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Research Article

Effect of Improvisation of Instructional Materials on Students' Achievement and Retention in Basic Science and Technology in Jos North LGA, Plateau State, Nigeria

*Obinna Nzechie [1], Prof. Bernadette Ozoji [2], Ameh Ugbo-ojoide Patience [3] and Ekele Sunday Abuh [4]

[1]Graduate of Integrated Science Education University of Jos, Nigeria.
[2]Associate Professor of Science Education University of Jos, Nigeria.
[3]Graduate of Mathematics and Statistics Education Joseph Sarwuan Tarka University, Nigeria.
[4]Graduate of Physics Education Joseph Sarwuan Tarka University, Nigeria.

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***Corresponding author:** *Obinna Nzechie*
Graduate of Integrated Science Education University of Jos, Nigeria.

Abstract

This research study examined the Effects of Improvisation of Instructional materials on Students' Achievement and Retention in Basic Science and Technology in Jos North Local Government Area of Plateau State, Nigeria. The study was carried out with four research objectives, four research questions, and four null hypotheses were formulated. The study adopted the use of quasi experimental research design and out of the two thousand nine hundred fifty (2,950) JSSII students in the area of study, a total of sixty (60) students were sampled out for the study, of which thirty (30) students each were assigned both for the experimental and control groups. Data for the study was collected through the pre-test, treatment, post-test and post-post-test using a researcher made instrument (Basic Science and Technology Achievement and Retention Test - BSTART) the BSTART consists of 20 objective test items. Data collected were analyzed statistically with the use of descriptive statistics of frequencies, mean and standard deviation for the four research questions and inferential statistics of independent t-test at 0.05 significant level was used to test the four hypotheses. The findings from the study revealed a significant difference in the mean achievement and retention scores of students taught Basic Science and Technology using Improvised Instructional Materials when compared with those taught Basic Science and Technology without Improvised Instructional Materials. It was concluded among others that since the students taught Basic Science and Technology with the use of Improvised Instructional Materials had a higher mean score than those taught without the use of Improvised Instructional Materials, there is need for teachers to be trained adequately, as this will enable them acquire the appropriate techniques and skills necessary for improvisation. Hence, it was recommended that Teachers should be trained and re-trained through workshops, seminars and conferences for the purpose of skill acquisition necessary for the production and use of Improvised Instructional Materials by the teachers for lesson delivery.

Keywords: *Improvised Instructional Materials, Students' Achievement, Retention, Basic Science and Technology, Quasi-Experimental Design, Jos North Local Government Area, Teaching and Learning, Instructional Strategies, Educational Innovation, Secondary Education.*

CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Education is the key to national development; it provides the intellectual capability needed by man to enhance human and material resources for scientific and technological advancement (Asiabaka, 2010). Education is a preparation for life; it is related to the acquisition of skills to earn a living. Today as always, the definition of education is ever-changing and increasing in scope. Our schools are confronted with new pressures arising from changing needs of students, societal expectation, economic changes and technological advancement to look into. Nevertheless, if educational programs are to be planned and if efforts for continued improvement are to be made, it is very necessary to have some conceptions of the goals that are being aimed at as these educational objectives become criteria by which materials are selected, content is outlined, instructional procedures are developed and human resources are also considered.

Education, according to Coombs in Egbodo (2016), consists of two components. He classified these two components into inputs and outputs. According to Coombs, inputs consist of human and material resource while output is the goals and outcome of the educational process, if one wants to investigate and assess the education system in order to improve its performance, then the effect of one component on the other must be examined.

Science and technology have greatly contributed to the convenience and comfort of man. It is hard to get any single life in this world that is not affected by the development in science and technology (Oloyede, 2007). Every manufactured good seen at home and place of work is a product of science and technology. For instance, mobile phones, radio and television sets, PC tablets, iPads, iPhones, iPods, laptops, and desktops are products of science and technology (Tunde & Anthony, 2010). In the same way, the fruit juices and soft drinks consumed daily, the cars, the motorcycles and bicycles, the clothes and shoes are all products of science and technology. In view of these contributions, Ashiker (2012) opined that concrete steps should be taken to get the Nigerian citizens well groomed in science and technology for the country's scientific and technological advancement.

The Federal Republic of Nigeria (FRN, 2004), in release of educational objectives for secondary schools, emphasized the need to equip students to live effectively in this modern age of science and technology. The major goal of science and technology education is to develop scientifically literate individuals that are concerned with high competence for rational thoughts and actions. The objectives of science education in this country according to FRN (2004) include the need to prepare students to observe and explore the environment; explain simple natural phenomena; develop scientific attitudes including curiosity, critical reflection and objectivity; apply the skills and knowledge gained through science and technology to solve everyday problems in the environment; and develop self-confidence and self-reliance through problem-solving activities in science. To attain these objectives, several strategies and resources have evolved for science teaching and learning. The resources range from human to materials including the audio-visual and media materials that can be used to sustain the attention of the students during the lesson. Towards the end of the 20th century and at the beginning of the 21st century, it became apparent that national development depends on educational advancement which in turn depends on technological progress (Onasanya, Shehu, Ogunlade & Adefuye, 2011). In order to achieve these objectives, Samba and Eriba (2011) opined that teaching must go beyond the "chalk-and-talk" method and it must involve the totality of the student, the instructions must be prepared in such a way that at any time, students learning must make use of more than two senses.

As the growth of educational programs continues to rapidly accelerate, concern over the retention of the students' knowledge is increasing. Retention is the ability of a student to hold and bring to mind a memory of the previously learned skills, knowledge and experience during and after examination. Retention is significantly important, not just for student success, but also for the success of academic institutions. Instructional material-aided instruction has the ability to sustain students' interest, encourage them to participate actively in the lesson and retain concepts learnt for a long time. The true art of memory and retention is the skill of attention (Tinto, 2007). For effective retention of the learnt concepts, principles, theories, laws, ethics and assumptions of science in students' short and long term memories, science teachers should; get, use, link and picture the learning experience through the use of adequate relevant instructional materials.

Basic science and Technology curriculum is a broad field curriculum in which subject matter from different subject areas of biology, chemistry, physics, astronomy, geology and environment are synthesized to provide a holistic and unified nature of science (Adejoh, 2006). It is a three-year subject, (JSS1 to JSS3), developed in spiral to form themes whereby topics get increasingly more detailed as the year progresses. The aim of basic science and technology is to begin to teach students what science is and how scientists work. To realize this objective, it is expected that students carry out the kind of activities scientists carried out in their works, which is the beginning of the acquisition of series of skills, attitudes, principles, knowledge, assumptions and ethics of science.

Therefore, Basic Science and Technology as a subject of living things and technological innovation needs to be taught not just theoretically but practically for it to be functional and to lay the basic foundations needed for scientific and technological development amongst students. For science teaching and learning to be effective, every student must be given an opportunity to handle the materials of science and experience science personally, hence the need for an improvised instructional material in the absence of the real ones.

Instructional Materials, also known as Teaching/Learning Materials, are collection of materials including animate and inanimate objects and human and non-human resources that a teacher may use in teaching and learning situations to help achieve desired learning objectives. Instructional materials aid students in concretizing learning experience so as to make learning more exciting, interesting and interactive.

Instructional materials which are educational input are of vital importance to the teaching of any subject in the school curriculum. Wales in Shodeinde (2015) was of the opinion that the use of instructional materials would make discovered facts glued firmly to the memory of students. A well-planned and creative use of visual aids in lessons should do much to bearish apathy, supplement inadequacy of books as well as arouse student interest by giving them something practical to see and touch, at the same time helping to train them to think things out themselves (Shodeinde, 2015).

The school environment has been described as an organization where material is produced, managed and organized in such a way that enables the students to acquire desirable learning behaviours. The process of managing and organizing these materials in teaching brings about fruitful learning since it stimulates students' senses as well as motivates them to learn. Denyer, in his study on science games in National curriculums in the United Kingdom, reported that games when used as a material enables less-able students to stay on task and remain motivated for longer period (Shodeinde, 2015).

Improvisation is the use of alternative resources in solving a given problem in the absence or shortage of original ones. In teaching-learning situations, improvisation of instructional materials is the use of local resources in our immediate environment to concretize and enrich the instructional activities in the classroom in order to achieve the desired objectives.

Improvisation of instructional materials is therefore the use of local resources in our environment to assist in the smooth dissemination and transfer of knowledge from teacher to students. Eze (2012) defines improvisation of instructional materials as the making of substances from local material found at home or school premises when the real or original materials are not available. According to Akinmoyeme (2006), improvisation of instructional materials is the act of using alternative materials and resources due to lack or insufficiency of some specific firsthand teaching aids to facilitate instruction. Therefore, improvisation of instructional materials is an act of using materials and equipment obtainable from local environment, or designed by the teacher or with the help of local resource personnel to enhance effective instruction.

Due to the abstract nature of scientific and technological concepts, particularly in basic science and technology, Improvisation of instructional materials undoubtedly becomes imperative in teaching and learning science related subjects, including Basic Science and Technology. However, the economic situation has made it difficult for teachers, school management and government to purchase the required resources to achieve the specific instructional objective. But the truth remains that the instructional materials generally are needed to aid the teacher’s oral explanation to the students in teaching and learning process, hence the use of improvised instructional materials in absence of the real ones.

There are varieties of materials which can be improvised as instructional materials, these materials include models, charts, preserved specimens of plants and animals, culturing equipment and microscope (Olagunju, 2000). The materials should be provided in quality and quantity in the classroom for an effective teaching-learning process (Umeoduagu, 2000). Nwoji(2000) in an empirical study, revealed that essential facilities such as radio, television, computers, chemicals, specimens, videos tape, stove, Bunsen burners, models and charts are not always available in schools. This inadequacy of these teaching materials has been of serious concern to educators.

The decline in performance in Science and Technology may be connected to this poor learning environment created by the inadequate infrastructural facilities. Mapaderun (2002) also emphasized that the availability and adequacy of these facilities promote effective teaching and learning activities in schools while their inadequacy affects academic performance negatively. Several efforts have been made by Science Teachers Association of Nigeria (STAN) to train secondary school teachers on improvisation techniques in various ways on science subjects including Basic Science Technology; hence there is a need for Basic Science and Technology teachers to improvise instructional material for effective teaching and learning of the subject.

Studies have shown that the use of instructional materials has mproved achievement (Nwagbo, 2006). Instructional materials are a wide varieties of equipment and materials use for teaching and learning by teachers to stimulate self-

activity on the part of the students. The teaching of Basic Science and Technology without instructional materials may certainly result in poor academic achievement by the students. Poor academic achievement in Basic Science and Technology may also be attributed to many other factors such as: low interest of students in basic science and technology, inadequate motivation from teachers, poor incentives to basic science and technology teachers, inadequate supply of instructional material, lack of qualified teachers, use of teacher-centered instructional strategies, inadequate use of instructional materials and use of abstract standardized materials. This implies that the mastery of Basic Science and Technology concepts might not be fully achieved without the use of instructional resources that the students are abreast with. The teaching of Basic Science without instructional materials may therefore certainly result in poor academic achievement.

