperiment, and **I**mprovisation. It is a teaching and learning approach which aims at making teaching and learning more pupil- centered. It is therefore, a paradigm shift from 'banking style/chalk and talk' approach to 'activity based/pupil centered approach'. ASEI as an intervention strategy takes cognizance of how pupils learn. Pupils do not simply copy the science world rather they construct their own meanings of it. They must be provided with the opportunity to construct scientific knowledge through the interaction of their observation, prior knowledge and mental processes. The key words that form the basis for the ASEI pedagogical paradigm, are:

- Activity-oriented teaching: carefully selected activities to enhance pupils' participation, interest, understanding and retention of knowledge.

- Student-focused learning: active pupils' involvement in the teaching and learning process where the teacher guides and gives them opportunity to express opinions, explain ideas based on prior experiences and verify their opinions/ideas through suitably designed activities.
- Experiment/Research based approach: scaled down, investigative experiments which are simpler, more relevant to specific lesson objectives, and enable pupils to discover or reinforce new concepts/ideas; rather than those prescribed in text books.
- Improvisation: teacher innovativeness to enhance pupils' interest, participation and learning; drawing from locally available resources and pupil's real life experiences.

In order to attain the ASEI condition, there is need for a shift from static to dynamic approach of teaching. Static approach is equated to the pre-ASEI condition while the dynamic approach represents the ASEI condition as shown in figure 2.2

Figure 2.2 ASEI PARADIGM SHIFT



Source: SMASE, Nigeria (2006)

2.4.1 The Impact of ASEI on Teachers and Pupils

SMASE (2006) opined that the practice of ASEI enables teachers to:

- ✓ Become more confident to carry out practical activities and experiments previously thought to be difficult or dangerous and try out new ones.
- ✓ Face the challenges arising from lack of resources and large classes because they are able to improvise some materials.

Teacher becomes a facilitator of learning and not the ultimate source of knowledge. The net impact is that the mathematics classrooms become more active in terms of pupils participation in meaningful learning activities.

On the other hand, the practice of this approach (ASEI) has the following impact on pupils:

- ✓ Pupils become actively involved whenever a lesson attains ASEI status. The lesson elicits great interest and responsiveness among pupils.

- ✓ They gradually attain the desired attitude.
- ✓ Level of understanding and retention of knowledge is increased.

In SMASE, ASEI lesson through PDSI approach is advocated. Among other things, the lesson should be easy to prepare, easy to use, teacher friendly, more focused, as inclusive as possible, and passing on to the pupils' maximum benefits in terms of objective attainments.

It is recommended that the teaching notes should be integrated in the lesson plans to avoid over reliance on them at the expense of planning. As the lesson progresses the teacher guides the learners to make meaning out of the lesson activities through various means such as, asking probing questions, class discussion and giving explanations. These will help the learner to link the activity with the concept being taught (SMASE, 2006).

2.4.2 Merits, Perceived Challenges of ASEI Approach and Solutions.

According to SMASE (2006), ASEI approach has the following advantages:

1. Gives room for pupils' participation.
2. Generates and sustains pupils' interest in mathematics.
3. Makes the teacher a facilitator of the learning process.
4. Helps the teacher prepare well to meet any challenge.
5. Increases understanding, retention and application of mathematics concepts in real life experience.
6. Arouses curiosity.
7. Develops cognitive and affective skills (minds-on activities).
8. Develops psychomotor skills (hands-on activities).
9. Develops process skills such as observation, record keeping, analysis and interpretation of data.

10. Takes care of the needs of pupils' individual differences.

11. Simplifies attainment of learning objectives.

12. Encourages the use of locally made materials.

The result of the survey carried out in 2006 shows that ASEI approach has challenges perceived by teachers as follows**:**

- Teachers workload is increased
- A lot of time is required for planning
- Syllabus coverage is hardly attainable
- Funding constraints
- Resistance by teachers to the new approach.

The following were given as solution to the perceived challenges (SMASE, 2006)

- Proffer storage and maintenance of materials
- Consistent practice
- Sensitizing curriculum developers and other stakeholders
- Improvisation.

ASEI as a paradigm shift is not a new method of teaching; rather it is a rallying point for teachers to consciously focus on the pupil who is the main player in the teaching/learning process. Whenever a teacher looks at a lesson plan or observes a lesson being taught, he/she should easily makes a quick evaluation by simply answering the question: is it an ASEI lesson? To succeed in attaining the ASEI condition in the classroom, every teacher has to go by the Plan, Do, See and Improve (PDSI) way.

2.5 Japan-Nigeria SMASE Project and Findings

In Nigeria, improving quality of Mathematics and science education is essential for national development, more specifically, joining one of the top in the world in accordance with the vision 2020. Teacher development, especially at the primary and secondary school levels is the key factor. (SMASE 2006).

Various studies (including the National Assessment of Learning Achievement in 1997, 2001 and 2003) have revealed that pupil's performance, especially in primary mathematics and science education is poor. In 2006 the FME, in collaboration with JICA, conducted a baseline study on primary mathematics and science education. The study showed that schools face serious challenges in the teaching of primary mathematics and Science: teachers were engaged in what could be called the "chalk and talk" strategy of teaching, and pupils were passive participants in the class. Almost all teachers expressed a desire for training opportunities in order to share and provide ideas for improving teaching methodologies. The study concluded that there was a strong association between inadequate teaching capacity and poor student performance. In-Service Education and Training (INSET) for teachers could therefore be an effective intervention for improving teacher's skills.

JICA has helped to establish sustainable and quality INSET programs for teachers of mathematics and science in many African countries: Kenya, Uganda, Malawi, Zambia, Niger, Rwanda, Senegal, Burkina-Faso, Ghana and South Africa. These INSET programs have become one of JICA's most successful projects in educational cooperation in Africa. In order for the participating countries to exchange skills, experience and issues in teacher education in mathematics and science, a regional association, "SMASSE-WECSA" (Western, Eastern, Central and Southern Africa), was established. The FME has participated in the association since 2004.

As a result of the FME's interaction with SMASSE-WECSA and the above mentioned 2005 baseline study, which revealed a need for INSET. In August 2006 the FME and SUBEBs (State Universal Basic Education Boards of Niger, Kaduna, and Plateau), in collaboration with JICA began a three-year INSET project in primary mathematics and science education. This project is known as the "SMASE Nigeria Project".

2.5.1 Project outline

The project has been running on a trial basis in three pilot states: Niger, Kaduna, and Plateau. The overall goal of the project is to upgrade teaching skills of primary teachers in mathematics and science. The project purpose is to enhance the ability of Core Teachers to provide INSET for teachers in primary mathematics and science. Using existing facilities, a National INSET center was established at National Commission for Colleges of Education (NCCE) in Abuja, and three state INSET centers were established in local secondary schools. At the National INSET center, four National Trainers train a total of twenty four State Trainers, who then return to their states to train a total of six hundred selected teachers (Core Teachers). The Core Teachers are then expected to train incumbent teachers in their respective regions (Local Government Education Authorities / Education Zone).

- **Key strategies and components**

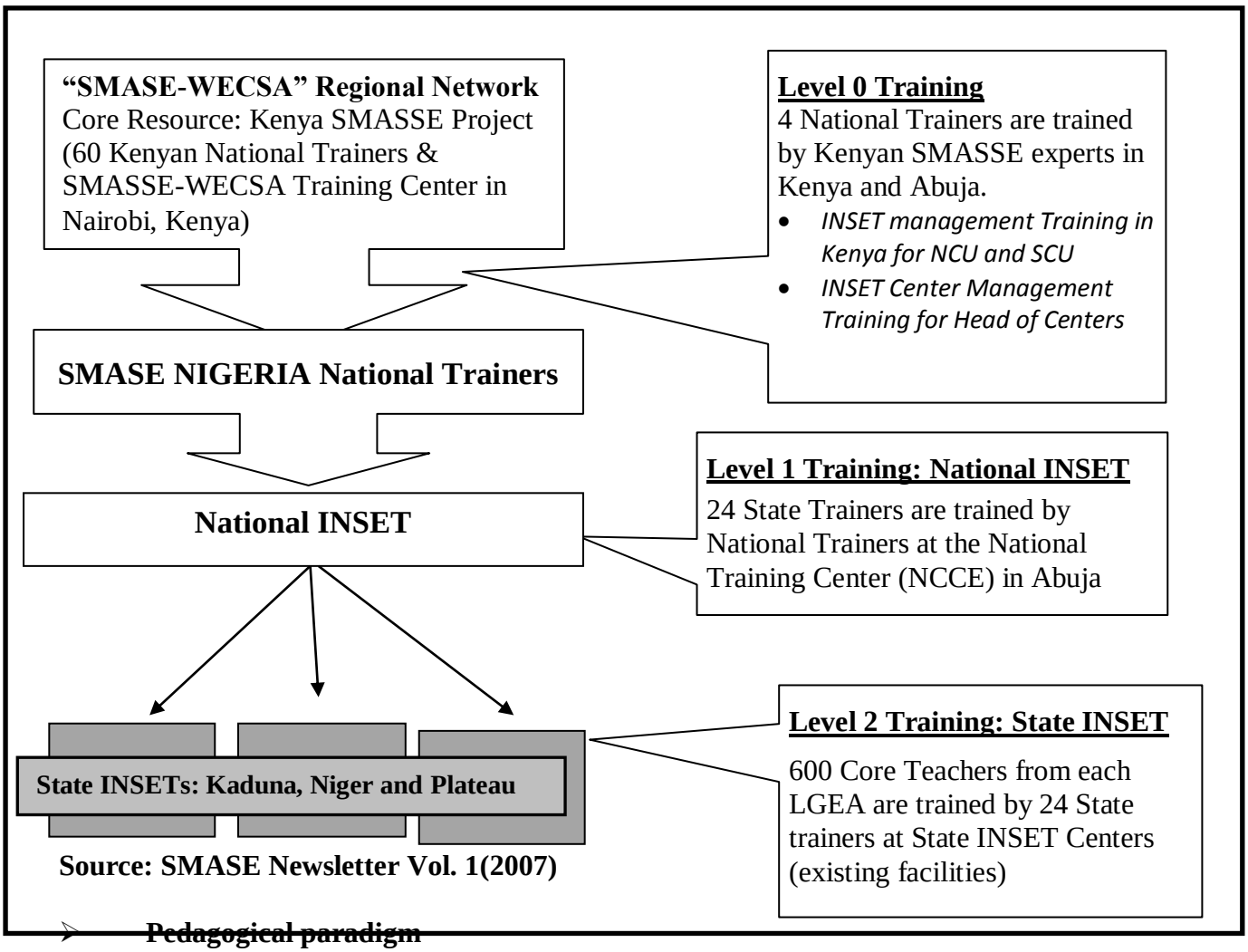
The cascade system of INSET

Selected National Trainers are trained by SMASSE-WECSA regional trainers in both Kenya and Nigeria. There are two levels of training, national level and state level. At the national level, National Teacher in their respective states (see diagram below).

Trainees attend one 10-day training session each year, for a total of three training cycles over three years. The themes for each year of INSET training are:

- 1st cycle: Enhancing positive attitudes.
- 2nd cycle: Enhancing classroom activities for effective teaching and learning.
- 3rd cycle: Actualization of ASEI & PDSI in the classroom.

Figure 2.3: SMASE In-service Education and Training Cascade System



Source: SMASE Newsletter Vol. 1(2007)

- **Pedagogical paradigm**

The SMASE project aims to shift the teaching paradigm from a "banking style" or "Chalk & talk" to the ASEI & PDSI approach. The aim is to cultivate pupils' scientific thinking ability by enhancing the quality of classroom activities through effective teaching and learning.

- **What is the ASEI philosophy?**

The SMASE project emphasizes and promotes the ASEI (Activity, Student-Centered, Experiment and Improvisation) philosophy in the classroom. The concept of ASEI is to actively involve students (pupils) through experiments and demonstrations, improvising by utilizing locally available materials in the classroom.

- **What is the PDSI approach?**

PDSI stands for Plan, Do, See and Improve. In order to ensure that the ASEI lessons give maximum benefit to the pupils. The teacher must plan and prepare the lesson before going to teach. Then, the teacher has to do the actual teaching, and see where the planning was weak, so as to improve in future lessons.

- **Sustainable system building**

Sustainability system in a project requires different resources to be pulled together. These are:

- **Financial resources:** In SMASE Nigeria all stakeholders have made financial commitment into the execution of the project up to date. The sharing formula is JICA: 41%, FME (including UBEC) 10%, SUBEBs: 45%, Colleges of Education and others: 4%. In addition to the sharing formula, some stakeholders are ready to make more commitment to the success of the project.
- **Human resources:** Four National Trainers and twelve State Trainers were committed to the project at its commencement. The trainers were working for the project on activity basis. The State Trainers will be increased to twenty four while the National Trainers will work full time for the project before the end of the pilot phase of the project.
- **Material resources:** This ranges from equipment furniture and fittings. JICA has supplied about 90% of the initial take off equipment of the project. NCCE and

SUBEBs have allocated office space with some furniture, boardroom and committee rooms for the activities of the project.

- **Administrative structure:** The administrative structure of the project is well spelt out in the project document. At the National level, there is National level, there is National Steering Committee and State Coordinating Unit. One National Coordinator and five Assistant Coordinators have been assigned to manage the project at the National level. One state Coordinator and one Assistant State Coordinator are to manage the project at the state level. These structures especially at the State level have started working and were well coordinated during the INSET cycle 1.
- **INSET quality:** National and State INSETs cycle 1 were conducted successfully in November and December 2006. Analysis of monitoring and evaluation report of the training shows that the INSET is of high quality, majority of the participants are now warming up for the INSET cycle 2 that will come in March at National level and August 2007 at state level.

2.5.2 Achievement of the SMASE project in 2006

Six months into the project life span, the SMASE project has achieved the following

- The establishment of one National INSET center (NCCE in Abuja).
- The establishment of three State INSET centers (in Niger, Kaduna and Plateau).
- The training of four National Trainers and twelve State Trainers in Kenya.
- The training of twelve State Trainers in National INSET cycle 1 in Abuja.
- The training of five hundred and seventy Core Teachers (selected primary teachers) in State INSET cycle 1 in three states.

2.5.3 Impact of ASEI Training

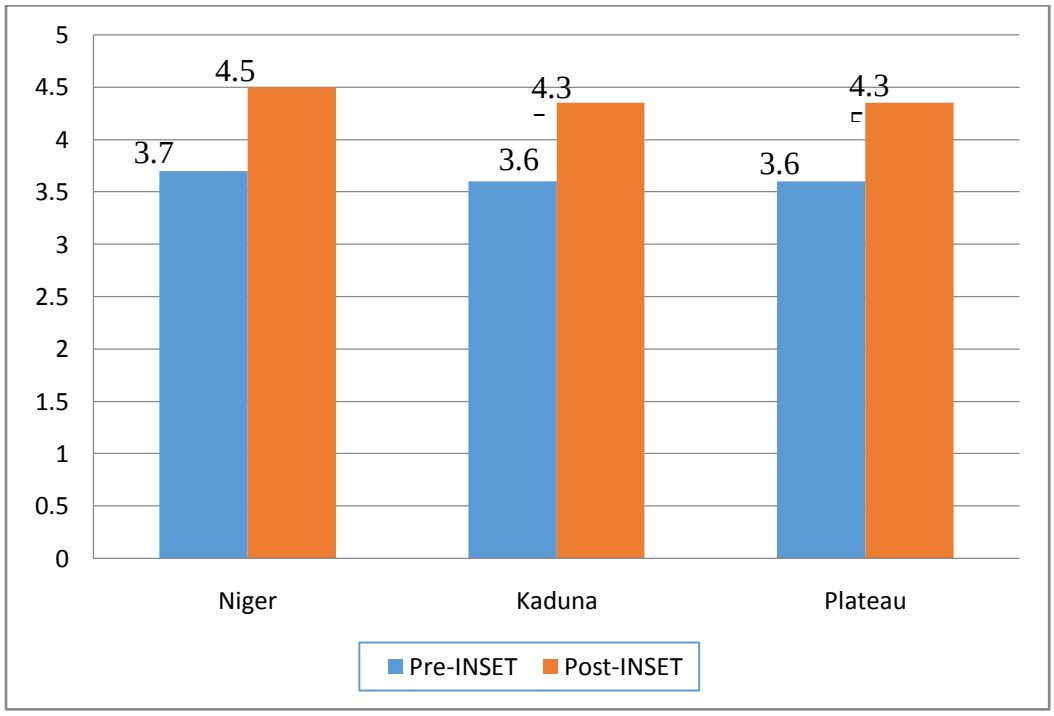
In order to ensure a high quality INSET program, monitoring and evaluation (M&E) has been conducted for each INSET cycle. Before INSET cycle 1, the project developed eleven types of M&E instruments and set an evaluation scale from 1 to 5, defining the ratings as:

1<Mean≤3 = Need effort, 3<Mean≤4.5 = Attaining, and 4.5<Mean≤5 = Attained.

Below are the findings through M&E for states INSETs cycle 1.

Finding 1: Through INSET cycle 1, Core Teachers' attitudes toward teaching mathematics and science has positively changed.

Figure 2.4: Attitude toward teaching Mathematics, State INSET cycle 1 (N=570)



Source: SMASE Newsletter Vol.1(2007)

Finding 2: During state INSETs, State Trainers provided high-quality sessions which enhanced Core Teachers' level of understanding of the training contents.

Table 2.1: Participants' Evaluation of the Quality of each INSET Sessions.