Conventional teaching methods such as "chalk-and-talk" method also known as a traditional teaching method in which teachers address students by using board to provide examples or illustrations. This has been used continually by the science teachers despite its criticisms by experts in science education. It is an oral presentation intended to teach students about concepts, theories, history, background and equations which places students in passive rather than active role in the classroom.

Nevertheless, the Nigerian Educational Research and Development Council (NERDC, 2007) advocates for the use of activity-based and guided inquiry approaches to basic science and technology instruction, but the adoption and application of these methods are still an illusion because of paucity of instructional materials and unwillingness of the science teachers to improvise alternative materials to improve instructional delivery. Consequently, teachers resort to conventional lecture method, walk into the classroom with a key-point-text for one-way communication; and copy a few points on the chalkboard. Lessons are rarely being planned and instructional materials are hardly being used by these teachers. This explains the choice of conventional lecture method as it controls variables to expose its ineffectiveness in delivering basic science and technology concepts and to provide a way forward that suggests the use of instructional materials that combines activity-based and inquiry approaches to science teaching.

The major reason for the choice of instructional-material-based method over lecture method is not just for mere comparison of the two methods but to create awareness among the junior secondary school teachers and students that there is a paradigm shift from conventional lecture method to an enhanced teaching strategy referred to as instructional materials based teaching/learning method that may minimize the achievement and retention gaps amongst students in basic science and technology education.

1.2 STATEMENT OF PROBLEM

Studies have shown that students' achievement and retention in basic science are unimpressive (Ibraheem, 2004) and (Ncharam, 2008). Instructional strategies and cognitive factors have been identified majorly as being responsible for poor achievement and retention of scientific and technological concepts by basic science and technology students.
Factors such as:

- Inability to identify/ locate resources
- Inability to develop appropriate materials from local resources;
- Lack of school-based resource Centre for instructional materials development, selection and utilization, and
- Lack of long and short term training to update teachers' knowledge and skill for instructional materials development, selection and utilization (NERDC, 2009).

Pose hindrances to the use of improvised instructional materials by basic science and technology teachers in teaching the subject as a foundational science subject in junior secondary schools.

Researchers, educators, administrators, Science Teacher Association of Nigeria (STAN) and other relevant educational agents have tried to develop various teaching strategies, yet schools have continually produced students with poor results in basic science and technology as well as other science subjects. These efforts have not yielded the desired results in students' achievement and retention as conventional teaching methods have always been used in teaching science subjects, particularly basic science and technology. Both male and female students of basic science and technology perform poorly. This has been attributed to the use of inappropriate teaching strategy in teaching science subjects.

Mofeed (2011) opined that improvisation of instructional materials such as computer-aided instructions can empower teachers and learners, and also transform teaching and learn processes from being highly teacher-centered too student-centered. This transformation will result in increased students' performance; create opportunities for learners to develop their creativity skills, problem-solving abilities, and information reasoning and communication skills. Consequently, improvisation of instructional materials could be the solution and adequate strategy in teaching and learning of basic science and technology. For the learning of basic science and technology to be meaningful and permanent, it is necessary that instructional materials must be used.

Therefore, the problem of this study is to explore the effect of improvisation of instructional materials on students' academic achievement and retention in Basic Science and technology, in Jos North, Plateau state.

1.3 PURPOSE OF THE STUDY

The purpose of this study is to investigate the effect of improvisation of instructional materials on junior secondary school students' academic achievement and retention in Basic Science and Technology in Jos North, Plateau state. The research study would aim at the following objectives:

1. To determine the students' academic achievement in Basic Science and Technology before treatment.
2. To find out if the use of improvised instructional materials in teaching basic science and technology enhances students' achievement in the subject better than the modified lecture method.
3. To compare the achievement scores of male and female students exposed to teaching/learning processes with improvised instructional materials in basic science and technology.
4. To compare the retention scores of students exposed to teaching/learning processes with improvised instructional materials and those taught without the use of simple lecture method in basic sciences and technology.

1.4 RESEARCH QUESTION

The following research questions were formulated in order to obtain answer to the problems under investigation:

1. What is the difference in the mean academic achievement scores of the students in Basic Science and Technology before treatment, in Jos north, Plateau state?
2. What is the difference between the mean achievement scores of students taught basic science and technology using improvised instructional materials and those taught without the use of improvised instructional materials in Jos north, Plateau state.
3. What is the difference between the mean achievement scores of male and female students thought basic science and technology using improvised instructional materials in Jos North, of Plateau state?
4. What is the difference between the mean retention scores of students taught basic science technology using improvised instructional materials and those taught without the use of improvised instructional materials in Jos North, Plateau state?

1.5 HYPOTHESES

The following null hypotheses were formulated for this study:

H_{o1}. There is no significant difference in the mean academic achievement scores of students in basic science and technology before treatment in Jos North, Plateau state.

H_{o2}. There is no significant difference between the mean academic achievement scores of students taught basic science and technology using improvised instructional materials and those taught without improvised instructional materials in Jos north, Plateau state.

H_{o3}. There is no significant difference between the mean academic achievement scores of male and female Students taught basic science and technology with improvised instructional materials in Jos North, Plateau.

H_{o4}. There is no significant difference between the mean retention scores of male and female students taught basic science and technology with improvised instructional materials in Jos North, Plateau state.

1.6 SIGNIFICANCE OF THE STUDY

The findings from this study may be of great benefit to the teachers, students, government officials, curriculum planners, and parents. The teachers may benefit from this research study, as the findings from the study may provide relevant information to the teachers as regards to the skills of producing and utilizing locally made instructional materials which on the other hand may help the teachers in providing targeted and specific instructional assistance to the students. The teachers, through the findings of this study, may be more oriented on the different learning abilities amongst students which may be taken care of by making use of improvised instructional materials when the real materials are not available, and also by spending more time on individual instruction with struggling students. So also, the study may provide substantial recommendations to teachers on the types of improvised instructional materials suitable for effective utilization in the teaching and learning of technological and scientific concepts in basic science and technology.

To the students, the findings from this research study may be of great benefit as the findings may encourage students to study basic science and technology concepts while advancing at their own pace, enabling them to spend the necessary time on each concept. In other words, the study may allow instructors to create more opportunities for individualised instruction through the use of improvised instructional materials which may be more beneficial to struggling students who may not keep up with the pace of lecture method of instruction. Above all, the findings of this study may motivate teachers to teach for understanding and retention which are products of meaningful learning, through the use of improvised instructional materials which may be a source of excitement and motivation to students. Furthermore, this study may also enable students to largely appreciate the importance of locally made instructional materials and hence, increase their participation and academic achievement in basic science and technology.

Government officials may benefit from this study as the findings from the study may help them to identify where, when, and how to assist and motivate teachers in improvisation of instructional materials as it relates to teaching and learning basic science and technology as a subject in junior secondary schools.

The study may also motivate the curriculum planners and encourage them to make substantial provisions for teachers in the curriculum for adequate production of instructional materials in basic science and technology as a modified means of achieving the desired behavioural objectives amongst the students.

Lastly, the parents whose children are in junior secondary schools may also benefit greatly from this research study as they may be enhanced on their great input towards effective basic science and technology acknowledgment by their children. Furthermore, parents may benefit indirectly when their children are effectively taught basic science and technology through the use of improvised instructional materials. This act of improvisation of instructional materials may make their children prosper and succeed in their studies, thereby reducing financial wastage on their parents. Apparently, the findings from this study may also help parents to draw the attention of the school authorities to the need for proper improvisation of instructional materials when the real materials are not readily available in the school.

1.7 SCOPEOF THE STUDY

This study investigates the effect of improvisation instructional materials on students' academic achievement and retention in Basic science and Technology, in Jos north, Plateau state.

Due to financial constraints and time factor, an in-depth research in all the Junior secondary schools located in Jos north L.G.A. cannot be conducted, instead the research study will be restricted to some carefully selected schools where students will respond religiously to the test instruments without prejudice.

The study will cover four basic science topics drawn from the Nigerian Educational Research and Development Council (NERDC) syllabus including work, energy, power and kinetic energy. The selection of these contents is because the students are likely to have reached the formal operational level of reasoning to understand the concepts of work, energy, power and kinetic energy.

The rationale for the choice of these variables is that the researcher aims to encourage students' achievement and retention which are products of meaningful learning. The teaching methodologies to be used in this study are the conventional lecture method without improvised instructional materials and the use of improvised instructional materials. The impetus for the choice of these teaching methodologies is to expose science teachers to the paradigm shift in science pedagogy in the contemporary world where instructional materials are instrumental in lesson delivery. Thus, development and application of relevant instructional aids in science and technology education to enhance students' achievement and retention which are the cardinal goals of this study.

1.8 OPERATIONAL DEFINITION OF TERMS

Effect: The possible result or outcome of an act or process.

Improvisation: This is the use of alternative resources in solving a given problem in the absence or shortage of the original materials by substituting, altering, formulating or converting the available material to replace the original one using one's intellectual ability.

Instructional materials: These are collection of items or objects that could be animate or inanimate, human or nonhuman which a teacher uses in the class during teaching-learning situation to make learning more exciting, interesting and interactive to concretize instruction and as well achieve the desired learning objectives.

Student: An individual of male or female gender who is undergoing academic training in a Junior secondary school.

Achievement in Basic Science and Technology: The level of the students' performance in Basic Science and Technology concepts: work, energy, power and kinetic energy.

Retention in Basic Science and Technology: This is the score obtained by the basic science and technology student from Basic Science Achievement and Retention Test (BSART) during delayed-posttest.

Basic science and Technology: Junior secondary school subject that integrates and teaches various aspects of science and technology as it relates to physics, chemistry and biology.

CHAPTER TWO
LITERATURE REVIEW

2.1 INTRODUCTION
This chapter reviewed relevant literature regarding the topic, which is “Effect of Improvisation of Instructional Materials on Students' Academic Achievement and Retention in Basic Science and Technology". The reviewed literature would be considered under the following headings: Basic Science and Technology concept, Basic Science and Technology Curriculum, Strategies for Teaching Basic Science and Technology, Convectional Method of Science Instruction, Use of Improvisation of Instructional Materials, In-service Training for Teachers on Improvisation of Instructional Materials, Empirical Studies and Summary.

2.2 BASIC SCIENCE AND TECHNOLOGY CONCEPT
The world today is undergoing major transformations. The global transformations are multidimensional, affecting the technological, economic, social, cultural and political development of human communities, particularly those of developing societies like Nigeria. Education in the generic and global context is a strategic instrument for social and economic transformation. The focus of education system all over the world is the development of the human capital required to meet present and future challenges of globalization and knowledge of the economy. Hence, the National Economic Empowerment and Development Strategy (NEEDS) recognizes that Nigeria’s economy can only be transformed and sustained through education that empowers the people and assures the technological development of the country.

The Universal Basic Education (UBE) Programme was introduced in Nigeria in September, 1988. Following this, in 2008, the Federal Government of Nigeria, through the Nigerian Educational Research and Development Council (NERDC) developed and introduced the 9-Year Basic Education Curriculum (BEC) in schools by realigning all extant Primary and Junior Secondary School Curricula to meet the key targets of the UBE programme. In view of some contemporary and national concerns, and to make the curriculum more practical, relevant, interest generating for young learners, and also in line with global best practices, the 9-year BEC was recently revised in 2012 and its implementation just commenced in September, 2014.

Basic Science and Technology as one of the key cluster subjects prepared with the aim of catching the young learner to love science, learn science and create change in the learners' environment, encompasses a broad field curriculum in which subject matter from different subject areas of biology, chemistry, physics, astronomy, geology and environment are synthesized to provide a holistic and unified nature of science (Adejoh, 20008019291536). It is a three-year subject, (JSS1 to JSS3), developed in spiral to form themes whereby topics get increasingly more detailed as the year progresses. The aim of basic science and technology is to begin to teach students what science is and how scientists work.

With the approval of the new 9-year basic education curriculum by the National Council on Education (NCE), Basic Science and Technology formally known as Integrated Science, then becomes a foundational science subject taught in junior secondary schools as recommended in the new 9-year Basic Science and Technology curriculum (NERDC, 2007).

According to the National Education Research and Development council (NERDC), the objectives of basic science and technology are to:

Help junior secondary school students develop interest in science and technology

Help Nigerian junior secondary students develop creative problem-solving ability

Help Nigerian school children appreciate the beauty of nature and learn how to preserve and improve their environment

Help the students apply their scientific and technological knowledge and skills to solve societal problems

Help prepare Nigerian students for further studies in science and technology.

2.3 BASIC SCIENCEAND TECHNOLOGY CURRICULUM
Offorma (2005) regards curriculum as a process of determining and pursuing set societal objectives through the instrumentality of the school. Offorma further explains that curriculum is the totality of the environment in which education takes place. Basic Science curriculum is the totality of learning experiences, practices and intended learning outcomes to which the Basic Science and Technology students are exposed throughout the period of their junior secondary school. It often consists of general learning objectives and a list of courses and resources.

The task before Basic Science and Technology is to provide a sound general education in science and technology for all Nigerian children; and to lay an adequate foundation for those children who would further their education in the

sciences (Abah, 2004). To achieve this, education must be made functional. Functional education is determined by the quality of the curriculum content and its implementation. Functional curriculum content must be valid, significant, learnable and consistent with societal realities, useful and reflects the interest of the learners (Offorma, 2005). Also, valid curriculum content must be related to the philosophy and objectives of education. Curriculum planners and developers attempted to take care of the above mentioned issues, but there are still some barriers to the attainment of these goals of education in Nigeria. Some of these set-backs are:

Curriculum overload
Overcrowded classrooms
Poor method of instruction
Lack of adequate laboratories
Insufficient instructional materials, (Chukwuneke & Chikwenze, 2012).

Students are seldom confronted with first-hand and concrete experience which could allow them perceive relationships, predict events and draw conclusions. This is as a result of lack of adequate laboratories and equipment, overcrowded classrooms, inappropriate teaching methods, etc. The problem of Basic Science may be solved or at least minimized significantly by changing the method of teaching the subject. Science and technology processes are hardly assessed in the Nigerian Secondary Schools. The fundamental aim of Nigerian Basic Science Project, which is a process-oriented curriculum, is to develop student' science process skills. Though the curriculum specifies hands-on process and skill acquisition, most children are not exposed to these real situations in the schools (Fatima &Alhaji, 2011).

This means that scientific, vocational and technological aspects of education are not effectively implemented. Hence, curriculum should be reviewed to make it relevant to national development in line with the global and national demands of this era. Curriculum review became imperative as a result of Federal Government of Nigeria's decision to introduce the 9 years of Basic Education and the need to attain the Millennium Development Goals (MDGs) by the year 2015, together with the need to meet the critical targets of the National Economic Empowerment and Development Strategies (NEEDS) summarized as; Value re-orientation, poverty eradication, job creation, wealth generation, and using education to empower the people. It became evident that the existing curriculum for junior secondary school should be reviewed, restructured and realigned to fit into a 9-year of Basic Education. The National Council on Education (NCE), at its meeting in December, 2005, directed the NERDC to carry out this assignment. The NCE also approved the new curriculum as Basic Education Curricula. Consequently, Duada and Udofia (2010) reported that a high level policy committee on curriculum development met and produced the guidelines for the curricula re-structuring. When this was done, NERDC convened between January and March 2006 where experts from various fields and works of life worked assiduously and produced the curricula. These curricula took effect from September 2007. In the restructuring, Basic Science replaced Integrated Science. The 9-year Basic science and Technology Curriculum according to Adeniyi (2007) is the product of re-alignment and restructuring of the revised curricula for Primary Science and Junior Secondary School Integrated Science. In selecting the contents, three major issues shaping the development of nations and influencing the world of knowledge today were identified. These were globalization, information and communication technology, and entrepreneurship education. Additionally, the themes according to NERDC (2007) were infused into the Integrated Science curriculum to form the Basic Science curriculum including, Environmental Education; Drug Abuse Education; Population and Family Life Education; and Sexually Transmitted Infections (STI) including HIV / AIDS. Infusion of content occurred in every class from basic 1-9. Also, some introductory technology topics have been introduced at the Lower and Middle Levels, while leaving the Upper Level with purely science topics. The overall objectives of the Basic Science and Technology Curriculum according to NERDC as outlined in Egbodo (2010) are to enable the learners to:

Develop interest in science and technology;
Acquire basic skills in science and technology;
Apply their scientific and technological knowledge and skills to meet societal needs;
Take advantage of the numerous career opportunities offered by science and technology; and
Become prepared for further studies in science and technology.

In order to achieve a holistic presentation of content of science and technology to learners, the thematic approach to content organization was adopted. Consequently, four themes according to (NERDC, 2007) were used to cover knowledge, skills and attitudinal requirements. These are: You and Environment; Living and Non-living Things; You and Technology; and You and Energy. At the upper basic level, however, theme in (iii) "You and Technology" was changed to “Science and Development”. The topics under each theme were sequenced in, bespiralginning with the simple to the complex across the 9-year of Basic Education in order to sustain the interest of learners and promote meaningful learning.

The use of guided inquiry method of teaching and learning is implied in the activities prescribed under each topic in order to promote learning by doing and skills development. The theme "Science and Development" was added to expose students to development in science and technology alongside skills that will enable them to face challenges, make informed decisions, develop survival strategies, and learn to live effectively within the global community (NERDC, 2007).

To this end, in effort to produce a basic science and technology subject that would satisfy the above philosophy and objectives, teachers are encouraged to enrich the content of the curriculum with relevant materials and information from their immediate environment, by adopting the curriculum to the needs and aspirations to meet with the decision of the Federal Government in order to attain the Millennium Development Goals (MDGs) and the vital targets of the National Economic and Empowerment Strategies (NEEDS). In connection with the foregoing, Egbodo (2010) encourages science teachers to be inventive, creative, and original as well make use of the ingenuity of the basic science and technology students for practical teaching and learning.

2.4 STRATEGIES FOR TEACHING BASIC SCIENCE AND TECHNOLOGY

The methods used by teachers in teaching basic science and technology as a foundational science subject should be of paramount concern, as its success or failure might have a long-lasting effect on the students. If basic science and technology concepts are not taught from known to unknown and from simple to complex, the students might find it difficult to understand the concept being taught and this might result to the development of negative attitude towards the subject by the students, which could lead to lots of interest in the subject and other science subjects at the senior secondary school level.

Laboratory activities as one of the methods of teaching basic science and technology, is an important strategy used in fostering understanding of certain scientific and technological concepts in basic science and technology as well as developing and promoting positive attitude towards basic science and technology amongst the students. Laboratory activity strategy plays an important role in developing and inculcating problem-solving skills among basic science and technology students. Furthermore, learning through the method of laboratory strategy, reinforces and concretizes scientific theoretical concepts through reality.

Another strategy that can be used for teaching basic science and technology is by taking the students to the field (open-ended laboratory) to provide firsthand experience of some scientific concepts in their natural environments as such experience is not available within the confines of the close-ended laboratory. Field trip, as one of the strategies that create the opportunity for students to be taken to the field outside the school, are important component of basic science and technology teaching that enables the teacher to expose the students to the scientific and technological concepts outside the school in their natural and technological settings. One of the importance of field trip method of science teaching is that it provides the opportunity for students to verify scientific laws and concepts in their natural form through reality.

Activity-based method of teaching is another strategy suitable for the teaching and learning of basic science and technology Ugwu (2004). It involves the hands-on manipulation of tools, materials, accurate measurement and observation, analysing of results and drawing of inference by both the teacher and the students. This method of instruction promotes problem solving skills amongst the students and, as well, makes learning concrete for students. The Nigerian Educational Research Development Council (NERDC) and The Science Teacher Association of Nigeria (STAN) emphasized on the effectiveness of the activity-based approach to science instruction and also recommended the use of the method in teaching basic science and technology (NERDC, 2012). In the same vein, basic science and technology teachers must understand that basic science and technology is a practical subject. Hence, the success of its delivery stretches beyond the cognitive objectives. A basic science and technology teacher is a demonstrator, mind influencer and also a motivator that inspires his / her students to carryout scientific activities by themselves for the acquisition of scientific process skills and knowledge. As a result, the basic science and technology teacher should deliver his/her lesson by demonstration and motivation, while his / her performance will be measured by what the students are able to do at the end of the lesson.

2.5 CONVENTIONAL METHOD OF SCIENCE INSTRUCTION

A method of teaching is a logical and systematic way of impacting knowledge in the learners to attain set objectives. Teaching methods could be teacher or learner centered. It is teacher centered when it is dominated by the teacher. Example of teacher-dominated teaching method is the lecture method. On the other hand, it is learner centered when dominated by the learner, and it leads to a better performance by the students. An example of learner dominated teaching method is discovery method. Methods of teaching adopted by a teacher influences the learners' learning styles and the acquisition of science process skills which are greatly needed for science and technology accomplishment in the country. Ugwu (2004) recommended that emphasis today should be on activity-based teaching.

Modified lecture method involves instructional delivery by combining lecture with demonstration accompanied with instructional materials to make lesson interesting and meaningful to the students. The method may encourage students to participate actively in the lesson through questions and comments to avoid boredom.

The choice of the lecture method as control comparative independent teaching variable in the study was due to the fact that it is the dominant teaching strategy used by most teachers irrespective of the age of the students, subject and concept under treatment. Another consideration for the choice of this teaching method is that teachers find it easy and therefore continually use it to teach all science subjects right from primary to tertiary institutions, despite its criticism by educational experts at its detriment to students' performance.