(average rating of 12 sessions in cycle 1 (N=570)		
Niger	Kaduna	Plateau
4.2	3.8	4.1

* Evaluation scale is set to 1 to 5

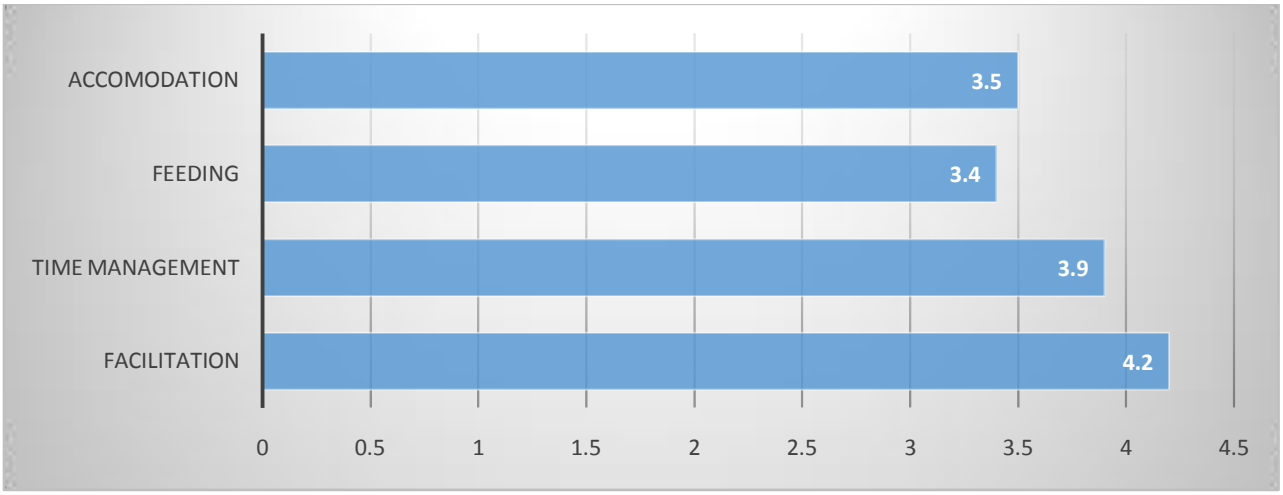
Table 2.2: Participants' Understanding of INSET Sessions.

(average rating of 12 sessions in cycle 2 (N=570)		
Niger	Kaduna	Plateau
4.37	3.99	4.1

Source: SMASE Newsletter Vol. 1(2007)

Finding 3: Participants (Core Teachers) were satisfied with State INSET services.

Figure 2.5: State (Niger, Kaduna & Plateau) INSET Cycle 1 Evaluation of INSET Service (N=570)



Source: SMASE Newsletter Vol. 1(2007)

2.5.4 Conclusion

All of the M&E categories resulted in ratings of 3.0 to 4.4 ("attaining"). Therefore, it can be concluded that the three states provided a successful State INSET cycle 1. However, in order to increase the quality of INSET, the project will continue to make efforts to improve the training for trainers, the quality of textbooks and the quality of INSET services.

To this end, JICA is now implementing a technical cooperation project, titled "strengthening Mathematics and Science Education Project" (SMASE) jointly with the Federal Ministry of Education.

The overall goal of the project is to upgrade:

- Capability of Nigerian school teachers in Mathematics and science.
- Teaching skills of primary school teachers in mathematics and science (SMASE 2006).

2.6Concept of Academic Performance

The Oxford English Dictionary (2006) defines performance as accomplishment and execution of tasks. The accomplishment of task in context of the academic function of school refers to academic efficiency which is measured of student performance in class work and national examinations. Academic performance is the outcome of education, the extent to which pupil, teacher or institution has achieved their educational goals that is commonly measured by examinations Bawa (2013).

In the context of teaching performance refers to the teachers' ability to teach consistently with honesty and regularity. Adams & Brown (2001) argues that performance is something a person regards as an outcome of work, because they provide the strongest lick to the

strategic goals of the organization, customer, satisfaction, economic and social contribution school performance should not only be viewed in terms of academic but also focus on other domains of education like effective and psychomotor. However, one can say that schools performance is the response of the school to the needs of the stakeholders in terms of the education outcomes.

2.6.1 Meaning of Academic Performance

Academic performance, was understood to be the display of knowledge attained or skills developed in school subjects designated by test and examination scores or marks assigned by the subject teachers as opined byBawa (2013) inBawa and Taiwo (2007). Also Ojerinde in (Adediwura and Taiwo, 2007) defined academic performance as individual's inherent potentials in terms of intelligence combined with other sociological factors. Similarly, Saka, Sam and Yusuf (2002) saw it to be what is measured regarding skill or knowledge developed through specific instruction or training with emphasis on how well instructional objective have been attained. This means that, the measurement of performance represents all abilities that can be evaluated on the basis of observing the individual as he performs the task involved. Still on the same concept, Decco and Crawford (2001) submitted that academic performance is the process of measuring the students' auxiliary (behaviors which must be acquired at the lower level of a learning structure) and terminal performances during and at the end of instruction. In addition, they supplied three uses that can be made with information obtained from academic performance to include; firstly determining how well the students have achieved the instructional objectives, secondly determining the adequacy of entering behavior and thirdly determining the adequacy of our instructional procedures. For the purpose of this research, academic performance was based on the scores

students obtained following administration of the Mathematics Performance Test (MPT) developed by the researcher.

2.6.2 Factors Affecting Academic Performance

Many researchers, psychologists and educators alike, have identified some variables that have effect on students' academic performance. For instance, Blooms in Lovell (1994) suggested two long term influences contributing to differences in scholastic achievement between children to include; meaning which education comes to have for the child in respect of his own personal advancement and role in society and value placed on education by parents and other significant adults in the child's life/the extent to which scholastic achievement is motivated and reinforced by these adults. Also Wiseman in Lovell (1994) in a study he conducted on 10 year old children who had taken a number of standard tests found that home circumstances of the child affected school attainment more than the school condition did. He also found among primary school pupils that economic level and social class are less important to children's progress than are aspects of parental attitudes (their attitude to education, books and reading).

Advancing their findings after conducting a follow-up study of 3,465 pupils from birth to 18 years, Ross and Simpson in Lovell (1994) reported that differences in ability and attainment associated with parent's education and family size and that these two factors continue to influence rate of progress over the period 8 to 18 years. Still on the same subject, the finding of Pidgeon in Lovell (1994) revealed much evidence supporting the assertion that teacher expectation affects pupils' performance. As a result, teachers need to think well of their pupils and set standard of work which is high since their expectation to some extent are self-fulfilling.

Bawa(2013) inSarwar(2004) who studied relationship of study attitude and academic performance at secondary level in Punjab found that study attitude was positively related to academic performance. Study attitude scores of females were more closely related with academic performance as compared to males and the study attitude scores of rural students were more closely related with academic performance as compared to urban students. Furthermore, mean scores of low and high academic achievers were compared and it was found that, high and low achievers differed in their study attitude and female/male and rural/urban students also differed in their study attitude. Similarly, Fujita (2006) in a study that examined the effect of extra curricula activities on academic performance of high school students revealed that; playing sports, watching television and participating in community service improve academic performance. In another study on the impact of stress factors on College students' academic performance, Womble (2006) found no correlation between the score of the perceived stress scale and academic performance. However, the stress factors that had most negative impact were sleep, problem with roommates and social activities. Similarly, Ojerinde in (Adediwura and Taiwo (2007) identified personality factors (such as anxiety, achievement, motivation and level of interest) and teacher variables (such as knowledge of subject matter, teaching skills, attitude in the classroom, qualification and experience) as factors affecting academic performance.

In a similar effort, the study of Basil (2007) that sought to examine socio-economic factors influencing students' academic performance in Nigeria, revealed insufficient parental income, family type and insufficient funding by government as the underlying factors. The work of Lan (2007) on the relationship between classroom practice and homework on students' performance however, identified some factors that accounted for variation in

students' performance in mathematics to include; language used at home, mother's level of education, student's self-efficacy towards mathematics, time spent on homework at home, the frequency of homework provided. The work of Aripin, et al (2008) on students' learning styles and academic performance found academic performance based on learning styles (6 major learning styles were identified viz: independent, dependent, collaborative, competitive, participant and avoidant) to be significant.

Review of the concept will be concluded with the work of Andrews (2009) who studied reasons why academic performance may be impacted and identified the following reasons why academic performance may be impacted and identified the following reasons as causes of decreased scholastic performance:

- Food insecurity (typically impacting youth with lower income families) and food insufficiency (where the individual's intake of food, due to resource constraints in adequate): Combined or individually, these who problems have been linked to poor health and developmental issues within large number of students,

- Poor sleep pattern: school age children require a minimum of 9 hours restful sleep each night. However, due to late bedtimes and early wake-ups more 40% of pre-adolescents do not get sufficient amount of restorative sleep and of all health problems studied, poor sleep was found to be the most unexpected and definitive cause contributing to poor academic performance,

- Alcoholic family dynamics: children from alcoholic families were found to be more susceptible to developing life-long psychological and behavioral problems,

- Bilingualism: this has the potential of presenting both challenges and advantages to school age children,

- Unemployment: when a member of a family loses job, the change in status quo has the potential of affecting the entire family. Studies showed that when a father becomes unemployed, negative effect on school work is recorded. Yet when a mother becomes unemployed, positive impact upon school work is recorded,

- Peer pressure and school schisms: as children need to feel sense of belonging, those who have trouble forming friendship develop low self-esteem and perform poorly in school, and

- Parental pressures: while parental involvement can be a good thing, too much of a good thing can lead to disruption, frustration and stress. Evidence showed that although parents can be very instrumental in guiding their children and helping them to achieve success, they can also create unreal expectations, instill pressure and foster performance anxiety in their children. Thus from the review, performance is an important basis for making appropriate modification in teaching and learning processes.

2.7Methods of Practice for Teaching and Learning Mathematics.

Teachers may use different methods of practice to execute and implement the theoretical teaching and learning approaches related to student-centered learning. These methods include problem inquiry and challenge-based learning. Each of these methods applies the shared foundation of student-centered learning theory with slight variations of emphasis. Hmelo-Silver et al. (2007) argue that there is no clear variation among this “broad variety of

instantiations". Readers, too, will likely find that these practices share many components and may, for the most part, seem indistinguishable in practice. The advocates of these practice methods, however, argue that the slight variations do matter and provide distinct learning experiences and outcomes.

- **Problem-based Learning:** This approach shifts the teacher's role from "dispensing information to guiding the construction of knowledge by his or her students around an initially ill-defined problem. Students refine the problem, develop research questions, investigate the topic using a wide variety of primary source material and work out a variety of possible solutions before identifying the most reasonable one" (Johnson, 2009).
- **Inquiry-based Learning:** It has "its origins in the practices of scientific inquiry and places a heavy emphasis on posing questions, gathering and analyzing data, and constructing evidence-based arguments" (Hmelo-Silver et al., 2007).
- **Challenge-based Learning:** Is "a collective learning experience in which teachers and students work together to learn about compelling issues, propose solutions to real problems, and take action. The approach asks students to reflect on their learning and the impact of their actions and publish their solutions to a worldwide audience" (Johnson et al., 2009). The citadel has for its conceptual framework learner-centered education. This is a fluid theoretical model which is subject to change, and indeed, does continuously change as the faculty continues to redefine this term. In this perspective, learner-centered education involves the learner and learning in the programs, policies, and teaching that support effective learning for all students. Administrators are responsible for developing, maintaining and enhancing

a school environment that enhances effective learning. They are also responsible for ensuring that teachers are knowledgeable about their students and about how learning occurs best. Teachers are responsible for having classrooms that promote effective for all. School counselors are concerned with improving both the conditions for learning (parent education, classroom environment, teacher attitude) and with helping each learner develop to his/her fullest potential. The following five premises support these assertions.

1. Learners have distinctive perspectives or frames of reference, contributed to by their history,the environment, their interests and goals, their beliefs their ways of thinking and the like. There must be attended to and respected if learners are to become more involved in the learning process and to ultimately become independent thinkers.
2. Learners have unique differences, including emotional states of mind, learning rates, learning styles, stages of development, abilities, talents, feelings of efficacy, and other needs. These must be taken into account if al learners are to learn more effectively and efficiently.
3. Learning is a process that occurs best when what is being learned is relevant and meaningful to the learner and when the learner is actively engaged in creating his or her own knowledge and understanding by connecting what is being learned with prior knowledge and experience.
4. Learning occurs best in an environment that contains positive interpersonal relationships and interactions and in which the learner feels appreciated, acknowledged, respected, and validated.
5. Learning is seen as a fundamentally natural process; learners are viewed as naturally curious and basically interested in learning about and mastering their world.

The ultimate goal for student-centered classrooms is for students to gain independent minds and the capacity to make decisions about their life-long learning (Brown, 2008). "What makes learner-centered education transformative is that meaning is co-constructed and that self-regulation occurs through interdependence, with a focus on being and becoming fully functioning (McCombs, 2009). There is both research-based and evidence-based support for student-centered learning. The evidence of the benefits to learning in construction of learning, collaborative learning, metacognition, teacher/student partnership in learning, and meaningful assessment in real world contexts are that children in learner-centered environments achieved more and at higher levels while being more engaged,.

Teachers often fear the change associated with adopting a student-centered approach (Prensky, 2008). That fear may be based on misconstrue of student-centered approaches that view them as synonymous with unguided or experientially-based learning. Advocates for student-centered learning agree that "there is little evidence to suggest that (such approaches) foster learning" (Hmelo-Silver, Duncan and Chinn 2007). Student-centered learning, in contrast, relies heavily on expert instructors-though in roles that teachers familiar with direct instruction may find novel. While it may produce some hesitation, the novelty of new forms of teacher-student interaction need not be unfulfilling for teachers. Student-centered learning allows teachers to work more one-on-one with students who need "just-in-time" instructional guidance as well as guide whole classes toward deep and relevant understanding of subject material.

According to Wise and O'Neill (2009), the debate between the "constructivist and instructionists" has focused much of its energy on determining whether constructivist approaches provide sufficient guidance to be effective. Wise and O'Neill believe this focus

both misses the point and results in the two sides talking past each other. The authors argue instead that the debate should focus not simply on the quantity of guidance, but also the timing and context of the guidance teachers give students. They argue convincingly that relying simply on the quantity of guidance ignores the complex relationships between teachers, students and learning.

A thorough review of the literature shows that learner-centered education has been developing for over five thousand years, and it continues to take on different shapes. Yet, many of the dispositions that are embedded in this education model tend to endures. The nature of all theory is to guide thinking, therefore, learner-centered education should guide teachers' thoughts, which will inevitably shape their behavior. Because the nature of all knowledge is fluid and temporary, responsible use of this model requires educators to commit to a life-long pursuit of improving their understanding of learner-centered education and of the broader processes called teaching and learning.

2.8Nature of Mathematics Teaching and Leaning in Nigeria

The convent obvious situation in mathematics and science education is the staggering decline in the performances of learners at all levels of our education system (Simon 2000). The implications for this trend which has persisted for decades are threat to the technological and scientific development of any nation, especially now that the entire word is driven by scientific and technological advancement. It is in recognition of this fact that the department of technology and science Education (DTSE), the federal ministry of education (FME) has been organizing and conducting in-service-education and training (INSET) such as the science orientation course (SOC) for primary school teachers. In an attempt to chart a new direction for INSET in Nigeria, the DTSE and the Japan international co-operation Agency

(JICA), reached an agreement to re-establish a system of retraining for serving teachers in the area of mathematics and science education in many African countries such as Nigeria, Kenya, Ghana, South Africa, Uganda, Malawi and Egypt among others. The Federal Government of Nigeria (FGN) officially joined the SMASE-WECSA Association in 2004 and subsequently became interested in adopting/adapting and promoting student centered experiment and improvisation (ASEI) movement and plan, do, see and improve (PDSI) approach.

Three states, namely, Niger, Kaduna and Plateau were selected as pilot state. The states were choose as pilot states because JICCA was already constructing additional classrooms in the states and for easy assessment of the project from Abuja. The SMASE-INSET was successfully conducted and completed in these states with the training of 8 states trainers and 200 core teachers per state from 2006 to 2009.

In order to start the INSET in the proposed three pilot states, the DTSE and JICA conceived a baseline study to empirically determine the state of mathematics and science education in the system. From the survey four (4) major teaching strategies/methods, namely; demonstration, lecture, group and project methods were found to be in use in teaching mathematics and science by the teachers in the schools visited. Specifically, 81% of the teachers use lecture method, 88.2% use demonstration method, 91.0% group method, 85.7% play method and 83.3% use questioning method. Majority of the teachers engaged in what could be called "chalk and talk" delivery as they do not give room for pupils' active participation in the classroom activities. They contended that it is high time the policy provision that "teacher education shall continue to take cognizance of changes in methodology and in the curriculum (FRN 2004) be actualized. The teachers contacted

through oral interview argued that these methods do not ensure effectiveness and efficiency in teaching and learning of these subjects. During the survey, twelve (12) topics/concepts in mathematics were presented to both the teachers and pupils to indicate the ones they find difficult or easy to teach and learn respectively.

The topic perceived difficult include addition and subtraction in base 2, word problems, 3 dimensional shapes, statistics, measurement (length), graphs, multiplication & division in base 2, conversion from base 2 to 10 and ratio and proportion. While those perceived easy include, addition and subtraction fraction, multiplication and division (representing 75% and 25% respectively).