Nevertheless, the Nigerian Educational Research and development Council (NERDC) stipulates the use of activity-based and guided inquiry approaches to basic science and technology teaching, but the adoption and application of these methods are still an illusion in the study area because of paucity of instructional materials and unwillingness of the science teachers to improvise alternative materials locally to improve instructional delivery. Consequently, the teachers resort to conventional lecture methods and walk into the classroom with a key-point text for one-way communication; and copy a few points on the chalkboard. Lessons are rarely planned and instructional materials are hardly used by these teachers. This explains the choice of lecture method as it controls independent variable to expose its ineffectiveness in delivering basic science and technology concepts; and to provide a way forward that suggests the use of improvised instructional materials that could combine activity-based and inquiry approaches to science teaching.

In convectional lecture method, the teacher as the authority-figure does most of the conversations, with the students as mere receivers of instruction. The students listen, write down a few notes and ask few or no questions. The technique does not encourage meaningful learning as the students are denied of chances to contribute keenly in the learning. It does not take cognizance of the slow learners. It encourages rote learning and rarely provides opportunity to practice communication and manipulative skills. Students taught with conventional lecture method will see science process skills as skills only scientists possess which to them are quite abstract, unattainable and unapproachable. Consequently, students' interest in science and their desire for further studies in science-related disciplines are either completely killed or is made to diminish largely as a result of the teaching method employed by the teacher which does not give consideration to learner's involvement.

2.6 USE OF IMPROVISED INSTRUCTIONAL MATERIALS STRATEGY

The use of improvised instructional materials provides learners with different ways to learn that enable them to participate actively in the lesson. The learners, unlike in the conventional method, are made the major focus of the teaching and learning process.

One of the goals of Nigerian educational system is the acquisition of appropriate skills, the development of mental, physical and social abilities and competencies as equipment for individuals to live and contribute to the development of the society (Federal Government of Nigeria, 2004). The realization of this goal has been impeded by the non-availability of instructional materials for ensuring effective teaching and learning for better results among students. It has been reported that the non-availability of instructional materials in schools serves as barrier to effective teaching (Adeyemi, 2007), this leads to persistent poor performance from students in many subjects over the years. Different scholars defined improvisation of instructional materials in different ways. For example, Bajah in Eminah (2009), defined it as the use of substitute equipment where the real one (ready-made) is not available. Kamoru and Umeono (2006), defined it as the act of using materials obtainable from the local environment designed by the teacher to enhance instruction. Improvisation is the art of using local resources available within the school environment by a teacher to produce simple but attractive and effective instructional materials for teaching.

Locally produced instructional materials contain ideas and photographs of the materials which teachers usually prepare to promote the physical, social, emotional and cognitive growth of the learners. The materials are designed to encourage students to be curious and to take initiative by exploring and interacting with other children. Young children learn best when their thoughts and experiences interact with materials, ideas, and people. Such interaction gives learners meaningful developmental learning experiences (Judy, 2004). Improvisation according to Osuagwu (2010) is the provision of materials locally made by teachers, students or an educational agency to represent the original material or equipment. Improvisation in teaching refers to the act of using alternative materials and resources to facilitate instruction whenever there is lack or shortage of some specific first-hand teaching aids (Enaiayeju, 2003).

Generally, improvisation could be regarded as the act of using alternative materials or equipment obtainable from the local environment or constructed by the teacher or with the help of local personnel to facilitate instruction. In this content, the term "local materials" refers to those materials easily obtainable from the immediate environment irrespective of where they are produced. The skill of producing local instructional materials is applicable to many different abilities across all academic and non-academic disciplines. Teaching-learning process may not easily be

achieved through the mere use of verbal words. As such, producing locally made instructional materials become very necessary. The focus of teaching is on the natural reciprocation of comprehension and production in communication; on the functional and collaborative practice of language in flexible learning environment; and individual possession of skills. Students find it easy and joyful learning with instructional materials. As such, improvisation reveals that there are possibilities of alternatives to teaching and learning aids. It should therefore meet specific teaching and learning situations. Improvisation in basic science and technology has become imperative in teaching and learning because the economic situation makes the cost of facilities and equipment very high amidst a decrease or lack of purchasing power.

Therefore, the teacher education programme must integrate material development whereby teachers learn how to design and construct various materials and equipment which could be used in teaching-learning process. Improvisations of instructional materials in basic science and technology by teachers that are innovative in concepts, encourages students and teachers to be more creative, innovative and original. It also develops skills in the cognitive, affective and psychomotor domains.

2.6.1 Types of Improvisation of Instructional Materials

Locally produced instructional materials, according to Eminah (2006), can be of three types, namely Improvisation by Substitution, by Modification and by Construction.

1. Improvisation by Substitution/Miscellaneous Materials

A resourceful teacher devotes his time producing materials best suited for learning purposes. Miscellaneous are locally available materials that are used just as they were collected without any alteration in shape or size. They include: models, maps, as well as the use of:

a) Dry cells in place of accumulators
b) Wood as pulleys
c) Discarded bottles as reagent
d) Plastic jerry cans as aspirators

2. Improvisation by Modification of Materials

With the aid of projection equipment, the teacher is able to produce cheaply, with limited time, materials that serve as desirable supplement to textual materials. These materials include drawings, charts, pictures, graphs, etc. It also involves the conversion of:

a) A burette to a pinchcock (clip)
b) A millimeter into a voltammeter.

3. Improvisation by Construction of the Materials

These materials are collected and compiled by the teacher to be used in the teaching learning activity. They include; pictures from newspapers, magazines, and students' work of good quality. It also involves the designing and construction of materials using low cost materials such as: -

a) Pinhole cameras
b) Insect catching nets

2.6.2 Classification of Instructional Materials

There are different types of instructional materials that can be utilized in the teaching and learning of Basic Science and Technology. These materials, according to Michael (2015), are classified into visual, audio, audio-visual, and realia.

Visual Materials

These are teaching and learning devices that appeal mostly to the sense of sight (eyes). In this category, we have simple visual materials such as slides, filmstrips, pictures, diagrams, charts, pictorial aids and transparencies. Like audio-media, they are inexpensive, often simple to use, and, above all, clear and impressive in their presentation.

Audio Materials

These are teaching devices that mostly appeal to the sense of hearing (ears). They consist of radio, thereafter, audio recordings such as cassettes and disc records. Other examples of audio media are devices like the telephone and walkie-talkie. They carry sound along without visual impression. Since audio-aids appeal mostly to the auditory sense, for them to be effective, students must not be auditorily impaired. Radio-record-players and tape-recorders that are becoming common household items could be judicious and effectively utilized in the classroom.

Audio-Visual Materials

These are instructional devices that have the capacity to provide the features of audio and visual media simultaneously. They appeal to both auditory and visionary senses (hearing and seeing). Typical of materials in this category are the television, videotaped programmes/ recordings, sound films, film-strips and slides with synchronized sound.

Realia

These are real objects such as specimens, models and so on. Realia is the best of all forms of instructional materials. This is because the students come in direct contact with the real object to be learnt. For instance, in a basic science class, the teacher brings some grains of rice and maize as examples of carbohydrates, some grains of beans and an egg as examples of protein, little content of palm oil and groundnut oil as examples of fat and oil.

The students stand to understand the concept "classification of food" better since the teacher presented real food items to the students as instructional materials while teaching the topic. Teachers are advised to use realia as their improvised instructional materials in lesson delivery (Michael, 2015).

2.6.3 Purpose of Improvising Instructional Materials

Instructional materials, in this context, are those relevant materials utilized by a teacher during instructional process to facilitate teaching and learning, and for the purpose of making the contents of the instructions more practical and less vague. It therefore follows that such resources may be both human and non-human provided they facilitate the acquisition and evaluation of knowledge, skills, attitudes, morals and values, Esu and Inyang-Abia (2004). Ordinary words or verbalization have been found to be inadequate for effective teaching. Instructional materials serve as a channel through which messages, information, ideas, and knowledge are disseminated more easily. They can, therefore, be manipulated, seen, heard, felt or talked about. They facilitate teaching-learning activities, therefore they are anything or anybody the teacher turns to for help in his / her teaching process.

Improvised instructional materials according to NTI (Module Two) are of paramount importance in the teaching and learning of basic science because of the following functions they perform:

1. They increase the rate of learning and, at the same time, allow the teacher to spend more time on other useful activities.
2. They provide reality of experience that stimulates self-activity on the part of the learners.
3. They provide learning experiences which are not within the immediate classroom environment
4. They discourage rote learning by emphasizing realistic learning.
5. They make abstract terms, concepts, and generalizations more practical and realistic.
6. They help the learners to focus their attention during teaching-learning process.
7. They provide the teacher with the means of guiding and controlling the desirable responses of the learners in relation to stimulus materials of the learning situations.
8. They develop in the learners, awareness of problems, open up possibilities for exploration, present meaningful interactions which naturally lead to provision of solutions.
9. They help to stimulate purposeful and utilized self-activity and this is much more preferable educationally than the passive and often boring listening method.
10. They improve the classroom communication process between the teacher and the learners. With this, the expected improvement in learning output will be accomplished.

Also, improvisation according to Tikon (2006) serves the following purposes in the teaching-learning process:

i. It ensures the realization of lesson objectives.
ii. It gives room for a teacher to demonstrate his / her creative skills.
iii. It gives room for the use of cheap local materials as alternatives to the readymade ones;
iv. It enables teachers to think of better and faster methods of making teaching-learning process easier for learners.
v. Afford students the opportunity to become familiar with available resources in their environment.

2.6.4 Criteria for Improvisation of Instructional Materials

In an attempt to improvise an instructional material, a teacher must familiarize himself / herself with what is in the syllabus, the topic to be taught with respect to the subject and the variety of local materials available within the environment relating to technology. Likewise, the instructional materials to be improvised must be simple, attractive and effective for teaching. The use of materials as instructional aide emphasizes innovation and change in method, over the traditional method of teaching. In order to aid the implementation of new method, instructional materials must be produced for effective teaching (Taiwo, 2009).

Lack of instructional materials in teaching-learning process can therefore be traced back to lack of initiatives on the part of teachers. Improvisation of instructional materials needs committed individual, judgment, self-direction and initiative. For instructional materials to be produced and made useful for teaching, a teacher has to be properly organized in terms of knowledge and skills of improvisation in order to obtain maximum utilization of potentials which will be revealed through such improvisation (Ogunlade, 2005). Teachers need to acquit themselves with the available equipment and materials as well as being conversant with the principles of improvisation for better result of teaching-learning process. Material design and production take a lot of commitment, which makes it mandatory for a resourceful teacher to

carefully consider the followings: interest, time, and skill of material design. Factors like the characteristics of learners, objectives of the study methodology and evaluation must be taken into consideration in the material design, production, and utilization (Abdullahi, 2010). Research study by Taiwo (2009), showed that access to technology increased teachers' opportunities for successful teaching experience, thereby contributing to greater confidence in their instructional ability. Teachers use materials because they (materials) motivate students and offer different modes of presentation. Most of the teachers who are confident in their ability use improvised materials as instructional tools to enhance students' learning (Lam, 2000).