The result of the survey also shows that the attitudinal problems start from lukewarm attitude of pupils to mathematics and science, through lack of commitment on the parents to the education of their wards. This caliber of teachers needs to be equipped to teach the subjects they are deficient in through INSET. On the issue of pedagogy agreed that there was need for a shift from a pedagogy that is teacher-centered to one that is pupils-centered. Teachers also agreed that there was need for capacity building since as many as 84.5% of them had never attended training workshops/seminars 76.4% had never attended subject conferences and 64.5% had never attended INSET of any type. There was generally poor professional development of teachers in three states; this is incongruous with National Policy on Education's assertion that "n service training shall be developed as an integral part of continuing teacher education and shall also take care of all inadequacies.

The survey also shows that there was general dearth of teaching/learning materials. Even the available ones were found obsolete (out dated) and grossly inadequate. Teachers and pupils claimed that they were not competent in the improvising of resource materials. On the issue

of lack of teaching resources, teachers should be exposed to the ways of improvising teaching materials through a system of INSET. The FGN's decision to adopt/adapt an INSET system based on ASEI movement and PDSI approach was based on the premise that such INSET system will help in making mathematics and science teaching and learning activity – based. From the foregoing, it is evident that mathematics education generally is in bad shape in Nigeria. This definitely requires an INSET system established on sustainable framework. For this reason, SMASE-Nigeria INSET system based on the principle of ASEI movement and PDSI approach was conceived and planned for.

2.9 Related Studies on Activity-based Learning.

Azuka(2013b), conducted an empirical research on the attitude of primary school mathematics teachers towards the use of activity-based learning (ABL) methods in teaching mathematics in Nigerian schools. Some two hundred and twenty four (224) primary schools teachers made up of 60 males and 164 females were sampled using purposive sampling from Abia state of Nigeria. The design of the study was a descriptive survey design four research questions and three hypothesis guided the study. Simple frequency counts percentages, t-test and analysis of variance were used to analyze the data. The result of the study showed that primary school mathematics teachers are positively disposed to the use of Activity-Based learning methods in the sense that they understand it and prefer to use it in schools. The study also showed that the teachers agreed that Activity-Based Learning is very significant to the students learning and that ABL enhances students learning experiences. The study further identified lack of materials and time as the major impediments to activity based learning in Nigerian schools. It again showed that gender and years of experience of the teachers do not affect the attitude of primary school mathematics teacher towards the use of activity based learning in schools.

However, the study showed that there is a significant difference in the primary school mathematics teachers towards the use of activity-based learning between, the university degree graduate and college of education gradual teachers.

Prabha (2011), conducted his research on activity-based learning (ABL), this study investigated the educational experiences and attainment of learning outcomes of students in class four who have gone through the ABL methodology. Classroom observations showed that a good deal of student time is spent on non-learning related activities for a majority of students. Contains social, emotional and psychological aspects of classroom behavior have been seen to be positive in ABL classes through certain problems were also seen consistently. Students with disabilities who are included in a regular classes have shown improvements in communication and certain life skills but not in cognitive skills various aspects of the methodology have been explored to analyze how the activities in the methodology address the issue of individual differences in learners' needs and the cognitive needs of the age group of elementary school. Learning achievements, were seen to be moderate for basic language and mathematics skill. And how for advanced language and mathematical skills. Further the level of learning out comes of public school students was found to be significantly lower than that of privates school students even at basic levels of skills.

Both qualitative and quantitative research methods been used in this study leaving outcomes were measured by constructing a simple oral and written test designed to the specific skills and knowledge levels. The scores obtained from the tests were used to conduct ANOVAS to test differences and understand the patterns of learning outcomes. A sample of 10 Panchayat

Union schools under one Chester resource center (CRC) of Thondamuthur Block in Coimbatore district in Tamil Nadu was chosen for the study.

Another empirical research was conducted by Ayotola and Ishola(2013) on preparation of primary teachers in pupil-centered activity- based mathematics instructions and its model. The study adopted pretest posttest control group quasi-experimental research design involving two colleges of education randomly selected from south west part of Nigeria. Pre-service teachers in one of the colleges were exposed to activity based instructions while in the other were exposed to conventional method. The results revealed that those exposed to activity-based instructions have higher mean scores in activity-based lesson planning and delivery skills and in subject matter knowledge too. Based on this intervention an instruction model for primary school teacher preparation was proposed.

2.9.1 Teachers' Attitude and Pupil's Mathematics Performance

Newstrom and Davis (2002) attitudes are feelings and beliefs that largely determine how one perceives their environment, commit themselves to the intended actions and alternatively behave. Nui and Wahome (2006) argue that poor or negative attitude towards learning is caused by the belief that the subject is hand, lack of facilities, theoretical teaching, harsh teachers and teacher absenteeism.

The student negative attitude towards learning: is measured through student absenteeism, feigned sickness and lack of attention in classroom. Lenga (2001), in everything we do, success is determined by the attitude with which we appreciate it and in most cases we become what we think. If teachers are to do well in their profession, then they should change their attitude towards the innovations and be ready to implement the resolutions in the classrooms.According to them some teachers are more adaptive than others. They found out

that knowledge alone does not lead to the kind of thoughtful teaching everyone strives to maintain. According to the study, teachers with similar professional knowledge and qualifications were found to have differences and qualifications were found to have differences in their teaching practices. They further suggested the need to move beyond knowledge in teacher education with an aim to explore question about preparing thoughtful teachers, SMASE in service training provides a basis for thoughtful planning for effective teaching of mathematics and science using ASEI/PDSI.

John and Karaac (2004) stated that teachers' individual attitude about mathematics and science teaching and learning have a significant influence on their instructional practices. They further stated that in some cases teachers' beliefs about science and mathematics teaching and learning are not consistent with classroom practices and though teachers are aware of the conflict between them, they never try to change.

2.9.2 Use of Improvised Teaching and Learning Resources and Pupil's MathematicsPerformance

Muriuki and Nyagah (2004) defined a research as any source of information or support that the teacher uses to make teaching more effective and meaningful to learners. A supportive learning classroom in one which is student centered and involves use of a variety of teaching and learning resources. Resources are tools that classroom teachers use to help their student learn quickly (Choi and Tang, 2009).

Teaching resources when used while teaching supplement oral explanations and descriptions used in demonstration and also used to promote learners interest in mathematics and science, motivate and practice of skills that illustrate and clarify concepts in mathematics. The

availability and use of materials like textbooks, science and mathematics apparatus, chemical and other supplementing reading materials have a vital influence on teaching and learning process with positive effect on learners' performance.Teaching and learning resources enhances understanding of abstract ideas and improves performance (SMASE, 2006).

Wanjohi (2006) observe that the use of teaching and learning resources enhance retention of what is learnt about 80 percent. Committed teachers are said to be spending a lot of time on activities related to students' affairs, such activities include collection and improvising teaching and learning resources (Choi & Tang, 2011).

CEMASTEA - Kenya (2012), reported that a study carried out in 2010, where 12 district, classes 6, 7 and 8 pupils and science teachers participated in the study. The findings showed that 37 percent of the teachers prepare appropriate and affective teaching and learning resources. CEMESTEA (2012) recommended that teachers should use teaching learning resources because they emphasize information, stimulates interest and facilitates the learning process of science and mathematics. On the contrary, some studies show that in-service program for teachers do not affect pupil's performance and that they are ineffective.

2.9.3 ASEI Lesson Planning and Pupils' Mathematics Performance

The third cycle of SMASE program was actualization of ASEI/PDSI approach. The teachers here were taught to develop ASEI/PDSI lessons which were tried out by their peers and then teach actual learners in the classroom (SMASE, 2006). ASEI is an abbreviation of 'Plan' (planning a lesson), 'Do' (carried out a planned activities or lesson), 'See' (assessing students understanding and evaluating the lesson) and 'Implore' (improving the lesson based on the evaluation). PDSI is a continuous reflection process which allows a teacher to improve

mathematics and science lessons, subsequently lessons and lesson delivery skills in general (CEMASTEA, 2010).

A part from schemes of work and lesson plans, teachers carefully plans the lesson and try out the teaching and learning activities as required by PDSI approach to teaching. The first part of PDSI is planning of the ASEI lesson and instruction outlining lesson activities that will enable learners to understand individual concepts and connects among them; learners get value for the lesson, get rid of the learning difficulties and have interest in the lesson. According to Arunga (2007), teachers are encouraged to rethink the usefulness of the lesson plans as critical tool for lesson delivery. Teachers are to consider learners background like needs interest, previous experiences in relation to the topic and learning difficulties (CEMASTEA, 2010).

The second part of PDSI is 'Do'. The teacher carriers the planned lesson activities as intended. There teachers focus on the innovative lessons, presenting the lesson in varied and interesting ways to arouse learners interest. The teacher ensures active learners participation and be facilitator to teaching and learning process (CEMASTEA, 2012). The third part of PDSI is "See". Teachers evaluate teaching and learning process during and after the lesson objectives and planned activities. This enables teachers to focus on good practices in the lesson and improve on the mistakes made in the previous ones. The teacher becomes more open to evaluation by fellow teachers, school administrators, quality and standards assurance officers and the learners (CEMASTEA, 2012).

The last part of PDSI is 'improve'. The teacher reflects on the performance, evaluation reports and effectiveness in achieving the lesson objectives. The teacher integrates good

practices and feedback in subsequent lessons. Migwi (2012) note that teachers evaluate the teaching and learning process by reflecting on performance and the effectiveness in achieving the lesson objectives. Nui and Wahome (2006) reported from SMASE project impact assessment survey of 2004 that students were actively involved in the learning process. However, noted that none of the teachers had written work plan but judging from the flow of the lesson, it was evident that teachers knew what they intended to do. Jangaa (2005) notes that teachers prepare lesson plan as a matter of requirement and only do it when followed by the administrators.

2.9.4 Use of Learner-Centered Approach and Pupils' Mathematics Performance

Recent studies in mathematics and science education show that the teaching of mathematics subject should be leaner centered with the teachers' role being that of a facilitator, guide, councilor, motivator, innovator, and researcher (SMASE, 2006).There must be student-centered activities involving a lot of improvisation in the experiments which helps to demystify science and also assist in changing the attitude of learner towards the subject (SMASE, 2006).

Using inquiry based approach, learning takes a lot of time but it is often effective. Students practice problem solving and critical thinking skills to arrive at a conclusion. According to Adams and Brown (2001), describes the changing nature of the teacher in a constructivist learning that is 'teachers must shift their attention away from themselves as effective presenters of scientific information towards a focus on students developmental needs to learn science with understanding'. For those teachers who have undergone SMASE-INSET, the method is highly used in teaching and learning of mathematics and science.

Other teaching approaches that are emphasized for teaching science and mathematics during the SMASE-project work, which enables learners to engage in scientific investigation in areas of their own interest, field work excursions to provide pupils with first hand evidence of scientific phenomena and how they impact on everyday life. Modern methods of teaching such as simulation, games, skits and puzzles which may be very affective in teaching science and mathematics it well understood and used (SMASSE, 2006).The principle of ASEI movement and PDSI approach was noted to be very compatible with Nigeria's educational aspirations because there was a need to move from knowledge-based to activity based teaching, teacher-centered to learner-centered, lecture method to experiment and research based strategies and then from full scale to small scale experiments and improvisation. The students are involved through hands-on, minds-on, eye-on, and mouths-on activities and develop their knowledge (SMASSE, 2002).

2.10 Implications of the Reviewed Literature

In Azuka (2013b) the attitude of school teachers in Nigeria towards the use of activity-based learning methods in teaching mathematics in schools. Activity-based learning is a new teaching strategy that is vogue in every subject and everywhere in the world. The study revealed that many teachers in Nigeria understand the ABL methods and the need for their use in schools. In fact many of the teachers prefer ABL to the conventional method. Hence there is need for a continuous retraining of teachers and provision of instructional materials

to schools to facilitate the utilization of ABL in schools. The study revealed that the major problems of the use of ABL methods in schools are lack of instructions and time.

Having looking at the findings of the study, it is obviously noticed that the research work is relevant to the present study in the sense that the effect measured. Only that the study was limited to teachers only while the present study will go further to determine the effect of performance in mathematics/ so that the study will examine the performance of pupils in mathematics when ASEI approach is used and also solve the problem of lack of instructional materials and time mentioned in Azuka (2013b) though the skills of improvisation

In Prabha. (2011), the main aspects of educational experience that have been focused upon in this study are the nature of activities in the ABL methodology, nature of activities in ABL classroom and the nature of students with disabilities in the ABL classrooms, which are supposed to be inclusive in nature. Considering the keyword activity based learning, it's obvious that the study is relevant to the present study (ASEI approach). The only difference is that Prabha in his study, the classroom observations were done in about 80% of schools in the same location. While the present study will cover different location of the area so that the sampling allows the study to capture variations in implementation of ASEI approach and study the benefits and challenges of the same.

In addition the data obtained from classroom observations showed that the major learning related activities was student studying on their own which reinforces observation, the same applies to ASEI principle since the approach as student-centered, where the pupils will be guided by the teacher to carry out relevant activities, thereby experimenting, observing and recording the findings themselves allowing them to work in groups and come up with the concept to be learnt which is quite different from the tradition method.

Based on the findings of Ayotola and Ishola (2013), it can be concluded that activity-based instructional strategies, that is pupil-centered activity-based instructional strategy (PABIS), is better than modified lecture or direct instruction commonly adopted for the training of primary mathematics teachers in the colleges of education in Nigeria. Both the subject matter knowledge and pupil centered knowledge (PCK) are better acquired when activity-based instruction strategies are employed than the conventional, modified lecture issued.

Finally, the teaching of primary mathematics methodology and delivery of activity-based lessons on each topic has relevance to the present study in the sense that they all study the impact of activity-based and pupils centered classes in teaching mathematics concept. Only that the present study use primary school pupils to determine the impact of ASEI strategy while the latter used colleges of education. The present study also wentfurther to investigate the difference in performance between male and female pupils when ASEI approach is used.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The study investigated the Impact of Activity based, Student centered, Experiment and Improvisation (ASEI) onperformance in Mathematics among primary six pupils in Zaria Local Government, Kaduna State. Attempt was made to discuss on the literature related to this study. In this chapter, the methodology is presented with the following sub-headings:

3.2 Research Design

3.3 Population of the Study

3.4 Sample and Sampling Techniques

3.5 Research Instrumentation

3.6 Validity of Research Instrument

3.7 Pilot Study

3.8 Reliability of Research Instrument

3.9 Administration of the Treatment

3.10 Procedure for Data Collection

3.11 Data Analysis

3.2 Research Design

The research design used in the study was quasi-experimental research design to determine the impact of activity, student, experiment and improvisation (ASEI) as predictor of leaners' achievement in Mathematics. A pretest post-test quasi experimental research design was used which involves two groups for comparison, one experimental and the other control. The experimental group was subjected to treatment (teaching with ASEI approach), while the control group was taught same concepts with conventional method. Pretest was administered at the beginning of the research to determine the level of homogeneity between the groups while after the treatment process posttest was also administered to determine the effectiveness of the treatment. The research design illustration is presented in figure 3.1

$$EG \longrightarrow O_1 \longrightarrow X_1 \longrightarrow O_2$$

$$CG \longrightarrow O_1 \longrightarrow X_0 \longrightarrow O_2$$

Figure 3.1: Research Design

EG = Experimental Group

CG = Control Group

O_1 = Pretest

X_1= Treatment using ASEI approach

X_0 = No treatment (conventional method)

O_2 = Posttest

3.3 Population of the Study.

The population of the study comprised of one hundred and thirteen (113) public primary schools in six districts in Zaria Local government of Kaduna state and all the schools were co-educational. The total population of the pupils was eleven thousand, six hundred and twenty seven (11,627).The schools in each district have different geographical location, some are located in rural while others in urban areas. The pupils in the population have approximately the same age since the study covered pupils in the same level of education (class six only). The summary of gender distribution of pupil is presented in Table 3.1

Table 3.1 Summary of Distribution of Schools & Pupils by Gender in Districts

s/n	EducationDistricts	No. of Schools	Males	Females	Total No.of Pupils
1.	Pada	14	968	1025	1993
2.	Tudun Wada	09	943	1017	1960
3.	RafinAlbasa	24	1509	1298	2807
4.	AnguwanDankali	25	766	649	1415
5.	Dambo	21	487	312	779
6.	Kaura	20	1355	1298	2653

Total	**113**	**6028**	**5599**	**11627**

Source: Zaria Local Government Education (2015)

The Table revealed the gender breakdown of six thousand and twenty eight (6028) boys and five thousand, five hundred and ninety nine (5,599) girls registered as primary six pupils in the six districts in Zaria Local Government as the target population of the study.

3.4 Sample and Sampling Techniques

In this study, two (2) districts were randomly selected out of the six (6) educational districts in Zaria Local Government, within which two (2) schools were selected randomly from each district. The two schools were the experimental and control groups of each district. A total of two hundred (200) pupils was used as the sample size, this is in accordance with Central Limit Theorem that regarded a minimum of thirty (30) sample size viable for experimental research (Usman, 2000; Alice, 2011). In order to ensure that each school is given equal chance of being chosen, a random sampling technique was used to select the four schools from the two education districts randomly selected. The schools wereWaziriLawal and SayenTunkara L.G.E.A primary schoolsas control and experimental groups respectively, all from Rafin Albasa district. Haruna Soba and Baba AhmadL.G.E.A Primary schools from TudunWada district are the control and experimental groups randomly selected respectively.All the schools have more than two arms (primary six). Intact classes consisting both male and female pupils were used to form the subject of the study. Out of the 200 participants, 100 were males and 100 were females. The characteristics of the population such as gender, age, level and settlement were considered in the sampling technique. The sample of the study is presented in Table 3.2

Table 3.2Gender Distribution of Pupils by Districts, Group, Schools and Location.

Education District	Group	School	Location	M	F	Total
1	Experimental	SayenTunkara	Rural	25	25	50
		Baba Ahmad	Urban	25	25	50
2	Control	WaziriLawal	Urban	25	25	50
		Haruna Soba	Rural	25	25	50
Total				**100**	**100**	**200**

3.5 Instrumentation

The instrument consisted of:

i. Mathematics Performance Test 1 (pretest) and

ii. Mathematics Performance Test 2 (Posttest)

3.5.1 Mathematics Performance Test 1 (Pretest)

Mathematics Performance Test 1 (MPT_1) was designed to determine the level of homogeneity between the experimental and control group. The test consisted 30 multiple choice objective items with options A-D which were based on the topics selected. The researcher decided to use 30 items considering the level of the pupils and the number of questions set in their leaving school certificate examination. In each item there was one correct answer and three distractors which were drawn from leaving school certificate examination past questions papers because of the standardization of the questions. The pretest, marking scheme and the answer sheets for pretestwere presented in Appendix I.

3.5.2 Mathematics Performance Test 2 (Posttest)

The Mathematics Performance Test 2 (MPT_2) was constructed to evaluate the effectiveness of the treatment. This test consisted 30 of multiple choice objective items with options A-D

which were based on the topics covered. The questions were also drawn from leaving school certificate examination past question papers. The answer scripts were collected and marked fairly and honestly by the researcher. The response of the respondents on the test was scored according to the key. The respondent that gave correct response to an item, he/she earned one mark for the item while zero mark was earned for a blank or an incorrect response. The posttest and its marking scheme were presented in appendix II.

3.6 Validation of the Instrument

The confirmation of validity is necessary to ensure that an instrument measures truly and accurately what are sets out to measure. Therefore, the instrument drawn from primary school leaving certificate examination past question papers was validated by two principal and one senior lecturers in mathematics education in the department of Federal College of Education, Zaria. The validators were requested to:

a. study the items and certify if the questions are considered to test what they are supposed to test.
b. certify if they are appropriate for the level of the pupils for which it is intended.
c. check for possible errors in the suggested answers.

The tests (Pretest and Posttest) were further evaluated by experts in Mathematics Education in the department of Science Education, Ahmadu Bello University Zaria, Kaduna State. After the validation exercise, the researcher made some adjustments to the test as suggested by the experts.

Table 3.3: Table of Specification.

Objectives/Content	knowledge	Comprehension	Application	Total	%

Plane shapes	2	1	2	5	16.7
Statistics	1	2	1	4	13.3
Ratio	1	2	2	5	16.7
Angles	2	1	1	4	13.3
Fraction	2	1	2	5	16.7
Number base	1	1	2	4	13.3
Sequences	1	1	1	3	10.0
Total	10	11	9	30	100

Source: Obeka(2009).

3.7 Pilot Study

The instrument was pilot-tested at two primary schools namely; Abdurrahman Mora L.G.E.A Primary school Tudun Wada and Alu Dan Sidi L.G.E.A Primary school Zaria City. 50 pupils were used for the pilot test which are not part of the sample but part of the population of the study. The mathematics performance test 1 (pretest) and mathematics performance test 2 (posttest) were administered twice to the pupils using test- retest method, with two weeks interval. Data obtained after the test was analyzed using split-half method employing odd-even procedure and a Spearman Brown rank Statistics was used to analyze the data for the instrument.

3.8 Reliability of the Instrument

Reliability of an instrument is the consistency of an instrument over time. Therefore, for the reliability of this research instrument, a test-retest approach was applied in which test was administered to an intact class of two non- participating schools. After two (2) weeks, the same test was administered to same set of pupils. The approach was used to determine the suitability of the test items for the study and also confirm the internal consistency of the test. The reliability coefficient of r = 0.71 was obtained.

3.9 Administration of Treatment

The treatment covers some mathematics contents of primary six that were identified difficult in the literature review. Two groups were involved in the study which are from different schools in order to control interaction. Before the treatment, a pretest was administered to both groups to measure their level of homogeneity. They were taught separately with the help of two research assistants for at least thirty five minutes twice a week for a period of seven weeks and the posttest was administered thereafter. The treatment session for both groups were conducted by trained research assistants with the aid of lesson plans prepared by the researcher. The lesson plans for both the ASEI approach and traditional method were shown in Appendix III and IV respectively.

3.10 Procedure for Data Collection

Both the pretest and the posttest were conducted during the school hours in order to avoid absenteeism and improve respondent's control. The pretest was administered to the pupils before the treatment while the posttest was administered after the treatment. The purpose of the pretest was to find out the previous knowledge, abilities and homogeneity of the respondents while the purpose of the posttest was to measure the achievement of the

respondents constituting the sample. The answer scripts were collected immediately by the research assistants and marked fairly and honestly by the researcher.

3.11 Procedure for Data Analysis

Scores obtained at the end of mathematics performance test 1 (MPT_1) and mathematics performance test 2 (MPT_2) formed the data for the study. These data were compiled and analyzed using statistical tools for testing the null hypotheses at 5% level of significance. The hypotheses and the statistical tools used were itemized as follows:

i) Null hypothesis 1 was tested using t-test statistics

ii) Null hypothesis 2 was tested using t-test statistics

iii) Null hypothesis 3 was tested using t-test statistics

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, AND DISCUSSION

4.1 Introduction

The Study examined the impact of ASEI strategy on mathematics performance of primary six pupils in Zaria Local Government of Kaduna State. This chapter presented analysis of data, summary of results, and discussion on the findings carried out to determine the 'impact of ASEI strategy on performance in mathematics among primary six pupils in Zaria local government, Kaduna State. The analysis of the data was presented in respect of related research questions and hypotheses and a summary of results obtained was made at the end.

The presentation and analysis were organized under the following sub-headings.

- Data Presentation and Analysis
- Summary of the major findings
- Discussion

4.2 Data Presentation

The research questions and hypotheses were aimed at determining the impact of ASEI strategy on mathematics performance of primary six pupils in Zaria local government of Kaduna state. The three research questions and hypotheses sought to determine the impact of the strategy on performance between pupils in experimental group and those in the control group.

Before presenting results on the basis of related research questions and hypotheses, demographic characteristics of the respondents which include school settlement and sex was presented in frequencies and percentages in Tables 4.1 and 4.2 respectively.

Table 4.1: Summary of Distribution of Schools by Location

Settlement	Frequency	Percent	Cumulative %
Rural	2	50	50
Urban	2	50	100
Total	**4**	**100**	

Table 4.1 indicated equal number of schools from different locations, rural and urban areas; two each representing 50% in each case.

Table 4.2:Summary ofDistribution of Participants by Gender

Settlement	Frequency	Percent	Cumulative %
Male	100	50	50
Female	100	50	100
Total	**200**	**100**	

Table 4.2 indicated that there were equal participants, male 100 (50%) and female 100 (50%) which also reflected the sex composition of the population of the study.

4.2.1 Descriptive Statistics of Experimental and Control Groups.

Research Question One: What is the difference between the mean scores of pupils exposed to ASEI strategy and conventional method in some mathematical concepts?

Table 4.3: Mean and Standard Deviation for Performance of Experimental and Control Groups

Group	N	Mean	S.D	Mean Diff.
Experimental	100	68.47	3.289	

				12.2
Control	100	56.27	3.707	

Table 4.3 highlighted the means and standard deviation of the experimental and control groups with 68.47, 3.289 and 56.27, 3.707 respectively. This revealed that the mean of the experimental group was higher than that of the control group with mean difference of 12.2.

4.2.2 Descriptive Statistics of Gender

Research Question Two: What is the difference between the mean score of male and female pupils exposed to ASEI strategy in some mathematical concepts?

Table 4.4: Mean and Standard Deviation for Performance of Male and Female Pupils

Sex	**N**	**Mean**	**SD**	**Mean Difference**
Male	50	68.73	3.313	
				0.52
Female	50	68.20	3.290	

Table 4.4 highlighted the means and standard deviations of male and female performance when taught mathematical concepts using ASEI strategy. From the Table it was revealed that the mean of the male pupils was slightly higher than that of the female pupils as 68.73, 3.313 and 68.20, 3.290 respectively. The mean difference of 0.52 was found.

4.2.3 Descriptive Statistics of Location

Research Question Three: What is the difference between the mean scores of urban and rural pupils exposed to ASEI strategy in some mathematics concepts?

Table 4.5: Mean and Standard Deviation for Performance of Urban and Rural Pupils

Location	**N**	**Mean**	**SD**	**Mean difference**

Urban	50	68.39	3.383	
				0.39
Rural	50	68.00	3.220	

Table 4.5highlighted the means and standard deviations of urban and rural pupils' performance when taught mathematical concepts using ASEI strategy. From the Table it was revealed that the mean of the urban pupils was slightly higher than that of the rural pupils as 68.39, 3.383 and 68.00, 3.220 respectively. The mean difference of 0.39 was found

4.2.4 Hypotheses Testing

Hypothesis One: There is no significant difference between the mean scores of pupils exposed to ASEI strategy and conventional method in some mathematical concepts.

To test this hypothesis, t-test statistics was used and the result is presented in table 4.6

Table 4.6 Summary of t-test on Pupils' Performance in Mathematics Performance Test for Experimental and Control Groups

Group	N	Mean	S.D	SDx	DF	t-value	P	Decision
Experimental	100	68.47	3.289	0.329				
					198	7.385	0.000	*
Control	100	56.27	3.707	0.371				

Key: * = Significant

Table 4.6 revealed that the calculated t-value (t=7.385) was significant at $\alpha = 0.05$. Similarly, P-value (0.000) <0.05. Therefore $H0_1$ was rejected and it was concluded that, there was significant difference between the mean scores of pupils exposed to ASEI approach and conventional method in Zaria Local Government Area, Kaduna State.

Null Hypothesis Two: There is no significant difference between the mean scores of male and female pupils exposed to ASEI approach in some mathematical concepts.

To test this hypothesis, t-test statistics was used and the result is presented in table 4.7

Table 4.7 Summary of t-test Analysis of Performance of Male and Female Pupils Exposed to ASEI approach

Sex	N	Mean	S.D	SDx	DF	t-value	P	Decision
Male	50	68.73	3.319	0.469	98	0.242	0.809	**
Female	50	68.20	3.290	0.465				

Key: ** = Not significant

Table 4.7 revealed that the calculated t-value (t=0.242) was not significant at $\alpha = 0.05$. Similarly, the p-value (0.809) > 0.05. Hence $H0_2$ was therefore retained and it was concluded that there was no significant difference between the mean scores of male and female pupils exposed to ASEI approach in some mathematical concepts.

Null Hypothesis Three: There is no significant difference between the mean scores of urban and rural pupils exposed to ASEI approach in some mathematical concepts.

To test this hypothesis, t-test statistics was used and the result is presented in table 4.8

Table 4.8 Summary of t-test Analysis of Performance of Urban and Rural Pupils Exposed to ASEI approach

Location	N	Mean	S.D	SDx	DF	t-value	P	Decision
Urban	50	68.93	3.383	0.478	98	0.424	0.673	**
Rural	50	68.00	3.220	0.455				

Key: ** = Not significant

Table 4.8 revealed that the calculated t-value (t = 0.424) was not significant at $\alpha = 0.05$. Similarly, the p-value (0.673) >0.05. Hence $H0_3$ was therefore retained and it was concluded that there was no significant difference between the mean scores of urban and rural pupils exposed to ASEI approach in some mathematical concepts.

4.3 Summary of the Major Findings

The study was carried out to find out the impact of ASEI strategy on mathematics performance of primary six pupils in Zaria Local Government Area of Kaduna State. Descriptive analysis of data collected and the outcome of hypothesis testing revealed that:

1. Pupils performed significantly better in mathematics in Zaria Local Government Area of Kaduna State when ASEI strategy was used to teach mathematical concepts compared to the conventional method considering their respective descriptive statistics and outcome of test of hypotheses.
2. Performance of male pupils was not significantly different from that of female pupils when taught mathematical concepts using ASEI strategy when respective descriptive statistics and outcome of tests of hypotheses were considered.
3. Pupils from urban areas in Zaria Local Government had insignificant different mean performance scores when taught some mathematics concepts using ASEI strategy in comparison with pupils from the rural areas in the local government. Considering the respective descriptive statistics and outcome of test of hypotheses, the difference between the means and standard deviation was insignificant.

4.4 Discussion

The main purpose of this study was to examine the impact of ASEI strategy on mathematics performance of primary six pupils in Zaria Local Government Area of Kaduna State. In pursuance of the above objective, a mathematics performance test was developed and administered to the sample of two hundred (200) pupils who were selected by simple random sampling, technique for the study. After marking and recording of scores, a descriptive statistics investigations with the aid of t-test statistics were conducted using SPSS package to find out the impact of the strategy on primary six pupils in the local government. The discussion was presented as follows:

It was discovered from the study that, pupils taught mathematics concept using ASEI strategy performed significantly better than those taught the same concepts using the conventional method having the mean scores of 68.47 and 56.27 respectively. This finding agreed with Muhammad and Niaz (2012) who reported that activity based teaching method is more effective than the traditional teaching method to develop higher order thinking skill (application).Similarly, the findings also agreed withTayyaba and Iqbal (2014)who reported that activity based method enhances the learning of students and also a significant difference was found between the achievement scores of the students in mathematics taught through activity based teaching method and traditional teaching method which is in favor of activity based teaching.

The result is also in agreement with the finding ofAzuka (2013) that reported that students understood mathematics concepts and have retention when they actively participate in the lesson. Teachers should move away from the “teaching method” and select strategies promoting active learning in the classroom. It is important to involve the students while developing mathematical concepts as students need to participate actively in the learning process.

The study reported in significant difference between the mean scores of male and female pupils exposed to ASEI approach in some mathematical concepts. In fact, the mean performance of males was slightly higher (68.73), when compared with that of females (68.20). This findings agreed with the finding of Shrikishma and Badri (2013) who reported that there is no significant difference between the mean scores of boys and girls regarding application based items achievement scores. Douglas and Wisdom (2014) is in agreement with the finding of this study that revealed that neither boys nor girls scanned to have performed better than the other in academic work; through the results from follow-up interview showed that boys tended to perform slightly better than girls in mathematics.

Korau (2008) who investigated the effect of formula approach on the teaching of mathematical concepts in Senior Secondary Schools in Kaduna State reported that, no significant difference was found in the performance of male and female students when taught quadratic equation using the formula approach. Abian and Odok (2006) reported also that there is no significant relationship between gender and achievement in number and numeration, algebraic processes and statistics. These researchers however, found the existence of a weak significant relationships in geometry and trigonometry. Owolabi and Etuk-Iren (2014) revealed that gender, age and mathematics anxiety did not significantly affect achievement in algebra and hoped that if both gender are given proper orientation opportunities and training gender will no longer be an issue in mathematics achievement in general and achievement in algebra in particular.

The findings of this study discovered that there was no significant difference between the mean scores of urban and rural pupil exposed to ASEI approach in some mathematical concepts. In fact, the mean performance score, of urban pupils was slightly higher (68.39) when compared with that of rural pupils (68.00). This finding agreed with Loretta and Boniface (2013) who

submitted that urban-rural disparities in learning achievement of primary four pupils in numeracy was insignificant in Ebonyi and Imo States. However, the results showed that the disparities was significant in Abia, Anambra, and Enugu States. This result reported that there was no significant difference in learning achievement of primary four pupils from urban and rural areas in Numeracy.

Ebonyi and Imo states, Eme (2014) reported that school location does not influence students' performance in mathematics in AkwaIbom State. The result showed that 409 (47.95%) from school situated in urban area scored a mean value of 45.45 to be superior to the 444 (52.05%) rural counterparts with the mean score of 34.18 on the MAT. Though the mean difference was in favor of the urban pupils, but the f-ratio (1.377) showed insignificant difference in the performance of rural and urban pupil's in mathematics.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The study investigated the impact of Activity based, Student centered, Experiment and Improvisation (ASEI) strategy on mathematics performance of primary six pupils in Zaria Local Government Area of Kaduna State. This chapter contained the summary of the research and conclusions of the study. In addition, contribution of the study to knowledge, recommendations, and limitation of the study were also highlighted. Finally some suggestions for further studies were made.

5.2 Summary

This study investigated the impact of ASEI strategy on performance in mathematics among primary six pupils in Zaria Local Government. In the beginning of the first chapter the status of mathematics subject at primary and secondary level as stated in the National Policy on Education (2004) was highlighted. There after the negative attitude of the students which lead to the poor performance in the subject as justified by Carnine (2006) was reported. Causes responsible for the poor performance which could be linked to curriculum, methods of teaching, poor learning environment, lack of adequate instructional material and human resources were determined. In the chapter still, the way ASEI adopted by some countries including Nigeria to address problems similar to the ones listed above was highlighted. Before the chapter ended, objectives of the study, research questions, null hypotheses, significance of the study, basic assumptions and scope of the study were all elaborated.