Resistance to the use of improvised materials may arise from the negative attitudes of teachers, or lack of expertise and training in material utilization (Abdullahi, 2010). According to Abdullahi (2010), modifying traditional teaching methods will be very difficult as teachers have conservative attitudes towards the use of instructional materials in teaching. Also, lack of funds, equipment and time are known obstacles to successful instructional material integration in teaching (Lam, 2000). The lack of funds to purchase and maintain instructional materials also serves as a deterrent to material utilization by secondary school teachers.

Teachers of nowadays are accustomed to the traditional methods of teaching, thereby avoiding any new methods of using instructional materials in teaching. Wadi (2003), stated that learning is enhanced when students interact and perform authentic tasks. A classroom situation is an opportunity to expose students to people who apply knowledge in practical context. The central mission of teaching is to support learning. Therefore, teachers should create classroom communities in which thinking and problem solving are supported by extensive interaction between students and materials. The quality, speed and effectiveness of learning depend much upon the kind of learning situation and environment available to the learner. Learning is the product of activity and environment. The more the students respond actively to the stimuli present in the learning environment, the more they progress in terms of learning outcome.

The mind, on the other hand, is a cognitive mechanism that processes varied perceptions into specific concepts and understanding which are essential for the development of attitudes and appreciation. The use of improvised materials in teaching-learning process provides experience that is concrete and realistic. This implies that real and concrete experience leads to development of understanding, which in turn enables learners to solve their own problems. According to Shah (2007), for effective teaching-learning process, individuals who wish to become great teachers must be willing to sacrifice time and effort to reach their goal of solving instructional problems by integrating instructional technology into the classroom. A classroom is one of the facilities of learning in formal settings. The best classroom environment is one that results in effective studio learning. Effective learning involves employing guidance and materials to encourage students to become self-directive thereby creating an atmosphere conducive for learning. Sound classroom control is achieved most efficiently if the teacher is equipped with a theoretical and working knowledge of the relevant principles and materials that undertake classroom behaviour.

The capacity of a child at a given time for learning school subjects is subject to methods of teaching and materials used by a resourceful teacher. The relevance of such materials to students' interests is a factor in readiness to learn. The next generation of our modern society will need knowledge and skills for which today‘s curriculum only forms a foundation. Discovering and understanding that the forefront of today‘s research will be essential and fundamental part of their world. Therefore, the success or failure in the task of learning in terms of introducing desired modification in the behaviour of the learner depends automatically upon the quality, control and management of the three learning elements, which are; methods, available resources, and environment, as well as their related factors (Brijesh, 2007).

2.6.5 Teachers' Perception of Improvised Instructional Materials

The way teachers view the role of improvised materials in instruction, to a large extent, will determine the level and degree of their usage. Teachers' perceptions of instructional materials are predicated upon what they feel instructional materials can do in teaching-learning process. Many research studies have pointed out various external deterrents for the improvisation and utilization of instructional materials. The major deterrent reported was lack of facilities and trained personnel (Higgins and Moseley, 2001). Other researchers have noted that some teachers appear to perceive instructional materials as threatening and perhaps inhuman. Lack of knowledge, skill and time are known obstacles to successful technology integration among teachers (Lam, 2000). Research shows that most teachers are either untrained or have had specialized training in fields other than in education. Thus, it is unfair to expect expertly designed and effective use of instructional materials from these categories of teachers. Resistance to the use of materials in teaching stems from the negative attitudes, lack of expertise and training in materials utilization. It is a fact that teachers are accustomed to traditional methods of teaching rather than the modern ones (Abdullahi, 2000). The non-utilization of instructional materials in teaching is due to little or no confidence in the materials' effectiveness.

The effort of the Federal Government in providing opportunities as indicated in the NPE (FGN, 2000) asserted:

a) Teacher education shall continue to take cognizance of changes in curriculum and methodology. Teachers shall be regularly exposed to innovations in the profession.

b) In-service training shall be developed as an integral part of continuing teacher education and shall also take care of all inadequacies. All these can be done through the inculcation and integration of the principles of instructional technology in teacher education programme.

Moor and Hunt, in Abdullahi (2000), suggested reasons for resistance to the use of instructional materials as; many educators resist new teaching techniques and the use of instructional materials based upon genuine concern, misunderstanding, misuse or unpleasant experience. Successful integration of technology into teaching depends on transforming teachers' belief and philosophy (Winchift & Sali, in Taiwo, 2009). As a result of this, teachers should be concerned with the practice of educational technology, part of which involves improvisation of instructional materials. Teachers must develop their potential ability to defeat the accompanying challenges. The need for new techniques in teaching and learning is necessary for learning to grow stronger and faster.

Among the several factors militating against the improvisation and utilization of instructional materials are teachers' lack of commitment to educational technology and skill in using the materials. The neglect of using any instructional materials has to a large extent impeded efforts of excellence in the educational system. Research findings indicate that Nigeria's technological backwardness is largely traceable to lack of necessary technological base. This is evident more importantly in the neglect of instructional materials by teachers. (Nwachuku in Abdullahi, 2010) observed that a typical classroom is very conventional, devoid of pictures and posters which have scientific impact, the result of which nothing can secure the imagination of learners and trigger discussion. Teachers have been found to be reluctant to sacrifice their time and energy to improvise instructional materials. Lack of resourcefulness and skills in the manipulation of materials are added problems to improvisation of instructional materials by teachers. The information explosion has forged a new dynamic role for the teacher to engage fully in creative thinking. Creating a learning environment were constructing and sharing of knowledge, skills and understanding is valued and a goal that every teacher must strive to reach.

Also, lack of adequately trained and qualified teachers right from primary school to secondary school level has resulted in students being ill-educated and ill-prepared in secondary schools, (Baikie, 2002). This has affected every sector of Nigerian education system. The issue is more apparent at the secondary school level with the broadened curriculum brought about by the 6.3.3.4 system of education. Therefore, teachers must search for creative ways to surpass technological imitations by the means of improvisation of instructional materials in order to challenge the student's mind.

2.6.6 Utilisation of Improvised Instructional Materials by Teachers

One of the significant concerns of all teachers is the ability to deal with students with varying abilities and backgrounds. These students require special opportunities to utilize their talents in learning effectively. Teachers owe their students best effort in providing meaningful learning experiences by adopting the new methods of teaching which emphasize the use of different types of instructional materials in teaching. Abdullahi (2010), stated that when effectively used in teaching-learning process, instructional materials make different concepts clear to students, and help them to gain knowledge best through experiences. The availability and utilization of whatever learning materials depends on the ability of the teachers to improvise. Teachers need to provide opportunities for learners to demonstrate their newly acquired knowledge and skills. This can enable learners to learn effectively, among different types of learning environment. It is astonishing that these variables are lacking among teachers in their study areas.

Due to the constantly changing and increasing demands of modern ways of teaching-learning, there is a greater need for a progressive change and redesign of teaching learning environments and spaces (Beetham, 2007). Studies show that most teachers in Nigeria do not make use of any resource materials in the teaching-learning of basic science and technology. Resistance to the use of instructional materials in teaching might be connected to the negative attitudes of teachers or lack of skills in the design and utilization of materials in teaching. While the use of innovative instructional materials can help to fulfill the need for improvement in learning, there is an associated imperative to view instructional materials in light of proven practices and models of teaching.

The traditional methods of teaching have taken the minds of teachers away from the modern methods of teaching. The conservative attitudes of some teachers towards the use of instructional materials led to the difficulty of modifying traditional methods of teaching to modern ones. According to Abdullahi (2010), teachers tend to regard instructional materials with deep suspicion, thereby regarding education as personal relationship between the teacher and learners. It has been observed that the problem of workload gives teachers little opportunity to prepare adequately for the proper utilization of materials in teaching. The utilization of available learning materials increases the degree of success in teaching. Teachers should be made to realize that improvisation and use of the local materials within the environment is an incredible valuable learning experience for both teachers and the learners.

The next generation of youths will need knowledge and skills for which today‘s curriculum only forms a foundation for. To lay this foundation is a problem to be ascertained. Anticipating the educational needs of future youths is further

complicated by the need to incorporate what is different from classical approaches to the discipline with modern instructional materials, methods and content. A teacher's focus is always on the improvement of the process of teaching and learning with commitment to the research in the field. Students need to be empowered by teachers in the learning activities through the improvement of instructional materials. Teaching and learning can be improved by effective use of instructional materials. The effectiveness of any instructional material lies in its ability to focus the attention of the learners. Teachers facilitate learning in school with the use of available resources within the environment. Research has shown that intellectual process involves perpetual and conceptual teaching with the words of mouth alone cannot easily stimulate learners to learning activity effectively. Instructional materials are useful in making instruction more effective and meaningful to learners. With the aid of these materials, teachers can take their students beyond classroom limits by allowing them to explore and learn by discovery.

The use of technology in teaching can change the way teachers teach, and the way learners perceive knowledge. Thus, teachers need to think of creative and result-producing methods such as the use of instructional materials which can enhance the learning process of the teaming population of students. To build the foundation for more coherent curricular in technology, a pilot initiative would support the development of learning progression.

2.6.7 Rationale for Improvising Instructional Materials

Effective learning requires that concepts be exposed in a variety of contexts. This cannot be possible without adequate and diverse teaching-learning materials utilized by a resourceful teacher (Adeyaju in Eminah, 2009). Learners differ in several respects. The social and intellectual background of each learner is different (Coppen in Eminah, 2009). Hence, not all the available materials meet the needs and interest of learners. Therefore, provision of locally produced instructional materials is the logical action to take for balancing activities among the different categories of learners.

According to Ogbeh (2007); rationales for improvisation of instructional materials include the following:

1. It contributes to the achievement of our education objectives by providing opportunity to develop necessary skills, attitudinal and practical skills needed to function effectively in the society.
2. Improvisation undertaken by the teacher enables him to rethink and research for cheaper, better and faster methods of making the teaching-learning process easier for the students. This implies it promotes creativity and self-reliance.
3. To some extent, improvisation fills the vacuum created by lack or shortage of equipment by providing a frame of reference on which students can key their attention to during classroom activities.
4. Improvisation provides a cognitive bridge to lead students from abstraction and its mental indigestion to a nodding acquaintance with reality. Scholars refer to this as giving students the bread of living experience rather than the stone of abstract theory.
5. Situations where equipment is available but not affordable and/or where technical expertise for saving or repairing equipment is lacking, or spare parts and replacement of items are not readily obtainable, clearly score the need for improvisation.

Based on the above rationale, the educational benefits of improvisation of instructional materials for teaching basic science and technology cannot be farfetched. Ideally, no effective education programme can exist without instructional materials. According to a Chinese adage, "A look is worth a thousand words". This statement illustrates the value of teaching and learning materials in enhancing effective learning, as these materials do not achieve any of the attitudinal values on their own. Rather, their usefulness depends on what the teachers make out of them. Intelligent handling of the improvised instructional materials in the classroom is necessary (Ogbeh, 2007).