In second chapter, review was made on previous works that are relevant to the current study. It began with the explanation of the concept of ASEI, its impact on both teachers and the pupils,

merits, perceived challenges and solutions. Japan-Nigeria SMASE project and finding characteristics of SMASE project were also discussed. In the chapter still, academic performance and some factors affecting it were outlined. In the chapter, methods of practice for teaching and learning mathematics which included problem-based, inquiry-based and challenged based learning approaches as well as the nature of mathematics teaching and learning in Nigeria were discussed. Review of literature related to the study was concluded by considering the implication of the review on the current study.

Chapter three described the design of the study. Quasi experimental design was used to investigate the impact of ASEI strategy on the dependent variable of the study i.e. performance. The population of the study was primary six pupils located in rural and urban areas of Zaria Local Government, Kaduna. The pupils' enrolment was eleven thousand six hundred and twenty seven (11,627) comprising six thousand and twenty eight (6,028 – 51.84%) males and five thousand five hundred and ninety nine (5,599 – 48.16%) females. From the population a sample of two hundred (200) subjects (100 from each of the two education districts) were selected using simple random sampling technique. Two instruments were used for the study which included mathematics achievement test (1 & 2) for pretest and posttest both were developed by the researcher. The instruments were validated by experts and sequel to a pilot study carried out, the reliability co efficient of r = 0.71 was obtained. The chapter also explained the procedure for data collection and for analysis after scoring, descriptive statistics and t-test statistics were used after processing data with statistical package for social sciences (SPSS). In taking decision, whenever the value of $p < 0.05$, H_0 was rejected and when $P > 0.05$, H_0 was retained.

Chapter four detailed how data was analyzed. Also, the summary of results of the study is given in the chapter. The hypotheses were tested using t-test statistics at $P \leq 0.05$ level of significance,

the three research questions and hypotheses determined the impact of ASEI strategy on performance compared to conventional method, gender and location (rural and urban). Summary of results showed that the strategy had significant impact on pupils' performance when ASEI was compared with conventional method in Zaria Local Government. However, the strategy had no significant impact on gender and location. The chapter concluded by discussing the aforementioned results.

The last chapter furnished information on the summary and conclusion based on the analysis and interpretation of findings of the study, recommendations, limitation of the study and suggestions for further studies.

5.3 Conclusion

Based on the analysis and interpretation of the findings study, the following conclusions were drawn:

1. ASEI strategy had significant impact on mathematics performance of primary six pupils relative to the conventional method in the local government.
2. ASEI strategy was found to be gender friendly
3. Location does not affect the use of ASEI strategy.

5.4 Contributions to Knowledge

The study examined the impact of ASEI strategy on mathematics performance of primary six pupils in Zaria Local Government area, Kaduna State. The contributions of the study to knowledge are:

1. The Study encouraged active pupils' participation when ASEI strategy is used in teaching mathematical concepts.

2. The ASEI provided improvisation skill to the participating teachers by making use of locally available materials to teach mathematical concepts as substitutes to the conventional materials.
3. The findings of the study have added new information to existing literature.
4. The instruments and manuals used could serve for further researches.

5.5 Recommendations

Sequel to review made, facts encountered and the findings of this study the following recommendations are offered.

1. Since activity, student, experiment and improvisation (ASEI) strategy had been found to have significant impact on primary school pupils' performance to some reasonable extent, there is need for primary school teachers to endeavor to use ASEI strategy during classroom instructions when teaching mathematical concepts.
2. Problem of unqualified teachers was identified among major constraints, efforts need to be made by the state government by organizing workshop on ASEI strategy so as to update teachers' improvisation skill.
3. Pupils should be encouraged by their teachers to carry out hands-on and minds-on activities in every mathematics lesson so as to make learning easy, real and permanent.
4. Curriculum developers should incorporate ASEI strategy in curriculum guidelines for achievement of intended learning outcomes and creativity.
5. Textbook publishers should make sure that the design of the pupils' and teachers' texts are ASEI complaints so as to achieve the stated objectives planned in the mathematics curriculum.

5.6 Limitations of the Study

This study has some limitations, some of which include the following:

1. Attendance of pupils from rural areas was low compared with that of the urban. The researcher therefore found it difficult to have the number of pupils sampled in the schools from rural areas.
2. The time allocated for each lesson was not enough for ASEI lessons especially in rural areas because the pupils spent much time before responding to researcher's instruction, as such the researcher had to search for more research assistance for team teaching.

5.7 Suggestion for Further Studies

The following suggestions are made for further study to expand the scope of this study:

1. A research may be conducted on the impact of ASEI strategy on pupils' performance in different levels other than primary six in the same local government and beyond.
2. The study could not cover all the primary six topics in the mathematics curriculum, it has covered only those perceived difficult to teach during SMASE base line Survey (2006). It is therefore suggested that more research should be carried out on other topics not touched in this study to find out whether similar or different results could be obtained relative to the current study.
3. Similar research may be conducted in other states so as to compare the impact of the strategy on pupils' performance in different areas of the state. This will be done with a view to find out whether similar or different results could be obtained relative to the current study.

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APPENDIX 1

Faculty of Education

Department of Science Education

Ahmadu Bello University, Zaria.

MATHEMATICS PERFORMANCE TEST 1 (MPT)

Pretest Study for experimental and control groups. **Time Allowed: 45 Minutes.**

SECTION A: BIODATA

Name of School:_____

Class:_____ Identification No:_____

Sex: Male [ ] Female [] Age:_____

SECTION B: ITEM ON MATHEMATICS ACHIEVEMENT TEST 1 (MAT)

INSTRUCTION.

Please read the following instructions carefully before you answer the questions

- Use HP pencil provided for the examination
- Write your school name, class and identification number for the examination in the space provided in the answer sheet.
- Read each question carefully before answering it
- After you have selected what you have chosen to be correct answer, go to your answer sheet and shade the appropriate alphabet in the space that corresponds with your choice.
- Shade only one letter for each answer

Now attempt the following questions, shade the correct answer in the answer sheet provided.

Q1. A triangle with base angles equal is called

a) Scalene triangle b) Equilateral triangle c) Isosceles triangle d)Right Angled triangle

Q2. Which of the following is equivalent to 4:12?

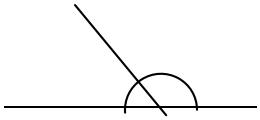
a) 1:2 b) 2:4 c) 1:4 d) 1:3

Q3. Find the average of the following scores 0, 1,3,5,7 and 8

a) 3 b) 8 c) 5 d) 4

Q4. Find the value of X^o in the diagram below

X^0 125^0



a) 50^0(b) 55^0(c) 60^0(d) 45^0

Q5. In tally representation ~~IIIIII~~ II is equal to

a) 12 b) 22 c) 17 d) 15

Q6 A rectangle with length 8m and breath 4m, its area is

a) $32m^2$ b) $12m^2$ c) $28m^2$ d) $15m^2$

Q7 If there are 25 boys and 40 girls in a class, what is the ratio of boys to girls?

a) 3:5 b) 4:8 c) 5:8 d) 8:5

Q8 Find the median of the following set of numbers 2,3,4,6,5,2,1

a) 2 b) 6 c) 1 d) 3

Q9 The following are acute angles except

a) 30^0 b) 27^0 c) 67^0 d) 100^0

Q10 Add ½ to $^2/_6$

(a) 3/8 b) 5/6 c) 2/12 d) ½

Q11 what is the perimeter of a square plot with side l0 ft ?

a) 200 ft b) 400 ft c) 100 ft d) 140 ft.

Q12 A bread maker has 750g of flour to be added to 500g of butter and 600g of sugar to make bread. What is the ratio of butter to flour?

a) 750g: 500g b) 500g: 750g c) 500g: 600g d) 750g: 600g

Q13 Evaluate 0. 5 x 12

a) 0. 60 b) 0. 32 c) 6.0 d) 60.0

Q14 Numbers in base 2 are called

a) Denary b) Binary c) Octal d) even.

Q15 Reduce 24/30 to its lowest form

a) 4/5 b) 12/15 c) 5/4 d) ¼

Q16 Which of the following does not belong to a circle?

a) Radius b) Diameter c) height d) Chord

Q17 Which of the following is not a plane shape?

a) Rectangle b) square c) triangle d) cube

Q18 4 in base 10 is equivalent to which number in base 2?

a) 100 b) 101 c) 001 d) 110

Q19 If 1000g = 1kg how many kilograms are in 2500g?

(a) 250kg b) 2.5kg c) 25kg d) 2.8kg.

Q20 If 100cl = 1 liters change 350cl to liters

(a) 2 liters b) 3.5 liters c) 2.5 liters d) 3 liters

Used the table below to answer questions 21 and 22

Marks	20	30	35	50	60	70	75
No. of pupils	3	2	3	6	0	4	1

Q21 What is the mode of the marks?

a) 30 b) 35 c) 60 d) 50

Q22 How many pupils scored 20 to 35 marks?

a) 8 b) 5 c) 0 d) 3

Q23 What is the volume of a cube with sides 4cm?

a) $16cm^3$ b) $61cm^3$ c) $64cm^3$ d) $46cm^3$

Q24 A motorcycle travels 8km in one hour (Ihr) How many kilometers will it travel in 1½ hr ?

a) 12km b) 2km c) 22km d) 12km.

Q25 two (2) angles add up to 90^o are called

(a) Adjacent b)supplementary c) complementary d) right

Q26 The next two numbers of the sequence 1,3,5,7 are

a) 9 & 11 b) 10 & 9 c) 8 & 9 d) 10 & 11

Q27 Which of the following are equivalent ratios?

a) 3:6 & 2:10 b) 12:24 & 15:30 c) 2:3 & 2:4 d) none of the above

Q28 change $\frac{12}{5}$ to mixed number.

a) $2\frac{1}{3}$ b)$1\frac{3}{4}$c)$2\frac{4}{5}$ d) $2\frac{2}{5}$

Q29 convert 1001_{two} to base 10

a) 8 b) 10 c) 9 d) 7.

Q30 The value of pi (π) is obtained by dividing the circumference by its

a) Radius b) diameter c) sector d) perimeter.

Marking Scheme for Mathematics performance Test 1

1. C	11. B	21. D
2. D	12. B	22. A
3. D	10. C	23. C
4. B	11. B	24. A
5. A	12. A	25. C
6. A	13. C	26. B
7. C	14. D	27. B
8. D	15. A	28. D
9. D	16. B	29. C
10. B	17. B	30. B

ANSWER SHEET FOR BOTH PRETEST AND POSTTEST

Instructions:

i) Use pencil and answer the questions by shading the appropriate box.

ii) Erase all wrongly shaded answers neatly.

iii) Do not shade more than box for each questions

Name of the respondent: _____

Sex: Male [ ] Female [ ]

Type of test: Pretest [ ] Posttest [ ]

Serial Number: _____

1.	[A]	[B]	[C]	[D]	16.	[A]	[B]	[C]	[D]
2.	[A]	[B]	[C]	[D]	17.	[A]	[B]	[C]	[D]
3.	[A]	[B]	[C]	[D]	18	[A]	[B]	[C]	[D]
4.	[A]	[B]	[C]	[D]	19	[A]	[B]	[C]	[D]
5.	[A]	[B	[C]	[D]	20	[A]	[B]	[C]	[D]
6.	[A]	[B]	[C]	[D]	21	[A]	[B]	[C]	[D]
7.	[A]	[B]	[C]	[D]	22	[A]	[B]	[C]	[D]
8.	[A]	[B]	[C]	[D]	23	[A]	[B]	[C]	[D]
9.	[A]	[B]	[C]	[D]	24	[A]	[B]	[C]	[D]
10	[A]	[B]	[C]	[D]	25	[A]	[B]	[C]	[D]
11.	[A]	[B]	[C]	[D]	26	[A]	[B]	[C]	[D]
12.	[A]	[B	[C]	[D]	27	[A]	[B]	[C]	[D]

13. [A]	[B]	[C]	[D]	28	[A]	[B]	[C]	[D]
14. [A]	[B]	[C]	[D]	29	[A]	[B]	[C]	[D]
15. [A]	[B]	[C]	[D]	30	[A]	[B]	[C]	[D]

APPENDIX II

Faculty of Education,

Department of Science Education,

Ahmadu Bello University, Zaria.

Mathematics Performance Test 2 (MPT).

Post Test Study for experimental and control groups **Time allowed: 45 minutes**

Instructions: select from options a – d what you believe to be the correct answer of each questions. You are to answer all the questions and all carry equal marks.

Q.1 when the sum of two angles gives 90^o, the angles are called

a) Supplementary b) right c) adjacent d) complementary.

Q.2 If a car travels 10km in 30 seconds, how many kilometers will it travel in 90 second?

a) 30km b) 300km c) 90km d) 5km.

Q.3 A Cube with length 5m, its volume is

a) $16m^3$ b) $10m^3$ c) $125m^3$ d) $20m^3$.

Use the Information below to answer questions 4 and 5

Scores	75	70	60	50	35	30	20
Frequency	1	4	0	6	3	2	3

Q.4 what is the mode of the score?

a) 50 b) 60 c) 35 d) 30

Q.5 how many pupils sat for the test?

a) 20 b) 19 c) 18 d) 27.

Q.6 If I liter = 100 Centiliter, how many centiliters make $2\frac{1}{2}$ liters?

a) 200cl b) 250cl c) 2.5cl d) 25cl

Q.7 Change 2500g to kg

a) 250kg b) 2.8kg c) 25kg d) 2.5kg

Q.8 Change 4 base tento base two.

a) 101_{two} b) 001_{two} c) 100_{two} d) 110_{two}.

Q.9 The following are plane shapes except

a) Cube b) square c) triangle d) rectangle.

Q.10 All the following belong to a circle except

a) Radius b) Height c) Diameter d) circumference

Q.11 Binary numbers are numbers in base

a) eight b) ten c) two d) three

Q.12 Evaluate 12 x 0.5

a) 60.0 b) 6.0 c) 0.32 d) 0.60.

Q.13Express $\frac{15}{25}$ in its lowest form

a) 5/8 b) 3/4 c) 4/3 d) 3/5

Q.14The sum of $\frac{2}{6}$ and $\frac{1}{2}$ is

a)$\frac{5}{6}$ b)$\frac{3}{8}$ c)$\frac{1}{2}$ d)$\frac{2}{12}$

Q.15 All the following are acute angles except

a) 27^o b) 100^o c) 67^o d) 30^o

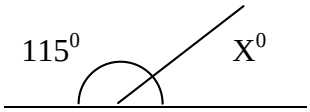
Q.16 The median of the scores 3, 4, 6, 2, 5, 2, 1 is

a) 6 b)2 c)3 d) 1

Q.17 The tally ~~IIIIII~~ III represent

a) 22 b) 12 c) 15 d) 13

Q.18 Calculate the angle marked x^o in the diagram below



a) 65^0 b) 75^0 c) 18^0 d) 90^0

Q.19 What is the average of the numbers 1, 0, 3, 5, 8 and 7?

a) 3 b) 8 c) 4 d) 5

Q.20Mrs.Alabi have 8 children, 3 boys and 5 girls what is the ratio of the girls to boys?

a) 3:5 b) 3:8 c) 5:3 d)5:8

Q.21 A triangle with base angles equal is called

a) Equilateral triangle b) right angled triangle c) scalene triangle

d)isoscelestriangle.

Q.22 The equivalent ratio of 4:12 is

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

Q.23 The length of a square plot is 100ft, what is its perimeter?

a) 140ft b) 400ft c) 100ft d) 200ft.

Q.24 A triangle with length 6cm and breadth 3cm, its area is

a) $28cm^2$ b) $12cm^2$ c) $9cm^2$ d) $18cm^2$

Q.25 The number that appears most in a set of numbers is called

a) Mean b) median c) mode d) tally.

Q.26 The value of pi (π) is obtained by dividing the circumference of circle by its

a) Diameter b) Radius c) Sector d) Perimeter

Q.27 convert 1001_{two} to base 10

a) 8 b) 9 c) 10 d) 7

Q.28 Change $\frac{12}{5}$ to mixed number.

a) $1\frac{3}{4}$b) $2\frac{1}{5}$ c)$2\frac{2}{5}$ d)$2\frac{3}{5}$

Q.29 Which of the following are equivalent ratios?

a) 2:3 & 2:4 b) 3:6 & 2:4 c) 12:24 & 15:30 d) None of the above.

Q.30 Find the common difference of the sequence 1,3,5,7.

a) 1 b) 5 c) 3 d) 2

Marking Scheme for Mathematics Performance Test 2

1. D	11. C	21. D
2. A	12.B	22. A
3.C	13. D	23. B
4. A	14. A	24. D
5.B	15. B	25. C
6. B	16. C	26. A
7 D	17. D	27. B
8. C	18. A	28. C
9.A	19. C	29. C
10.B	20. C	30. D

APPENDIX III

ASEI LESSON PLANS FOR EXPERIMENTAL GROUP

LESSON ONE

Week: One

Subject: Mathematics

Theme: Geometry & Mensuration

Topic: Plane Shapes

Sub-Topic: Area of Square and Rectangle

Date: 18th January, 2016

Duration: 35 minutes

Class: Primary 6

Number of pupils: 50

Average age: 12 years

Methodology: ASEI Approach

Learning Objectives: By the end of the lesson, pupils should be able to:

i) Calculate the area of square when the side is known.

ii) Apply the idea of (i) and (ii) in real life situations.

Rationale: The knowledge of plane shapes has been found to be very important in various field such as engineering, building, construction and so on. Pupils in their earlier classes were already exposed to the study of plane shapes. It is therefore important for pupils to expand their knowledge with particular reference to the area of square and rectangle.

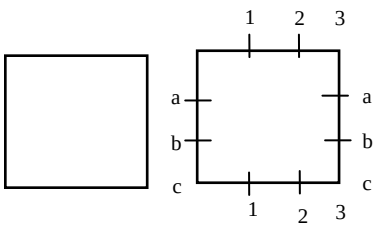
Pre-requisite Skills and Knowledge: The pupils learnt about the properties of plane shapes and how to measure their perimeter using stings and ruler.

Teaching/Learning Materials: Square, Rectangle (cut from wood), Ruler, Strings and Pencils.

Reference Materials: National Mathematical Centre *Teaching Module for Primary Six*

Lesson Development

Stage	**Teacher's activity**	**Learners' activity**	**Learning/Teaching Points**
INTRODUCTION (5min)	Teachers groups the pupils and give them one square and one rectangular wood and ask them to use string and ruler to determine their perimeters.	Carrying out the activity instructed by the teachers	Recall how to determine the perimeter of plane shapes.
PRESENTATION Step I (2 min)	Teacher shares the learning materials to each group and ask them to identify them and also give each group worksheet and allow them to select their team leader.	Selecting a team leader and also identifying the materials given to them.	Leadership training and identification of learning materials.
Step II (5 min)	Teacher gives the conditions	Carrying out the activities as	Determinatio

	on how to carry the activities one after the other as follows: 1. Take the square wood given to you and measure its sides using strings and ruler. 2. Use ruler to mark one-one cm on each side and name the marks 1,2,3, and a,b,c, on each opposite sides. 3. Use ruler to join 1-1, 2-2, 3-3 and a-a, b-b and c-c. 4. Count the number of small squares formed and record in the worksheet provided. 5. Take the other square of sides 5cm, repeat the activity and record the number of small squares formed. **Illustration:** A B  	instructed and recording the number of small squares formed.	n of area of square

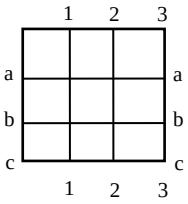
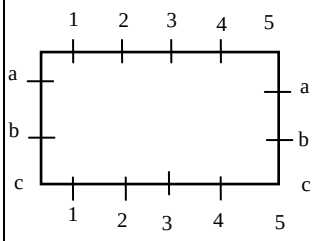
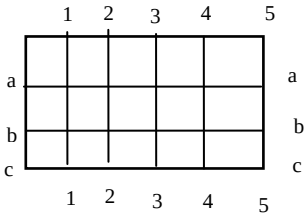
<table>
<tr>
<td></td>
<td>C

</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step III (5 min)</td>
<td>Teacher ask pupils to use the same process to count the number of small squares found in a rectangular wood provided with length 5cm and breadth 3cm.

Illustration



</td>
<td>The same as Step II</td>
<td>Determinatio n of area of or rectangle</td>
</tr>
<tr>
<td>Step IV (3 min)</td>
<td>Teacher asks each group leader to report their findings so as to compare the results</td>
<td>Reporting of results.

Expected results:

<table>
<tr><th></th><th>Shape</th><th>L</th><th>B</th><th>No. of Squares</th></tr>
</table></td>
<td>Comparing the results of the groups</td>
</tr>
</table>

		1	**Square**	**3cm**	**-**	**9**
		2	**Square**	**5cm**	**-**	**25**
		3	**Rectangle**	**5cm**	**3cm**	**15**

.

Step V (5 min)	Teacher explains that the number of small squares formed in each shape is the area of the shape and we can use the formulae below to calculate the area of square and rectangle respectively. 1. Area = LXL = L^2 2. Area L x B Where: L = Length and B = breadth	Listening and observing that: 1) L = 3cm Area = L^2 = 3cm x 3cm = $9cm^2$ 2) L = 5cm Area = L^2 = 5cmx5cm $25cm^2$ 3) L = 5cm b = 3cm Area = Lx6 = 5cm x 3cm = $15cm^2$	How to calculate the area of square and rectangle using formula
EVALUATION (5 min)	Teacher evaluates the lesson by asking pupils questions	Responding to questions asked.	Confirming the achievement of

	e.g.: 1. What is the area of square of side 6cm? 2. A rectangle of sides 4cm by 2cm. What is its area?		the stated objectives.
CONCLUSION (5 min)	Teacher re-explains the use of formula as other way of finding the area of square and rectangle and clear misconception if any.		
HOMEWORK	Use construction and formula method to calculate the area of square with side 8cm and that of rectangle with length 6cm and breadth 3cm.		

WORKSHEET

ACTIVITY	SHAPE	LENGTH	BREADTH	NO. OF SQUARE
A				
B				
C				
D				

LESSON TWO

Week: Two

Subject: Mathematics

Topic: Number bases

Sub-Topic: Conversion of number in base 10 to other bases

Date: 25th January, 2016.

Duration: 35 minutes

Class: Six

Number of pupils: 50

Average age: 12 years

Methodology: ASEI Approach

Learning Objectives: By the end of the lesson, pupils should be able to:

i) Convert number in base ten to two

ii) Change numbers in base ten to three

iii) Compare numbers in base ten with numbers in other bases and observe the digits involve in each base.

Rationale: Number system generally is a very, important and interesting aspect of mathematics, especially the binary system in today's world of technology. Its application begins as early in one's life as seen in cases such as on and off switches in our electronics, open and close, the human two legs, eyes, hands, ears and lots of others, this there is great need for its each understanding.

Pre-requisite skills and Knowledge: Pupils learnt about:

i) Binary, denary numbers and the digits involved in each base.

ii) Division of whole numbers with and without reminder.

Teaching and Learning Materials: Match Sticks, bottle tops or beads, strings, cardboard paper

Reference material: National Mathematical Centre *Teaching Module for Primary School Six*

Lesson Development

Stages/Time	**Teacher's activity**	**Learners' activity**	**Learning/Teaching Points**
INTRODUCTION (5 min)	Teacher reviews a few work on addition, subtraction, of denary and binary numbers as: i) $23_{10} + 76_{10} = 2\ (105) = 3$ (units)+7 (105) +6 (units) $= 9(105)+9(\text{units}) = 99_{10}$ ii) $110_{two} + 10_{two} = 1000_2$ i.e. $1\ 1\ 0_{ten}$ $+\quad 1\ 0_{two}$ $1\ 0\ 0\ 0_{two}$	- Adding together base 10 numbers. - Adding together base 2 numbers. (noting that in base 10 borrowed or carried numbers are in tens and that of base 2 is in twos)	Recalling addition of denary and binary numbers.
PRESENTATION (3 min)	Pupils get into groups and are given number of bottle	Identifying materials given to them and	

	tops and a worksheet.	grouping the bottle tops.	
Step 1 (5 min)	Teacher instructs the pupils to carry out the activities as follows: Follow the instruction and fill in the table in the worksheet.  1. Count eight bottle tops 2. Group the bottle tops in twos and record the last box (right to left). 3. Pick one bottle top from each group and discard the rest. 4. Re-group the bottle top you picked in twos and record the reminder next to the first one. 5. Pick one bottle top from each group of twos and keep	Performing the activities instructed by the teacher as well as recording the results in the worksheet.	Conversion of 8 base 10 to base 2.

	off the rest. 6. Re-group the bottle tops you picked in twos and record the reminder to the next box. 7. Repeat the activity until you get the quotient zero, and record the remaining bottle top in the last box. i.e. $8_{ten} = X_{two}$ 1 0 0 0 two		i.e. $8_{ten} = 1000_{two}$
Step II (5 min)	Teacher instructs the pupils to follow the same process with 9 bottle tops and record the results i.e. $9_{ten} = X_{two}$	Carrying similar activity with 9 bottle tops **Expected result** 1 0 0 1 two	Conversion of 9 base ten to base 2. i.e. $9_{ten} = 1001_{two}$
Step III (5 min)	Teacher asks pupils to repeat the first activity but taking 3 bottle tops at a time.	Counting, grouping and recording in the worksheet **Expected answer.**	Conversion of 8 base ten to base three i.e. $8_{ten} = 22_{three}$

			2	2	three	
Step IV (5 min)	Teacher asks each group to present their results for comparison and also explain that this is how we convert base 10 numbers to other bases.	Presentation of group work.				Method of conversion from base 10 to other bases using concrete objects.

EVALUATION (5 min)	Few oral questions are asked to assess achievement of objectives: - What is 5_{ten} in base 2? - What base are we using when we group items in twos? - How do we change 12_{ten} to base two? etc.	Responding to questions asked by the teacher.	Assessing the achievement of learnt concept.
CONCLUSION (2 min)	Teacher summarizes the lesson by referring back to the steps taken in converting from base 10 to other bases i.e. - Grouping in the required based and units - Adding up to get result.		Strengthening learnt concept in summary form.

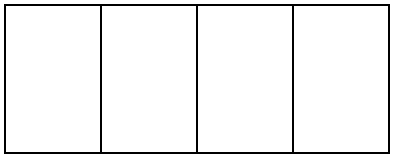
HOMEWORK	Follow the procedure in the activities above to convert. 1) 14_{ten} to base 2 2) 18_{ten} to base 3 3) 20_{ten} to base 4.		

WORKSHEET ONE

ACTIVITY A

TOPIC: You are provided with bottle tops. Carryout the Activity and fill in the table below starting from the right to the left hand of the table

$8_{ten} = X_{?}$



1) Count eight bottle tops as given above.

2) Group the bottle tops in twos and record the reminder in the least box of the table.

3) Pick one bottle top from each group and discard the rest.

4) Regroup the bottle tops you picked in twos and record the reminder next to the first one.

5) Pick one bottle top from each group of twos and keep off the rest.

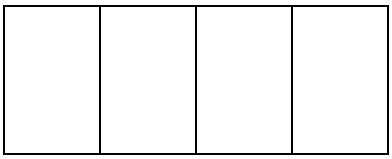
6) Regroup the bottle tops you picked in twos and record the reminder to the next box.

7) Repeat the activity until you set the quotient zero and record the remaining bottle top in the last box.

ACTIVITY B

You are also provided with bottle tops. Follow the instructions and fill in the table below

$9_{ten} = X_{?}$



Count 9 bottle tops as given

1) Group the bottle tops in twos and record the reminder in the last box from the right.

2) Keep off the reminder

3) Pick one bottle top from each group and discard the rest.

4) Group the bottle tops you picked in twos and record the remainder next to the first one.

5) Pick one bottle top from each group of twos and keep off the rest.

6) Regroup the bottle tops you picked in twos and record the reminder to the next box.

7) Repeat the activity until you set the quotient zero and record the remaining bottle top in the last box.

MINDS ON ACTIVITY

A. Convert $8_{ten} = X_{two}$?

Compare your results with the one in the table of activity A. comment

B. Convert $9_{ten} = X_{two}$?

Compare your results with the one in the table of activity B. comment

LESSON THREE

Week: Three

Subject: Mathematics

Theme: Geometry & Mensuration

Topic: Circle

Sub-Topic: Concept of Pi (π)

Date: 1st January, 2016.

Duration: 35 minutes

Class: Primary 6

Number of pupils: 50

Average age: 12 years

Methodology: ASEI Approach

Learning Objectives: By the end of the lesson, pupils should be able to:

i) Determine the value of Pi (π)

ii) Calculate the circumference of a circle using the value of Pi (π) above.

iii) Appreciate the reason why value of Pi is constant.

Rationale: The value of pi is important because of its application when calculating the area and circumference of circles. The value of pi is constant no matter how the size is. It is therefore necessary to teach the pupils why the value is constant through activity based learning.

Pre-requisite Skills and Knowledge: Pupils were familiar with

i) Circle and its part

ii) Area of circle using the formula $A = \pi r^2$

iii) Multiplication, division of whole numbers and fraction

Teaching/Learning Materials: Tins of different size, thread and ruler

Reference Materials: National Mathematical Centre *Teaching Module for Primary School Six*

Lesson Development

Stages/Time	**Teacher's activity**	**Learners' activity**	**Learning/Teaching Points**
Introduction	Teacher asks questions on the previous work e.g. 1) Measure the perimeter of one face of the match box given to you using thread and ruler. 2) List five parts of a circle etc.	Calculating the perimeter of match box.	Assessment of previous work
Presentation	Teacher puts pupils in groups and share the materials for activities.		
Step I	Teacher gives the following instructions and asks the	Carry out the activities as instructed by the	Determination of value of π

	pupils to carry out the activities and record the results in their worksheet. 1) Take the tin labeled A, measure its Circumference with thread and ruler and record in the space provided. 2) Use thread and ruler to measure the diameter of the tin and record. 3) Divide the circumference by the diameter and record the result.	teacher as well as recording the result obtained.	

Step II	Teacher instructs the pupils to carry out the next activity as follows: 1) Take the second tin labeled B. 2) Follow the same process in activity 1 and record the result	Measuring, dividing and recording result	Value of π

<table>
<tr>
<td>Step III</td>
<td>Teacher instructs the pupils to perform the next activity using the tin labeled C.
NOTE: All the three tins are of different size.</td>
<td>Performing experiment using tin C.</td>
<td>Value π</td>
</tr>
<tr>
<td>Step IV</td>
<td>Teacher asks the groups to report their findings on the board and ask them to observe and compare the results of dividing the circumstance of each tin by its diameter.
<table>
<tr><th>Tin</th><th>Circumference</th><th>Diameter</th><th>C/D</th></tr>
<tr><td>1</td><td></td><td></td><td></td></tr>
<tr><td>2</td><td></td><td></td><td></td></tr>
<tr><td>3</td><td></td><td></td><td></td></tr>
</table>
</td>
<td>Reporting, observing and comparing the results.</td>
<td>The value of π is constant.</td>
</tr>
<tr>
<td>Step V</td>
<td>Teacher asks the pupils to take the value of Pi obtained in their table (3.142 or $\frac{22}{7}$) to calculate the circumference of circles with given radius e.g.:</td>
<td>Calculating the circumference of circle
Solution:
1) r = 3cm
c = $2\pi r$ = 2 x $\frac{22}{7}$ x 7
= 18.86cm
2) r = 5cm</td>
<td>Calculation of circumference of a circle using the constant value of π
($\frac{22}{7}$or 3.142)</td>
</tr>
</table>

	1) When r = 3cm 2) When r = 5cm Using the formula C = $2\pi r$	c = $2\pi r$ = 2 x $\frac{22}{7}$ x 5 = 31.43cm	
EVALUATION	Teacher asks questions based on the activities done and the results obtained and ask the pupils to name the concept realized from the exercise.	Responding to questions	Assessment of the achievement of the stated objective.
SUMMARY / CONCLUSION	Teacher summarizes how the value of π is obtained as constant using the activities carried out and then clear misconception if any.		Strengthening learnt concept in summary form.
HOMEWORK	Take 3 tins at home all of different size, follow the same procedure and determine the value of π		

LESSON FOUR

Week: Four

Subject: Mathematics

Theme: Number and Numeration

Topic: Fraction

Sub-Topic: Addition of Fraction

Date: 8th February, 2016.

Duration: 35 minutes

Class: Primary 6

Number of pupils: 50

Average age: 12 years

Methodology: ASEI Approach

Learning Objectives: By the end of the lesson, pupils should be able to:

i) Add two simple fractions using paper folding system

ii) Compare the result of *(i)* with normal addition

iii) Apply the idea of addition traction to share things among themselves.

Rationale: Fraction involves sharing of things, thus, it has wide application in daily life activities. In fact the topic in the syllabus is grouped under number and numeration. Therefore there is need to study the concept in order to meet up with the challenges that may come across during sharing of items, mixing of different items among others.

Pre-requisite Skills and Knowledge: Pupils have learnt about:

i) Fraction and its types

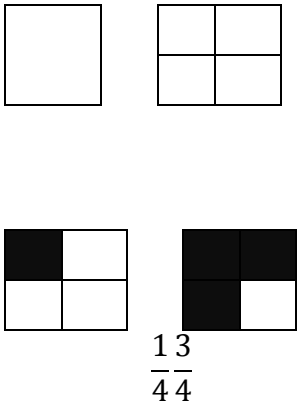
ii) Conversion of improper to mixed number and vice-versa

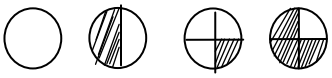
iii) Addition of whole number

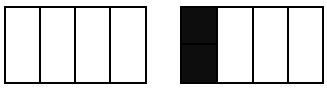
Teaching/Learning Materials: Cardboard paper, scissors, tin, pencil and ruler.

Reference Materials: National Mathematical Centre *Teaching Module for Primary School Six*

Lesson Development

Stages/Time	**Teacher's activity**	**Learners' activity**	**Learning/Teaching Points**
Introduction (5 min)	Teacher puts pupils into groups and share materials to each group. The pupils are asked to carry out the following activity with instruction below: Use the rectangular plain paper cuttings to do the following activities; a) Fold it into four equal parts b) Write down any two properties c) Cut the pieces of paper into four equal pieces along the	Performing the activities instructed by the teacher. **Expectation**  $\frac{1}{4}\frac{3}{4}$ Two proper fraction	Recall types of fraction

	fold lines d) Share the pieces among three of you equally and record the fraction representing your own portion e) Discuss and harmonize your answers.		
PRESENTATION Step I (5 min)	Teacher asks the pupils to carry out more activities following the instructions below: a) Draw a circle on the cardboard paper and cut it out with scissors. b) Fold the circle into two equal parts and shade one part. Record the fraction of the shaded portions. c) Fold the whole shape again into 4 equal parts and shade one part. Record its fraction. d) Open the whole shape and write the fraction of all shaded parts.	Carrying out the activities instructed, discussing and record the results. Illustrations  A B C D B + C = D $\frac{1}{2} + \frac{1}{4} = \frac{3}{4}$	Addition of two fractions.