2.6.8 Importance of Improvising Instructional Materials

Local production of instructional material is making the substance from available materials when the real equipment is not available (NERDC, 2005). The use of instructional materials in teaching could extend the scope and power of instruction. It could also help to bridge the gap between the teacher and students in terms of understanding different concepts in the lesson, thereby making learning more immediate and more relevant. To make teacher education programme more viable, there must be room for adoption of new principles and procedures in instructional technology that are necessary for growth in learning. This calls for more concern with improvisation of materials through local initiatives. Balogun (2008) opined that locally produced instructional materials encourage creative expression and foster experimentation, sensitive to tactile and visual experience improvements. Creativity in classroom environment communicates to learners and teachers what is expected of them and what is happening in the classroom. A well-planned environment is inviting and interesting and conveys a message.

A resourceful teacher is one who, when faced with a problem, considers a variety of solutions and chooses the most appropriate ones. In the absence of ready-made resources, a teacher improvises appropriate alternatives to solve the problem. Teachers normally prepare local materials in order to promote the physical, social, emotional and cognitive growth of learners. The materials are designed to encourage learners to be curious and to take initiative by exploring and

interacting with other learners. Students learn when their thoughts and expectations interact with materials, ideas, and people; such interaction, according to Judy (2004), gives learners meaningful developmental learning experience. Locally produced instructional materials give teachers the pride of using their talents, allow a teacher to reproduce his potentials in concrete form and increase the teacher's knowledge of the subject matter.

Abdullahi (2010) opined that the widespread recognition of the importance of local materials in teaching will encourage teachers to produce instructional materials for use in the teaching learning process. They save the teacher's time, simple to make and require little explanation by the teacher for students to understand them. When effectively utilized by the teacher, locally-made materials help to stimulate students' interest, reduce the number of verbal responses and provide experiences not easily secured in other ways. He also stated that local materials are those resources found within the environment that are useful and effective if properly utilized by a resourceful teacher in the teaching-learning activities.

2.7 IN-SERVICE TRAINING FOR TEACHERS ON IMPROVISATION OF INSTRUCTIONAL MATERIALS

The need for qualified teachers is high as the world is moving technologically. The need to raise the skills of the existing teachers, of which some are unqualified, is necessary. Beyond that, the skills and knowledge teachers need are no longer fixed but moving. Teachers, therefore, need more opportunities than ever before to go and learn more about their careers.

Teacher education programme, according to Egbodo (2016), failed to move in the direction of specialization. Although national policy pronouncements have continued to talk about the professionalization of teaching, this in practice can be possible only when there is specialization in teacher education. The basic requirement of every teacher is that of educational qualification and confident / mastering of subject area. To do all these, such a teacher must be well trained in teaching methods, and be aware of the needs and feelings of the students and the society as well. Teachers now face a widening range of demands and roles than ever before. The attention given to teacher education and their continuing professional development, in many cases, lagged behind that, given to other parts of the education system (UNESCO, 2001).

The absence of in-service training programme has left teachers stagnant over lengthy periods. Teacher education and training is the programme of studies which leads to qualified teacher status according to the official standards of a country. The need to improve the quality of education in this situation requires a general retraining of teachers at all levels of education. Modern teachers need to be provided with new strategies for coping with varied learning situation, (Egbodo, 2016). The in-service training of teachers will help tremendously in improving the quality of teachers and eliminate the shortage of trained and qualified teachers in our schools. The quality of teaching in secondary school systems will improve appreciably and the product of the schools will be better prepared for entry into higher institutions, Baikie (2002). For proper preparation of teachers who are to operate at new professional level, a new definition of institution for teacher training needs to be provided. The new institutions must be deeply involved in research, experiment and be of innovative, and also encourage the practical application of such innovations.

The scrapping of the Teachers College has practically revealed the detrimental neglect of in-service training among teachers nation-wide (Egbodo, 2016). Teachers in training should be sensitized on the need to update their knowledge and skills for effective teaching. Teachers should design a self-evaluation form to assess the effectiveness of their teaching using instructional materials periodically as applicable to the organization of the content of school syllabus at all levels.

The effort of the federal government in providing opportunity for anyone who shows interest in teacher education is indicated in the National Policy on Education (FGN, 2004) that teacher education shiuld continue to take cognizance of changes in methodology and in curriculum. Teachers should be regularly exposed to innovation in the profession. In-service training shall be developed as an integral part of continuing teacher education and shall also take care of all adequacies. Hence, Isola in Umar (2012), stressed the need for a definite, well planned in-service training programme of improvisation for teachers. He suggested regular meaningful workshops on improvisation techniques for teachers to improve and update their competence. The workshop will give teachers advice on using available resources to perform classroom experiments, especially in impoverished areas. Many teachers do not realize that they have plenty of resources available for classroom experiments. Once the teachers begin to understand the principles behind improvisation through the in-service programmes, they can key into the initiatives of improvising their own instructional materials.

Also, a lot of teachers lack confidence in their ability to design their own instructional materials. However, in-service training programmes will give teachers the opportunity to engage in group work and develop teamwork skills to improvise instructional materials.

2.8 EMPIRICAL STUDIES

Egbochukwu (2002) investigated the impact of locally produced instructional materials on the realization of the objectives of public primary education in selected primary schools in Anambra State. The study was conducted with eight research objectives and eight research questions were raised in line with the stated objectives. The study randomly samples 400 out of a total 640 respondents in Anambra State. The instrument used was questionnaire, divided into three sections (parts). The study adopts a descriptive type of survey design. All the data obtained from the administered instrument was subjected to Analysis of variance (ANOVA) test. Differences between groups were established through t-tests of adjusted means. Eight hypotheses were tested at the 0.05 significant level, six of which were upheld, while the remaining two were rejected. The study concluded that locally produced instructional materials have a significant impact on the realization of the objectives of public primary education and that teachers should be trained to improvise instructional materials. It suggests that although this research work provides an empirical basis for the assessment of those variables that are critical to attaining the objectives of Public Primary Education in Nigeria, more needs to be done by upcoming researchers to explore other dimensions to the issue of attaining the objective of Public Primary Education through the use of proper instructional material.

In the opinion of the researcher, since teachers are critical to the attainment of educational objectives at all levels, it is important that issues relating to their welfare / wellbeing be given adequate attention. Because teaching is an intellectual enterprise, the teachers' needs must be adequately addressed if his concentration and devotion are to be secured. This study is very relevant to the current study as it investigated the impact of locally produced instructional materials in the realization of the objectives of public primary education in selected primary schools. But the research work is different to the current study in the area of research instrument used. The study used questionnaires to collect data, while the present study will use achievement test for data collection. It is also different to the present study in the sense that it was carried out in primary school, while this current study will be conducted in junior secondary school.

Yusuf (2002) carried out research titled: Influence of availability of learning resources on the academic performance of students in the senior secondary schools in Kebbi state. The study was carried out with four objectives, four research questions and four null hypotheses. Questionnaires were used for data collection and the data collected was subjected to ANOVA. The study found that availability and utilization of learning resources has a significant effect on the academic performance of students in Agricultural Science. The current research work is related to past research work as it draws the attention of the researcher to the influence of availability of learning resources has on the academic performance of students in the secondary schools. Despite the similarities, the study differs from the present study as it used questionnaire for data collection and ANOVA was used for data analysis, whereas the current study will use achievement test for data collection and the data collected will be analysed with the use of t-test.

In the same vein, Patrick (2004) carried out a study titled: Effect of Instructional Materials on the Performance of Senior Secondary School Biology students. The study was conducted with five research objectives, five research questions and five null-hypotheses were postulated for the study. The study was a survey research and questionnaire was used for data collection. Chi-square was used to analyse the data collected and the study found a significant difference in the performance of Biology students taught with instructional materials and those who were taught without instructional materials in favour of those taught with instructional materials. Likewise, the researcher concluded that government should encourage teacher's improvisation and usage of instructional materials. The current research work is related to the past research work of Patrick in the sense that both research works seek to determine the effect of instructional materials on the performance of students. However, the researcher did not state the sample size. Also, the data collected was subjected to chi-square while the present study will use t-test for data analysis.

Balarabe and Mannir (2003), surveyed the opinions of the respondents on the impact of teachers' improvisation. The study was conducted with three objectives and three research questions. The population comprised of six hundred and twenty (620) secondary school students. The sample size was 108 students selected randomly. The researcher also used oral interviews for some students. They reported that teachers' improvisation of instructional materials has a significant impact on students' academic performance. The similarity of the present study lies in the fact that both studies were concerned with the improvisation of instructional materials. The survey research was conducted without the use of hypotheses. Despite that, their survey research work contributed to the current research work.

Equally, Adeyanju (2005), in his study of effect of locally produced instructional materials on the performance of Junior Secondary School Business Studies students. The study was conducted with six research objectives, six research questions and six null-hypotheses were postulated for the study. The study employed the use of quasi-experimental design and found a significant difference in the performance of Business Studies students taught with locally produced instructional materials and those who were taught without instructional materials in favour of those taught with locally produced instructional materials. In carrying out this study, the researchers used t-test for data analysis and data was collected using standardised test. This study is relevant to the current research because it studied the effect of locally

produced instructional materials on the performance of Business studies students in the junior secondary schools. Also, the study is related as it uses standardised test to collect data, while the present study will also use a researcher made test to collect data from the respondents. The area of dissimilarity is that the study was carried out with six objectives, research questions and six null-hypotheses while the present study will be conducted with four objectives, four research questions and four null hypotheses. Furthermore, the research was carried out on business studies junior secondary school students, while the current research work focuses only on basic science and technology students.

2.9 SUMMARY

This chapter reviewed the related literature on the effects of improvisation of instructional materials on the academic performance of Basic Science students in Jos north L.G.A. of Plateau State, Nigeria.

Improvisation is regarded as the act of using alternative materials or equipment obtainable from the local the local environment by the teacher to facilitate instruction. Also, things that could be used by the teachers for improvisation of instructional material as well as important things required for improvisation of instructional material were discussed. And it was revealed that improvisation of instructional materials needs committed individual judgment, self-direction and initiative. For instructional materials to be produced and made useful for teaching, a teacher has to be properly organized in terms of knowledge and skills of improvisation for maximum utilization of potentials which will be revealed through such improvisation.

Literature was also reviewed on the importance of in-service training of teachers on the improvisation of instructional materials. The need to improve the quality of education in this situation requires a general retraining of teachers at all levels of education so as to improve their skills to improvise instructional materials which will help in influencing the arousal, selection, direction and maintenance of all human behaviour. Students require some form of stimulus to activate, provide direction for, and encourage persistence in their study and learning efforts. The reviewed studies showed that none of these researches was conducted on basic science and technology in any part of Plateau state. As such, this study on "The Effects of Improvisation of instructional materials on the academic achievement of Basic Science and Technology students in Jos North, Plateau state," will be carried out to fill these identified gaps.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 INTRODUCTION
This chapter discusses the methods used for the research under the following headings; Research design, Population, Sample, Sampling Technique, Instrumentation, Validation and reliability of the Research Instruments, Method of Data Collection and Method of Data Analysis.