Step II (10 min)	Teacher asks them to carry out the next activity as follows: a) Draw and cut out a rectangle of length 5cm and breadth 3cm using cardboard paper provided. b) Fold the shape into four	Performing the activity instructed. **Expectation**  A B = $^1/_4$	Adding of fraction.

	equal and shade one part. Record the fraction of the shaded portion. c) Shade Two out of the remaining unshaded parts and record the fraction of the shaded portions. d) Add the 1st shaded part and the second part i.e. adding the two recorded fraction together.	 C = $^2/_4$ B + C i.e. $\frac{1}{4} + \frac{2}{4} = \frac{3}{4}$  D = $^3/_4$	
Step III (5 min)	Teacher ask the pupils to follow the same procedure of activity 2 and find the result of $\frac{1}{3} + \frac{2}{3}$ using paper folding system.	Carrying the activities as instructed by the teacher.	Adding $\frac{1}{3}$ to $\frac{2}{3}$
EVALUATION (5 min)	The teacher evaluate the lesson by asking questions based on the lesson.	Responding to questions asked.	Assessing the achievement of objectives.
SUMMARY/	Teacher summarizes the	Listening to the summary	Comparison of

CONCLUSION (5 min)	lesson by re-explaining briefly the steps followed in the activities carried out in the lesson clear misconception if any and finally compare the results obtained practically with results when normal calculation is used.	and confirming whether the results are the same or not.	results.
HOMEWORK	You are asked to share one orange among 2 Isa and Musa. Later in the day you are given 3 more oranges to share among the same people. Calculate how many oranges does each gets at that day?		

LESSON FIVE

Week: Five

Subject: Mathematics

Theme: Number and Numerations

Topic: Ratio **Sub-Topic:** Equivalent Rations

Date: 15th February. 2016 **Class:** Primary 6

Duration: 35 Min. **Number of Pupils:** 50

Learning Objectives: By the end of the lesson, the pupils should be able to;

i) explain the meaning of Equivalent Ratio

ii) solve problem on equivalent ratio using concrete objects.

Rationale: The knowledge of ratio is being used in our daily lives such as cooking, construction. Equivalent ratios are ratios that have direct proportional change hence the knowledge will help them to lay learning foundation for proportion.

Pre-requisite previous knowledge: Fraction, (Division) and Multiplication

Learning materials: Stones, bottletops, and match sticks.

Reference: National Mathematical Centre *Teaching Module for Primary School Six*

Lesson Development:

Stage	**Teacher's activity**	**Learners' activity**	**Learning/Teaching Points**

<table>
<tr>
<td>Introduction
(5 min)</td>
<td>Teacher introduces the lesson by giving two pupils (Musa and Aisha) stones as shown in the table below respectively

<table><tr><td>Musa</td><td>?</td><td>2</td><td>3</td><td>4</td><td>5</td><td>?</td><td>?</td></tr><tr><td>Aisha</td><td>?</td><td>6</td><td>9</td><td>12</td><td>15</td><td>?</td><td>?</td></tr></table>
Teacher asks all the pupils to compare the number of stones given to Musa and Aisha for all the columns.
Teacher asks pupils to explain what they have done.
Teacher asks pupils to look at what they have done and complete the table considering how they compare the stones given to Musa and Aisha
Teacher then asks “which is the easier way to compare”?</td>
<td>Pupils compare by findings the difference (stones), example of column one, 6-2 = 4. If Musa has 2 stones, Aisha has 4 more stones

Pupils compared by division i.e. (6/2) stones = 3. Aisha’s stones is 3 times that of Musa for the first column.
Pupils explain that they have subtracted Musa’s and also divided Aisha’s stones by Musa’s stones for all the columns.</td>
<td>Comparing quantities by difference.

Comparing quantities by division

The concept of</td>
</tr>
</table>

		In order to complete the table, it is easier to compare by division and multiplication.	equivalent ratio
	Teacher comments on what pupils have done by telling them, they have compared the stones in two ways i.e. by Subtraction and Division. He then explains the meaning of equivalent ratios as ratios that have direct proportional change when you compare either by division or multiplication.		Expression of ratio
	Therefore the ratio of Aisha's stones to Musa's is directly proportional i.e. = 3:1. The sign: indicates ratio and it is read as ratio 3 to 1. We can also say that the ratio of Musa's to that of Aisha is 1:3 or 1 to 3.		
	Teacher asks pupils to read the	Pupils read the	

	expression. It means that for every 1 that Musa has, Aisha has 3. We can also write it as 1/3.	expression as ratio 1 to 3 or 1:3.	

PRESENTATION: Step 1 (2mins) (group work)	Teacher groups the pupils into 5 and names the groups A to E with these numbers of pupils per group respectively 2, 4, 6, 8, 10.	Pupils arrange themselves into their various groups.	
Step 2 (2mins) (partial grouping)	Teacher asks pupils to share the stones brought to the class, 2 stones to each pupil.	Pupils share the stones among themselves.	
Step 3 (5mins) (group work)	Teacher asks the pupil to compare the number of stones in their various groups.	Pupils make comparison i.e. the quantities of stones and number of pupils in group i.e. 4 stones to 2 pupils = 4:2 = 2:1. Also 8 stones to 4 pupils = 8:4 =2:1 and	To observe how quantities change.

		so on.	
Step 4 (5mins) (group work)	Teacher asks pupils to explain what they observe. Teacher summaries the activities on stones by asking the pupils what they have learnt sharing the stones. Teacher concluded by telling pupils that their observation were correct. The ratio of stones to number of pupils were directly proportional hence the meaning of equivalent ratio.	pupils may observe that as the number of pupils increases in the group , the number of stones also increasesi.e. When 2 pupils get 4 stones, 4 pupils get 8 stones and so on.	To observe how quantities change.

EVALUATION: (6mins) (simplification of ratio)	Teacher gives the pupils the following exercise 1, A bread maker has 81g of	Pupils attempt the question:	Assessing pupil' ability to show equivalent ratios

(individual)	flour to be added to 9g of butter, 27g of sugar and 3g of yeast to make bread. Find the ratio of i. Yeast and Butter ii. Butter and Sugar iii. Sugar and Flour 2, If there are 30 girls 20 boys in a class, what is the ratio of the girls to the boys?	**Expected Responses** I, Yeast and Butter =3g:9g = 1: 3 II, Butter and sugar = 9g : 27g = 3 : 9 = 1 : 3 III, Sugar and Flour = 27g : 81g = 9:27 = 3 : 9 = 1 : 3 2, Ratio of girls to boys = 30 : 20 = 2 : 3	
CONCLUSION (5mins)	Teacher summarizes the lesson base on the pupils response to the above questions to enhance pupils deeper understanding and asks a pupil that get it right	Pupils listening and exchange ideas. Pupils ask questions on the areas find difficult and quickly go through	Deeper understanding of equivalent ratio

	to also explain. The teacher concludes by clarifying areas of confusion and also inform the pupils that ratios can also be simplified even though they are equivalent.	the lesson with that teacher.	

LESSON SIX

Week: Six

Subject: Mathematics

Theme: Everyday Statistics

Topic: Data Collection and Representation

Sub-Topic: Tally Table

Date: 22nd February, 2016.

Class: Primary Six

Duration: 35 minutes

Number of Pupils: 50

Learning Objectives: By the end of the lesson, the learners should be able to:

i) Generate data from the throw of a Die (25 times)

ii) Prepare a tally data Table for the data generated.

Rationale: Statistical data are just numbers that give certain information and handling such data is part of everyday life. E.g. number of males and female pupils in a School, the

numbers of people in a country etc. The ability to generate data and present them in frequency table will help in the understanding of further statistical concepts.

Pre-requisite / previous knowledge: Learnersare familiar with the collection, identification, sorting, classification, grouping (according to colors, shape, sizes etc.) and counting of a given things/items/data. Making of Tally Table from a given Data.

Learning Materials: Improviseddice for each Group, One Cardboard Sheet for each Group, Markers, and Worksheets.

Reference Materials: Macmillan Champion Primary 5 Mathematic book 5, Module 29, Page 215. Primary School Mathematics Curriculum for 4-6.

Lesson Development:

Stage	**Teacher's activity**	**Learners' activity**	**Learning/Teaching Points**
INTRODUCTION (3 min)	Teacher asks learners to count the number of pupils in the class and group them into male and female. Teacher briefly review the previous lesson on making tally table from given data	Learners respond by counting the population of the class and given the number of male and females in the class. Recall the making of tally table form a given data.	Recalling the concept tally table. Reviewing of previous knowledge.

DEVELOPMENT NT: Step I 2 minutes	Teacher puts learners into groups of 6 and distribute Dice and worksheets to each group. Teacher explains the instructions in the worksheet.	Learners move into their various groups, receive materials and worksheet. Chose group leader and secretary.	Identification of materials.
Step II 8 Minutes	Teacher goes round to guide learners in their groups.	Learners perform the activities as instructed in worksheet.	Generating data from the throwing of die. Developing tally table from data.
Step III 7 minutes	Teacher asks the group to present their work (Tables generated will be used to draw Bar Chart in the next lesson)	The learners give report of their findings group by group.	Reporting skills. Sharing the ideas on generating and representing data by tally table.
Step IV 10 minutes	Teacher ask learners following questions:	Learners respond to the questions e.g.: heights,	Confirmation of attainment of

	1. What other ways one can generate data make tally table. 2. Explain how a tally from your given example.	ages, show sizes, etc., and explain how a tally table can be made from the data.	lesson objectives.
EVALUATION 3 minutes	Teacher corrects misconceptions and harmonizes report from groups.	Learners listened to clarification of misconception	Clarification and consolidation of lesson objectives.
CONCLUSION 2 minutes	Teacher summarize key points of the lesson i.e. To build a Tally table from generated data, group Assignment: Generate data using different objects in your environment and prepare a tally table.	Learners listen and ask question if any.	Consolidation of lesson objectives.

DATA COLLECTION AND REPRESENTATION:

WORK SHEET FOR TALLY TABLE

Read through the instructions carefully.

Activity 1

You are given a Die. Throw it once and record your outcome in the table below. Repeat this throw 24 times and record the outcome for every throw you made.

OUTCOME

Throw of Die	1	2	3	4	5	6

1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						

Activity 2

Record how many times each number has appeared as an outcome in activity 1 above in the tally table below:

Number on the face of the Die (Outcomes)	**Number of appearance of a number on the Die**	**Tally Marks**
1		

2		
3		
4		
5		
6		

APPENDIX IV

LESSON PLANS FOR CONTROL GROUP

LESSON ONE

Week: One

Date: 18th January, 2016.

Duration: 35 minutes

Class: Six

Number of pupils: 50

Sex: Mixed (Boys and Girls)

Average age: 12 years

Subject: Mathematics

Topic: Plane Shapes

Sub-Topic: Area of Square and Rectangle

Methodology: Conventional Teaching Method

Instructional Materials: Blackboard, Textbook, & Chalk

Behavioral Objectives: By the end of the lesson the pupils should be able to:

i) Define the area of Plane shape

ii) Calculate the area of a square

iii) Calculate the area of a rectangle

Previous Knowledge: Pupils were familiar with:

i) Properties of some plane shapes like square, rectangle, triangle etc

ii) Perimeter of rectangle, square and triangle in their previous lessons.

Introduction: Teacher introduces the lesson by asking the pupils questions base on the previous knowledge e.g.

i) What are the properties of a rectangle

ii) What is the perimeter of a square with length 2.5cm

Solution: Perimeter = 4L

= 4x2.5cm = 10.0cm

Presentation: Teacher present the lesson based on the followingsteps:

Step I Teacher explains the meaning of area: Area is the number of square units it takes to completely fill a shape like square, rectangleetc.

Step II: Teacher states the formulae for calculating the area of square and rectangle:

Square = length x length

= L x L = L^2 (in square units)

Rectangle = Length x Breadth

= L x B (in square unit)

Step III: Teacher solves two or more examples e.g.:

1) Find the Area of square with length 3cm
2) Find the area of rectangle whose dimension is given by 5cm and 3cm

Solutions:

1) Area of square = L x L = 3cmx3cm = $9cm^2$

2) Area of rectangle = L x B = 5cm x 3cm = $15cm^2$

Evaluation: Teacher evaluates by giving some questions to solve on the area of square and rectangle to ascertain pupils' clarity about the lesson e.g.

1) Define area
2) Find the area of square whose sites is 5cm.
3) Calculate the area of rectangle with length 10cm and breadth 5cm.

Conclusion: Teacher concludes the lesson by going round the classroom to check the exercise given to them and finally allow them to copy the solved examples in their exercise books.

Homework: i) Calculate the area of a rectangular paper whose length is 6cm and breadth 3cm

ii) Calculate the area of a square with length 8cm

LESSON TWO

Week: Two

Date: 25th January, 2016.

Duration: 35 minutes

Class: Six

Number of pupils: 50

Sex: Mixed (Boys and Girls)

Average age: 12 years

Subject: Mathematics

Topic: Number bases

Sub-Topic: Conversion of numbers in base ten to other bases

Methodology: Conventional teaching method

Instructional Materials: Blackboard, Textbook & Chalk

Behavioral Objectives: By the end of the lesson the pupils should be able to:

I) Convert numbers in base ten to base two.

II) Change the numbers in base ten to base three

III) Compare numbers in base 10 with that of other bases and observe the digits involved in each base.

Previous Knowledge: Pupils were familiar with:

I) Binary, denary the digits involve in any base.

II) Addition of numbers in base 2

III) Division of whole numbers with and without remainder.

Introduction: Teacher introduces the lesson by asking questions based on the previous knowledge e.g.

i) What are the numbers involve in base five.

ii) Evaluate $110_{two} + 101_{two}$

Presentation: Teacher presents the lesson under the following steps:

Step I: Teacher explains how number in base ten are converted to base two i.e. through successive division and keeping the remainders aside as the result of the required base. (The remainders should be written from down upward).

Step II: Teacher converts two or more numbers in base ten to base two and other bases,

1) Change 8_{ten} to base two

2) Convert 9_{ten} to base two

3) Convert 8_{ten} to base three

Solutions:

1.

2	8			
2	4	R	0	↑
2	2	R	0	
2	1	R	0	
	0	R	1	

$8_{ten} = 1000_{two}$

2.

2	9		
2	4	R	1
2	2	R	0
2	1	R	0
	0	R	1

$9_{ten} = 1001_{two}$

3.

3	8		
3	2	R	2
	0	R	2

$9_{ten} = 22_{three}$

Step III: Teacher re-explains how the examples were solved and then solve more together with the pupils.

Evaluation: Teacher evaluates the lesson by asking questions based on the lesson e.g.

1) Which number in base 2 is equivalent to 5 in base 10?
2) How do we change 12_{ten} to base 4?

Conclusion: Teacher concludes the lesson by going round the class to assist the pupils in copying the examples in their note books.

Homework: Convert i) 14_{ten} to base 2 ii) 18_{ten} to base 3 iii) 20_{ten} to base 4

LESSON THREE

Week:	Three
Date:	1st February, 2016
Duration:	35 minutes
Class:	Six
Number of pupils:	50
Sex:	Mixed (Boys and Girls)
Average age:	12 years
Subject:	Mathematics
Topic:	Circle
Sub-Topic:	Concept of pi (π)

Methodology: Conventional Teaching Method

Instructional Materials: Blackboard, Textbook, & Chalk

Behavioral Objectives: By the end of the lesson the pupils should be able to:

i) Calculate the circumference of a circle with given radius, using the value of π

ii) Calculate the circumference of a circle when the diameter is given and explain why the value of π is constant.

iii) Apply the idea in (i) and (ii) above to determine the perimeter or circumference of any circular object in the environment.

Previous Knowledge: Pupils have learnt about Properties**,** parts of a circle, Perimeter, area of square and rectangle. Multiplication and division of whole numbers.

Introduction: Teacher introduces the lesson by asking the pupils some questions based on the provisions knowledge e.g.

i) State the properties of a circle.

ii) What is the perimeter of match box with length 8cm and breadth 3cm?

Presentation: Teacher presents the lesson under the following steps.

Step I: Teacher explains that the circumference of a circle otherwise called perimeter of circle is found using the formula $C = 2\pi r$

Where:

C stands for circumference,

r stands for radius and

πhas the value of $\frac{22}{7}$ or 3.142

Step II: Teacher solves two or more questions on the board as example on circumference. e.g.

1) A circle with radius 3cm, what is its circumference?
2) Find the circumference of a circle whose diameter is 16cm

Solutions:

1) C= $2\pi r = 2x\frac{22}{7} x3 = \frac{132}{7}$ = 18.86cm
2) D=2 i.e. r = $\frac{D}{2} = \frac{16}{2}$ = 8cm

Now C=$2\pi r = 2 x \frac{22}{7} x 8$

$= \frac{352}{2}$ = 176cm

Step III: Teacher allows the pupils to solve two or more similar questions on the board thereby correcting their mistakes where necessary:

Evaluation: Teacher evaluates the lesson by asking questions based on the lesson taught e.g.

1) What is the formula for circumference of circle?
2) What is the circumference of a circle with radius 12cm?

Conclusion: Teacher concludes the lesson by clearing misconception if any especially about the value of π.