3.2 RESEARCH DESIGN
The study adopts a non-randomized pretest-posttest quasi-experimental design. According to Sambo (2005) and Ofor (2000), quasi-experimental research design permits the use of intact classes. The selection of this design for the study is because the class arrangement of subjects will not be interrupted. This is because the research will be conducted in a school setting. Some classroom situations do not lend themselves to excessive manipulations. Consequently, it may not be possible for the researchers to randomly sample the students and assign them to groups without disrupting the academic programme and the timetable of the schools involved in the study.

The illustration below shows a diagrammatic representation of the research design.

Expetal Group ———> O_1 **X** O_2 **R** O_3

Control Group ———> O_1 **—** O_2 **R** O_3

Where: O_1 = Pretest, O_2 = Posttest, O_3= Post-Posttest, **X** = Treatment, **R** = Retention

3.3 POPULATION
The population for this study consists of all the basic science and technology students in JSSII in Jos North Local Government Area of Plateau state. According to the Ministry of Education 2016/2017 Annual School Census (ASC) Monitoring Template, there are 76 secondary schools in Jos North Local Government Area both public and private. 74 are coeducational and 2 are single-sex; Comprising 2,950 JSSII students. The choice of JSS II students is based on the fact that they are not preparing for any external examination at this level. The students are also expected to have been exposed to basic science and technology concepts at the JSS I and II levels to give them a rich knowledge of the subject. Furthermore, another consideration for the choice of JSS II students is that at this stage the students are expected to have reached the formal level of reasoning, cognition and interpretation.

3.4 SAMPLE
The sample for this study is made up of 60 JSS II basic science and technology students drawn from two schools within the sample area. The experimental group consists of 15 boys and 15 girls, while the control group also comprises of 15 boys and 15 girls respectively.

3.4.1 Sampling Technique
Multi-stage sampling technique will be used in selecting sample for this study. In this type of sampling according to Emaikwu (2013), different sampling techniques are applied at several stages of the research study. Purposive sampling will be used in selecting schools, simple random sampling technique will be used in selecting students and proportionate stratified random sampling will be used in selecting gender for the study.

There will be two groups in this study drawn from the same population of JSS II basic science and technology students within the study area. The assignment of students into two groups will be through randomization. One of the groups will be randomly designated experimental group (group one) while the other group will be the control group (group two). In this study, the experimental group will be taught a topic in basic science and technology using improvised instructional materials while the control group will be taught the same topic without using improvised instructional materials. This design aims to compare the post-test and post post-test scores of the two groups in the achievement test.

The schools will be selected purposively. In purposive sampling according to Emaikwu (2013), specific elements which satisfy some predetermined criteria are selected. Research on improvisation of instructional materials must necessarily be conducted in schools where instructional materials are not available. This is why the schools will be selected purposively.

3.5 INSTRUMENTATION

The instrument that will be used for collecting data is the Basic Science and Technology Achievement and Retention Test (BSTART). The instrument will be used to test students' achievement and retention in basic science and technology. The BSTART contains 20 multiple-choice objective test items with four options (A-D) per question. The choice of multiple choice test items is because of its objectivity in marking.

The BSART items developed by the researcher will be prepared by first constructing a table of specifications (test plan) which will classify each test item according to the topics and the objectives the test addresses. The researcher intends to use the table of specification because it helps to construct a test that has content validity whereby there will be a match between what was taught and what will be tested. It will also help to align test items with learning objectives. The BSTART will be used for the pretest to determine students' performance before the treatment. The same BSTART will be used for the post-test to determine the achievement of the students after the treatment. The BSTART will then be used again as the post post-test, this time to measure the students' retention of knowledge from the learnt concepts.

3.5.1 Validation of Instrument

The research instruments developed will undergo validation by three experts, two from the Department of Science and Technology and one from Educational Foundations all from the faculty of education, University of Jos. The experts would validate the instruments in terms of clarity of language, appropriateness and adequacy of the items in measuring what they are expected to measure. The advice of the experts would help in erasing, modifying and selecting the best set of test items for the study. An instrument is said to be valid when it achieves the purpose for which it was constructed. The purpose of the BSTART is to determine students' achievement and retention in Basic science and technology classes before and after treatment in the course of the study.

3.5.2 Reliability of the Instrument

The researcher carried out a pilot study in order to test the reliability of the research instrument. The schools that were selected for the pilot study did not form part of the schools for the main study.

The students were randomly divided into two groups; experimental and control groups. Each group consisted of twenty (20) students (ten boys and ten girls). The students were given the BSTART items containing twenty (20) objective questions to answer before treatment. This was to ascertain their entry knowledge and to assess the equality of the two groups.

The main purpose of pilot study according to Kerlinger, Fred and Howard (2000), is to confirm the suitability of the instrument for its adequacy and effectiveness. The trial testing (pilot study) would enable the researcher to determine the clarity of the test items, their readability, appropriateness and adequacy as well as to determine the suitable timing for the test. The time duration for the test was estimated using the average time taken by the first and last students to complete the test.

To determine the reliability coefficient (r), data collected was subjected to statistical analysis using the Cronbach Alpha coefficient method which yielded a reliability Coefficient value of 0.78 for the instrument. Hence, this result shows that the instrument is reliable because the closer the result is to one (1), the more reliable the instrument becomes.

3.6 PROCEDURE FOR DATA COLLECTION

Data for the study will be collected through the following procedure:
The researcher will administer a pre-test to the experimental and control groups in their respective schools. In the pre-test, the Basic Science and Technology Achievement and Retention Test (BSTART) will be administered to the groups. Objective question sheets will be provided for the students to choose the correct answers from the provided options A-D. The researcher will then mark the sheets of the test items to obtain the students' scores before the treatment. The exercise would provide baseline data on students' performance in basic science and technology before treatment. The researcher will then undertake classroom teaching for all the students in their schools with respect to their groups. The topics for the instruction will be extracted from the syllabus for the JSS II at the time of the study. The two groups will be given the same content treatment but the experimental group will be taught with the use of improvised instructional materials while the control group will be taught without the use of improvised instructional materials (lecture method approach).

Post-test will be administered after treatment. During the post-test, the researcher would administer the BSTART instrument to both the experimental and control groups in their respective schools. Objective question sheets will be provided for students to choose the correct answers from the provided options A-D. The researcher will then mark the sheets of the BSTART items to obtain the students' scores after the treatment with respect to their groups.

Lastly, to measure the students' retention of knowledge in basic science and technology, the post post-test will be administered one month after the post-test. During the post post-test, the researcher will also administer the BSTART instrument to both the experimental and control groups in their respective schools. The test instrument will be given to the students to choose the correct answers from the provided options A-D. The researcher will mark the sheets of the BSTART items to obtain the students' scores for the post-post-test.

3.7 METHOD OF DATA ANALYSIS

The data obtained through BSTART will be analyzed with respect to each research question and hypothesis. The data collected will be classified into pretest, post-test and post post-test for both the experimental and control groups. The data generated will then be analyzed using appropriate statistical tools, data collected will be presented in a tabular form and responses will be calculated in percentages followed by detailed interpretation. Also, descriptive statistics such as mean and standard deviation will be used to analyze the research questions, while t-test will be used to test the four hypotheses at a 0.05 significant level. Any hypothesis that is greater than 5% ($p > 0.05$) will be rejected and any hypothesis that is less than 5% ($p < 0.05$) will be retained.

CHAPTER FOUR
DATA ANALYSIS, RESULT AND DISCUSSION

4.1 INTRODUCTION
This chapter contains data presentation, analysis, interpretation as well as discussion of findings. The order of presentation of data is in accordance with the research questions and hypotheses of the study.

4.2 DATA PRESENTATION, ANALYSIS AND INTERPRETATION
The data collected from Basic Science and Technology Achievement and Retention Test Instrument (BSTART) will be presented and analyzed using mean and standard deviation to answer research questions, while t-test will be used to test the hypotheses at a 0.05 level of significance.

Research Question 1
What is the difference in the mean academic achievement scores of the students in Basic Science and Technology before treatment?

Table 1: Mean achievement scores and Standard deviation of students' scores before treatment

Group	N	Mean	SD	Standard Mean Error
Experimental	30	2.92	2.12	0.3871
Control	30	3.12	2.64	0.4820
Mean Difference		0.20		

Table 1 shows that before treatment, the experimental group had a pretest mean score of 2.92 with a standard deviation of 2.12 while the control group had a pretest mean score of 3.12 with a standard deviation of 2.64. The mean scores difference of the two groups is 0.2 which implies that the groups were of close cognitive abilities before the treatment, since the mean difference of 0.2 was considered small and negligible. Therefore, there is no significant difference in the mean academic achievement scores of the students before treatment.

Research Question 2
What is the difference between the mean academic achievement scores of students taught basic science and technology using improvised instructional materials and those taught without improvised instructional materials?

Table 2: Mean achievement scores and Standard deviation of students' scores after treatment

Group	N	Mean	SD	Standard Mean Error
Experimental	30	14.27	2.86	0.5222
Control	30	7.41	3.02	0.5514
Mean Difference		6.86		

Table 2 shows that the mean achievement scores of students in experimental group is 14.27 with a standard deviation of 2.86 while the mean achievement scores of the students in control group are 7.41 with a standard deviation of 3.02. The mean difference between the two groups is 6.86 in favour of the experimental group. Thus, the experimental group achieved higher than the control group because the use of improvised instructional materials stimulated and encouraged the students to participate actively in the lessons.

Research Question 3
What is the difference between the mean academic achievement scores of male and female students taught basic science and technology using improvised instructional materials?

Table 3: Mean achievement scores and Standard deviation of male and female students' scores from the experimental group after treatment

Gender	N	Mean	SD	Standard Mean Error
Male	15	14.60	3.00	0.7756
Female	15	13.93	2.71	0.6997
Mean Difference		0.67		

Table 3 shows the mean achievement scores and a standard deviation of male and female students in the experimental group after treatment. The table reveals that the mean achievement score of the male students is 14.60 with a standard deviation of 3.00 while that of female students is 13.93 with standard deviation of 2.71. The mean difference between the two genders is 0.67 which is about 3% and it was considered negligible by the researcher. Therefore, there is no significant difference between the mean achievement scores of the male and female students in the experimental group after treatment. Hence, the effect of improvised instructional materials is not gender bias in academic achievement of basic science and technology students.

Research Question 4

What is the difference between the mean retention scores of students taught basic science and technology using improvised instructional materials and those taught without improvised instructional materials?

Table 4: Mean Retention scores and Standard deviation of students' post post-test scores

Group	N	Mean	SD	Standard Mean Error
Experimental	30	13.20	2.56	0.4674
Control	30	4.67	3.42	0.6244
Mean Difference		8.53		

Table 4 shows the mean retention scores and standard deviation of the students' scores. Form table 4, the experimental group had a mean retention score of 13.20 with a standard deviation of 2.56 while the control group had a mean retention score of 4.67 with standard deviation of 3.42. The mean difference between the two groups is 8.53 which is about 43% in favour of the experimental group. Therefore, the experimental group retained more knowledge than the control group.