Homework: Calculate the circumference of circle with:

A. (1) radius = 10cm (2) Diameter 8cm

B. Take any circular object in your house, measure its diameter and calculate its circumference

LESSON FOUR

Week:	Four
Date:	8th February, 2016.
Duration:	35 minutes
Class:	Six
Number of pupils:	50
Sex:	Mixed (Boys and Girls)
Average age:	12 years
Subject:	Mathematics

Topic: Fraction

Sub-Topic: Addition of fractions

Methodology: Conventional teaching method

Instructional Materials: Blackboard, Textbook, & Chalk

Behavioral Objectives: By the end of the lesson the pupils should be able to:

i) Add two or more fractions with the same denominators.

ii) Add two or more fractions in mixed form.

iii) Solve problems on fractions involving (i) and (ii) above.

Previous Knowledge: Pupils learnt about:

1) The definition of fraction with example.
2) Types of fraction
3) Conversion of improper fractions to mixed numbers and vice-versa in their previous lessons.

Introduction: Teacher introduces the lesson by asking questions based on the previous knowledge e.g.

1) What is fraction?
2) Mention 2 types of fractions
3) Change $1\frac{2}{3}$ to improper fraction.

Presentation: Teacher presents the lesson under the following steps:

Step I: Teacher add two and three fractions on the board all having the same denominators

1- $\frac{1}{2} + \frac{3}{2} = \frac{1+3}{2} = \frac{4}{2} = 2$

2- $\frac{1}{4}+\frac{3}{4}+\frac{6}{4}=\frac{1+3+6}{4}=\frac{10}{4}=\frac{5}{2}$

Step II: Teacher explains clearly how answers were gotten i.e. since the denominators are the same, we add the numerators all over one of the denominators.

Step III: Teacher add fractions that are in mixed form on the board.

1) $1\frac{2}{3}+3\frac{1}{3}=\frac{5}{3}+\frac{10}{3}=\frac{5+10}{3}=\frac{15}{3}=5$

2) $2\frac{2}{5}+6\frac{1}{5}=\frac{12}{5}+\frac{31}{5}=\frac{12+31}{5}=\frac{43}{5}$

Step IV: Teacher solves more questions involving step (i) and (iii), e.g.

1) $\frac{1}{2}+1\frac{3}{2}=\frac{1}{2}+\frac{5}{2}=\frac{1+5}{2}=\frac{6}{2}=3$

2) $2\frac{2}{5}+\frac{6}{5}=\frac{12}{5}+\frac{6}{5}=\frac{12+6}{5}=\frac{18}{5}$

Evaluation: Teacher evaluate the lesson by asking the pupils to solve the following on the board thereby correcting their mistakes where necessary.

1) $\frac{1}{3}+\frac{4}{3}$

2) $\frac{5}{7}+\frac{3}{7}+2\frac{1}{7}$

3) $\frac{8}{6}+1\frac{5}{6}$

Conclusion: Teacher concludes the lesson by going round to make sure that the pupils copy all the examples correctly.

Homework: Evaluate:

1) $\frac{10}{8}+\frac{6}{8}+\frac{3}{8}$

2) $\frac{20}{5}+2\frac{6}{5}$

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

LESSON FIVE

Week:	Five
Date:	15th February, 2016.
Duration:	35 minutes
Class:	Six
Number of pupils:	50

Sex: Mixed (Boys and Girls)

Average age: 12 years

Subject: Mathematics

Topic: Ratio

Sub-Topic: Equivalent Ratios

Methodology: Conventional teaching method

Instructional Materials: Blackboard, Textbook, & Chalk

Behavioral Objectives: By the end of the lesson the pupils should be able to:

i- Explain the meaning of equivalent ratios

iiShow that two or more ratios are equivalent.

Previous Knowledge: Pupils have idea on:

i) Meaning of ratio

ii) Reducing fractions to their simplest forms.

iii) Highest common factor HCF

Introduction: Teacher introduces the lesson by asking questions based on the previous knowledge e.g.

i) What is ratio

ii) Reduce $\frac{10}{20}$ to its simplest form

iii) What is the HCF of 6 and 12?

Presentation: Teacher presents the lesson under the following steps:

Step I: Teacher defines equivalent ratios and explain clearly i.e. two or more ratios are said to be equivalent if they have the same value.

Step II: Teacher explains the steps to be followed when determining equivalent ratios.

i) Express the ratios as fraction

ii) Divide each fraction by highest common factor of the numerator and denominator.

iii) Compare the result, if the results are the same then the ratios are equivalent.

Step III: Teacher takes some pair of ratio and use the steps above to determine if they are equivalent e.g.

Determine if the following ratios are equivalent

(1) 8:4 and 10:5 (2) 3:9 and 9:27

Solutions

1) $\frac{8}{4} \div \frac{4}{4} = \frac{2}{1} = 2$

$\frac{10}{5} \div \frac{5}{5} = \div \frac{2}{1} =$

Since $2 = 2 \Rightarrow \frac{8}{4} = \frac{10}{5}$ Hence, 8:4 and 10:5 are equivalent to ratios.

2) $\frac{3}{9} \div \frac{3}{3} = \frac{1}{3}$

$\frac{9}{27} \div \frac{9}{9} = \frac{1}{3}$

Since $\frac{1}{3} = \frac{1}{3} \Rightarrow \frac{3}{9} = \frac{9}{27}$ Hence, 3:9 and 9:27 are equivalent ratios

Step IV: Teacher re-explains how the results were obtained following the steps listed in step II above and solve more questions.

Evaluation: Teacher evaluates the lesson by asking the pupils to find the equivalent ratios on the board, thereby correcting their mistakes where necessary**.**

Conclusion: Teacher concludes the lesson by going round the class and assist the pupils in copying the solved examples in their exercise books.

Homework: Say if the following ratios are equivalent or not.

1) 5:15 and 6:18
2) 12:24 and 15:30
3) 3:6 and 2:10

LESSON SIX

Week: Six

Name of School: L.E.A. Primary School, Zaria

Date: 22nd February, 2016

Class: Primary 6

Number of pupils: 50

Gender: Boys and Girls

Average age: 12 years

Duration: 35 minutes

Topic: Data Collection and Representation.

Sub-Topic: Tally Table.

Methodology: Conventional Teaching Method.

Instructional Materials: Blackboard, Textbook & Chalk

BehavioralObjectives: By the end of the lesson the pupils should be able to:

i) Prepare a tally table from a given information

ii) Construct tally tables when frequency table is given

iii) Use the number of arms in the school for each class and construct a tally table.

Previous Knowledge: Pupils were familiar with the collection, identification, sorting, counting item according to colors, shapes, and sizes. Arrangement of numbers in ascending or descending order as well as construction of frequency table.

Introduction: Teacher introduces the lesson by asking questions based on the previous knowledge e. g. Arrange the following numbers in ascending order 1,0,5,6,8,10,3,2,1,4.

Expectation: 0, 1,1,2,3,4,5,6,8,10

Presentation: Teacher present the lessons as follows:

Step I Teacher writes some scores generated from the throw of a die 15 times as follows:

1,2,3,2,3,4,5,6,5,6,6,2,6,5,6.

Step II Teacher uses the result above and construct a tally table while pupils listen and respond to questions. i. e.

Numbers	Tally	Frequency
1	II	1
2	III	3
3	II	2
4	I	1
5	III	3
6	~~IIII~~	5
Total		15

Step III Teacher explains clearly how the tally column is filled using strokes or bars.

Step IV Teacher construct a frequency table and ask the pupils to prepare a tally table

Scores	Frequency
10	4

12	6
13	3
14	8
15	10

Step V Teacher ask pupils to construct a tally table using the number of arms for each class in the school, there by correcting their mistakes where necessary.

Evaluation: Teacher evaluates the lesson by asking questions based on the lesson e. g. how do we prepare tally tables?

Conclusion: Teacher concludes the lesson by going round the class and assist the pupils while copying the note in their exercise books.

Homework: Use the idea of step V to generate data and use it to prepare a tally table

APPENDIX V

DEPARTMENT OF SCIENCE EDUCATION
AHMADU BELLO UNIVERSITY ZARIA

Vice Chancellor: ***Professor Ibrahim Garba*** *B.Sc, M.Sc(ABU) Ph.D DIC (London), FNMGS*
Head of Department: ***Dr. Mamman Musa*** *B.Ed, M.Ed, Ph.D (ABU), FMAN, FANE, DAC.*

Your Ref:
Our Ref: DSE/R/I/Vol.1

Date: 20TH, JANUARY, 2016

THE EDUCATION SECRETARY,
LOCAL GOVT. EDU. AUTHORITY
ZARIA.

Dear Sir/Madam.

PG AN INTRODUCTORY LETTER TO ACCESS RESEARCH DATA

This is to introduce the bearer, ILIYASU ADAMU with registration number M.ED/EDUC/15587/2011-2012 as one of our M.ED MATHEMATICS EDUCATION students who is conducting a research on the topic:

IMPACT OF ASEI STRATEGY ON PRIMARY SIX PUPILS PERFORMANCE IN MATHEMATICS AT ZARIA LOCAL GOVERNMENT, KADUNA STATE, NIGERIA.

Please accept our sincere thanks in advance for your kind action.

Yours faithfully,

HOD (PGS)
Above

Dr. Mamman Musa
Head, Science Education Department

APPENDIX VI

ZARIA LOCAL GOVERNMENT EDUCATION AUTHORITY

P.M.B. 1040, ZARIA.
Tel: 069 - 323911 - 12

Your Ref: _____

Our Ref: _____ *Date:* 2nd June -2016

H/Teacher,
Wazirí Lawal LGEA,
primary School,
Zaria.

LETTER OF INTRODUCTION

This is to introduce ILIYASU ADAMU as a post graduate student of Ahmadu Bello University, Department of Science Education who is to conduct his/her research work on the topic: IMPACT OF ASEI STRATEGY ON PRIMARY SIX PUPILS' PERFORMANCE IN MATHEMATICS AT ZARIA LOCAL GOVERNMENT KADUNA STATE, NIGERIA.

in your school.

Kindly accord him /her on all the necessary assistance needed.

Thanks

Ladidi Garba
H.O.D P R S
For Education Secretary,
Zaria LGEA.

Education for all is responsibility for all

APPENDIX VII

ZARIA LOCAL GOVERNMENT EDUCATION AUTHORITY

P.M.B. 1040, ZARIA.
Tel: 069 - 323911 - 12

Your Ref: _____

Our Ref: _____ *Date:* 2nd June - 2016

H/Teacher,
Sayen Tunkara LGEA,
pry. Sch. Zaria

LETTER OF INTRODUCTION

This is to introduce ILIYASU ADAMU as a post graduate student of Ahmadu Bello University, Department of Science Education who is to conduct his/her research work on the topic: IMPACT OF ASEI STRATEGY ON PRIMARY SIX PUPILS' PERFORMANCE IN MATHEMATICS AT ZARIA LOCAL GOVERNMENT KADUNA STATE, NIGERIA.

in your school.

Kindly accord him /her on all the necessary assistance needed.

Thanks

Ladidi Garba
H.O.D P R S
For Education Secretary.
Zaria LGEA.

Education for all is responsibility for all

APPENDIX XIII

ZARIA LOCAL GOVERNMENT EDUCATION AUTHORITY

P.M.B. 1040, ZARIA.
Tel: 069 - 323911 - 12

Your Ref: _____

Our Ref: _____ *Date:* 2nd June-2016

H/Teacher,
Baba Ahmad LGEA,
pry. Sch. Zaria

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APPENDIX IX

ZARIA LOCAL GOVERNMENT EDUCATION AUTHORITY

P.M.B. 1040, ZARIA.
Tel: 069 - 323911 - 12

Your Ref: _____

Our Ref: _____ *Date:* 2nd June-2016

H/Teacher,
Haruna Soba LGEA
Pry. Sch. Zaria

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Thanks

Ladidi Garba
H.O.D P R S
For Education Secretary.
Zaria LGEA.

Education for all is responsibility for all

APPENDIX X

```
DESCRIPTIVES VARIABLES=EXPGR CNGR
  /STATISTICS=MEAN STDDEV SEMEAN.

T-TEST GROUPS=FACTOR(1 2)
  /MISSING=LISTWISE
  /VARIABLES=VAR00002
  /CRITERIA=CI(.9500).
```

T-Test

Notes

Output Created		08-Mar-2016 15:58:18
Comments		
Input	Active Dataset	DataSet0
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	200
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis in a list are based on the cases with no missing or out-of-range data for any variable in that list
Syntax		T-TEST GROUPS=FACTOR(1 2) /MISSING=LISTWISE /VARIABLES=VAR00002 /CRITERIA=CI(.9500).
Resources	Processor Time	00:00:00.016
	Elapsed Time	00:00:00.016

```
[DataSet0]
```

Group Statistics

	FACTOR	N	Mean	Std. Deviation	Std. Error Mean
VAR00002	EXPGR	100	20.5400	3.28885	.32889
	CNGR	100	16.8800	3.70716	.37072

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Diff.	Std. Error Difference	Lower	Upper
VAR00002	Equal variances assumed	1.381	.241	7.385	198	.000	3.66	.49558	2.68271	4.63729
	Equal variances not assumed			7.385	195.228	.000	3.66	.49558	2.68263	4.63737

Descriptives

Notes

Output Created		08-Mar-2016 15:57:10
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	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	200
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	All non-missing data are used.
Syntax		DESCRIPTIVES VARIABLES=EXPGR CNGR /STATISTICS=MEAN STDDEV SEMEAN.
Resources	Processor Time	00:00:00.000
	Elapsed Time	00:00:00.000

[DataSet0]

Descriptive Statistics

	N	Mean		Std. Deviation
	Statistic	Statistic	Std. Error	Statistic
EXPGR	100	20.5400	.32889	3.28885
CNGR	100	16.8800	.37072	3.70716
Valid N (listwise)	100			

APPENDIX XI

```
T-TEST GROUPS=GENDER(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=VAR00002
  /CRITERIA=CI(.9500).
DESCRIPTIVES VARIABLES=MALE FEMALE

  /STATISTICS=MEAN STDDEV SEMEAN.
```

T-Test

Notes

Output Created		08-Mar-2016 17:12:02
Comments		
Input	Active Dataset	DataSet0
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	200
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST GROUPS=GENDER(1 2) /MISSING=ANALYSIS /VARIABLES=VAR00002 /CRITERIA=CI(.9500).
Resources	Processor Time	00:00:00.016
	Elapsed Time	00:00:00.015

```
[DataSet0]
```

Group Statistics

	GENDER	N	Mean	Std. Deviation	Std. Error Mean
VAR00002	MALE	50	20.6200	3.31902	.46938
	FEMALE	50	20.4600	3.29012	.46529

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	Lower	Upper
VAR00002	Equal variances assumed	.028	.868	.242	98	.809	.16000	.66092	-1.15158	1.47158
	Equal variances not assumed			.242	97.993	.809	.16000	.66092	-1.15158	1.47158

Descriptives

Notes

Output Created		08-Mar-2016 17:10:39
Comments		
Input	Active Dataset	DataSet0
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	200

Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	All non-missing data are used.
Syntax		DESCRIPTIVES VARIABLES=MALE FEMALE /STATISTICS=MEAN STDDEV SEMEAN.
Resources	Processor Time	00:00:00.000
	Elapsed Time	00:00:00.000

[DataSet0]

Descriptive Statistics

	N	Mean		Std. Deviation
	Statistic	Statistic	Std. Error	Statistic
MALE	50	20.6200	.46938	3.31902
FEMALE	50	20.4600	.46529	3.29012
Valid N (listwise)	50			

APPENDIX XII

```
DESCRIPTIVES VARIABLES=URBAN RURAL
  /STATISTICS=MEAN STDDEV SEMEAN.

T-TEST GROUPS=LOCATION(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=VAR00006
  /CRITERIA=CI(.9500).
```

T-Test

Notes

Output Created		08-Mar-2016 16:37:43
Comments		
Input	Active Dataset	DataSet0
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	200
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.

	Cases Used	Statistics for each analysis are based on the cases with no missing or out-of-range data for any variable in the analysis.
Syntax		T-TEST GROUPS=LOCATION(1 2) /MISSING=ANALYSIS /VARIABLES=VAR00006 /CRITERIA=CI(.9500).
Resources	Processor Time	00:00:00.015
	Elapsed Time	00:00:00.016

[DataSet0]

Group Statistics

	LOCATION	N	Mean	Std. Deviation	Std. Error Mean
VAR00006	URBAN	50	20.6800	3.38327	.47847
	RURAL	50	20.4000	3.21984	.45535

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
VAR00006	Equal variances assumed	.478	.491	.424	98	.673	.28000	.66051	-1.03077	1.59077
	Equal variances not assumed			.424	97.761	.673	.28000	.66051	-1.03081	1.59081

Descriptives

Notes

Output Created		08-Mar-2016 16:36:02
Comments		
Input	Active Dataset	DataSet0
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	200
Missing Value Handling	Definition of Missing	User defined missing values are treated as missing.
	Cases Used	All non-missing data are used.
Syntax		DESCRIPTIVES VARIABLES=URBAN RURAL /STATISTICS=MEAN STDDEV SEMEAN.
Resources	Processor Time	00:00:00.000
	Elapsed Time	00:00:00.000

[DataSet0]

Descriptive Statistics

	N	Mean		Std. Deviation
	Statistic	Statistic	Std. Error	Statistic
URBAN	50	20.6800	.47847	3.38327
RURAL	50	20.4000	.45535	3.21984
Valid N (listwise)	50			