4.3 VALIDATION OF HYPOTHESES

Hypothesis 1

Ho_1: There is no significant difference in the mean academic achievement scores of students in basic science and technology before treatment.

Table 5: t-test of students' mean achievement scores before treatment (Pretest scores)

Group	N	Mean	SD	df	$t_{calculated}$	$t_{critical}$	Decision
Experimental	30	2.92	2.12	58	0.3235	2.000	H_o
Control	30	3.12	2.64				Accepted

Table-5 shows the result of t-test of students' mean achievement scores before treatment at a 0.05 significant level. From the table, the calculated value of t is 0.3235 while the critical value of t is 2.000. This shows that the calculated value of this less than the critical value of t, hence, the null hypothesis which states that there is no significant difference in the mean academic achievement scores of students before treatment, is accepted. Therefore, the experimental and control groups were at the same cognitive level before treatment was administered to the two groups.

Hypothesis 2

Ho_2: There is no significant difference between the mean academic achievement scores of students taught basic science and technology using improvised instructional materials and those taught without improvised instructional materials.

Take 6: t-test of students' mean achievement scores after treatment (Post-test scores)

Group	N	Mean	SD	df	$t_{calculated}$	$t_{critical}$	Decision
Experimental	30	14.27	2.86	58	9.033	2.000	H_o
Control	30	7.41	3.02				Rejected

Table 6 shows the result of the t-test of the students' mean achievement scores after treatment at 0.05 significant level. From the table, the calculated value of t is 9.033 while the critical value of t is 2.000. This implies that the calculated value of t is higher than the critical value of t, hence, the null hypothesis which states that there is no significant difference between the mean academic achievement scores of students taught basic science and technology using improvised instructional materials and those taught without improvised instructional materials, is rejected. This indicates that there is significant difference between the mean academic achievement scores of students in experimental and control groups, when compared statistically. Thus, the experimental group that were exposed to treatment with improvised instructional materials, achieved better than the control group that were taught without improvised instructional materials.

Hypothesis 3

Ho_3: There is no significant difference between the mean academic achievement scores of male and female students taught basic science and technology with improvised instructional materials.

Table 7: t-test of the experimental group male and female students' mean achievement scores

Group	N	Mean	SD	df	$t_{calculated}$	$t_{critical}$	Decision
Male	15	14.60	3.00	28	0.642	2.048	H_o
Female	15	14.93	2.71				Accepted

Table 7 shows the result of t-test from the experimental group male and female students' mean achievement scores after treatment. From the table, the calculated value of t is 0.642 while the critical value of t is 2.048. This implies that the calculated value of t is less than the critical value of t, hence, the null hypothesis that states that there is no significant difference between the mean academic achievement scores of male and female students taught basic science and technology with improvised instructional materials, is accepted. Therefore, the experimental group male students achieved approximately the same as the experimental group female students. Thus, the use of improvised instructional materials in basic science and technology instruction is not gender bias.

Hypothesis 4

Ho_4: There is no significant difference between the mean retention scores of students taught basic science and technology using improvised instructional materials and those taught without improvised instructional materials.

Table 8: t-test of students' mean retention scores (Post Post-test scores)

Group	N	Mean	SD	df	$t_{calculated}$	$t_{critical}$	Decision
Experimental	30	13.20	2.56	58	10.936	2.000	H_o
Control	30	4.67	3.42				Rejected

Table 8 shows the result of t-test from students' mean retention scores from the post post-test. The table indicates that the calculated value of t is 10.936 while the critical value of t is 2.000; this means that the calculated value of t is higher than the critical value of t. Hence, the null hypothesis which states that there is no significant difference between the mean retention scores of students taught basic science and technology using improvised instructional materials and those taught without improvised instructional materials is rejected. Therefore, this indicates that students of the experimental group who were taught basic science and technology using improvised instructional materials retained knowledge more than the students in control group who were taught without improvised instructional materials.

4.4 DISCUSSION OF FINDINGS

Findings from research question one and hypothesis one using independent sample t-test revealed that there was no significant difference in the mean achievement scores of the two groups of students (Experimental and Control groups) before the treatment was administered. This connotes that the two groups were at the same level of cognition before the researcher administered the treatment. Therefore, the simple random technique used in sampling the students was effective and it created the validity grounds for subsequent results.

The research question two and hypothesis two revealed a significant difference in the achievement scores of students taught Basic Science and Technology with the use of improvised instructional materials when compared with those

taught without the use of improvised instructional materials. This indicates that students that were taught basic science and technology using improvised instructional materials instruction method achieved better than those taught without the improvised instructional materials. This is in agreement with the findings of Ada etal (2012); Salem (2011); Madjoub (2013); Keziah (2011); Basturk (2005); Robinson (2005); Akour (2006) and Orisebiyi (2007); who found and reported that there was significant difference in the performance of students taught with improvised instructional materials and those taught without it. Contrary to the above finding, the result is in contrast to the findings of Bayraktar (2008) who did not find any significant difference between the students exposed to improvised instructional materials and those exposed to lecture method of instruction. The reason for the enhanced achievement of the experimental group could be that the students were stimulated to learn by the use of improvised instructional materials instruction which spawned interest, excitement, total involvement in teaching-learning process, and encouraged the students to learn. The results of the study call for the adoption and development of appropriate instructional strategies like improvised instructional materials technique by developing instructional material packages to enhance meaningful teaching and learning in basic science and technology.

The third research question and hypothesis indicated that there was no significant difference in the mean achievement scores of the male and the female students in the experimental group after the administration of the treatment. This implied that the use of improvised instructional materials teaching strategy did not favour any gender. Therefore, from the findings of this study, the use of improvised instructional materials is not gender biased. This is in agreement with the findings of Mudasiru and Adedeji (2010), who found no significant difference in the performance of male and female students exposed to instructional material strategy. This is also in consonance with the findings of Ada etal (2012) and Salem (2011) who found no significant difference in the performance of male and female students exposed to treatment with instructional material package. Therefore, there is no gender imbalance in students' achievement when using improvised instructional materials in lesson delivery.

Findings from research question four and hypothesis four revealed that the students exposed to improvised instructional material instruction retained and retrieved basic science and technology concepts they learnt better than their counterparts in control group who were taught without using improvised instructional materials. This was shown by mean retention score of 13.20 for experimental group which is higher than that of 4.67 for control group. The t-test in Table-8 also indicated that the improvised instructional material method is a significant factor in students' retention abilities in basic science and technology. This was also shown by the rejection of the null hypothesis that “there is no significant difference between the mean retention scores of students exposed to instructional material-aided instruction and those taught without instructional materials”. It thus implies that instructional material-aided instruction is one of the valuable strategies of impacting basic science and technology concepts into the of students in Nigerian secondary schools. This was shown by the comparison of mean retention scores of the experimental group and control group. There was significant difference between the retention scores of students taught basic science and technology with improvised instructional material and those taught without instructional materials. This result is in agreement with the findings of Tabassum (2004); Gbodi and Laleye (2006); Orisebiyi (2007) who found significant difference in the retention scores of students taught with instructional materials and students taught without instructional materials. Also, the finding of Spence (2004) confirmed that the use of improvised instructional materials proved to be effective in enhancing students' retention. The results showed that instructional material-aided instruction can sustain students' interest.

Lastly, the result from Table 2 & 4 showed that students who performed well in achievement test also performed extremely well in retention test. This indicates that the use of instructional materials-aided instruction enabled the students to really understand the concept and thus, rote learning was discouraged. Conclusively, the use of instructional materials-aided instruction which enhanced students' achievement also enhanced better retention of facts, formulae, knowledge, theories, principles, and concepts. Furthermore, the use of improvised instructional materials will concurrently boost better achievement and retention in basic science and technology among secondary school students.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter contains the summary of the research study in the following sequence: conclusion, recommendations, limitations of the study and suggestions for further studies.

5.2 SUMMARY

This research study was conducted to investigate the effect of improvisation of instructional materials on the academic achievement and retention of junior secondary school students in basic science and technology in Jos North L.G.A. of Plateau state, Nigeria. The study was carried out with four research objectives, four research questions and four null hypotheses. The study adopted the use of quasi-experimental research and out of the two thousand nine hundred fifty (2,950) JSSII students in the area of study, sixty (60) students were sampled for the study, of which thirty (30) students were assigned for both the experimental and control groups respectively. Data for the study was collected through pre-test, treatment, post-test and post-post-test using a researcher-made instrument (Basic Science and Technology Achievement and Retention Test – BSTART), the BSTART instrument consists of 20 multiple-choice objective test items. Data collected were analyzed statistically through the use of descriptive and inferential statistics.

Based on the results of the analysis, the following findings were established:

i. It was found that students taught basic science and technology using improvised instructional materials, achieved higher in the achievement test than those taught without improvised instructional materials.
ii. Students taught basic science and technology using improvised instructional materials retained and retrieved basic science and technology concepts better than those taught without improvised instructional materials.
iii. There was no significant difference in the mean achievement scores of male and female students taught basic science and technology using improvised instructional materials.

5.3 CONCLUSION

Based on the findings of this research, it was concluded that the use of improvised instructional materials in basic science and technology instruction enhances the achievement and retention of junior secondary students. The improvisation of instructional materials did not favour one gender more than the other in terms of achievement and retention in basic science and technology. The male and female students in the experimental group had no significant difference in their achievement and retention tests. This means that the achievement and retention of basic science and technology students did not depend on gender but on cognitive abilities and the teaching strategy used by the teacher.

5.4 RECOMMENDATIONS

Based on findings from this study, it is recommended that:

1. Teachers should be trained and re-trained through workshops, seminars and conferences for the purpose of skill acquisition necessary for the improvisation and appropriate use of instructional materials by the teachers for lesson delivery.
2. The use of instructional materials which will motivate learners to pay more attention to the learning activities in schools should be encouraged and incorporated into the secondary school curriculum.
3. In respect to the findings of the study, teachers should be enlightened on the improvisation and use of appropriate instructional material as this will aid teaching and learning in schools.
4. Teachers should be adequately motivated to improvise and use instructional materials. This can be done by improving the condition of service for teachers and better remuneration for school administrators.

5.5 LIMITATIONS OF THE STUDY

The researcher encountered the following limitations in the course of the study:

1. The research study covered very few schools in the area of study due to limited time and financial constraints.
2. Difficulty in obtaining durable and affordable materials for the improvisation of instructional aides was another limitation encountered by the researcher.

5.6 SUGGESTIONS FOR FURTHER STUDIES

The following are suggestions for further:

1. Another research study should be carried out on the impact of teacher‘s quality on the production of instructional materials.
2. Research studies should be conducted on the Impact of locally produced instructional materials in curbing examination malpractice in secondary schools.

3. A study on the attitude of teachers and students towards improvisation of instructional materials should be carried out.
4. Another study should be conducted on the same topic in other parts of Plateau state so as to establish the validity of the findings from this study.

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