TITLE PAGE

USMANU DANFODIYO UNIVERSITY, SOKOTO
(POSTGRADUATE SCHOOL)

EFFECT OF AVAILABILITY AND UTILIZATION OF INSTRUCTIONAL RESOURCES ON STUDENT'S PERFORMANCE ON SCIENCE IN SENIOR SECONDARY SCHOOLS IN SOKOTO STATE, NIGERIA

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DEDICATION

This study is dedicated to my parents, my beloved wife and all other members of our family.

CERTIFICATION PAGE

This dissertation has met the requirements for the award of the Masters' Degree in Science Education (M.Ed) Science Education of the Usmanu Danfodiyo University, Sokoto and is approved for its contribution to knowledge.

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ABSTRACT

The study investigated the effect of availability and utilization of instructional resources on student's performance in science in senior secondary schools in Sokoto State. A descriptive survey research design was used. Forty seven (47) science teachers in seven (7) sampled schools were selected across six (6) Educational Zones in the state. A total of three hundred and thirteen (313) senior secondary school two (SSII) students were selected as sample out of one thousand six hundred and twenty eight (1628) students'. Three (3) instruments were used in collecting data which included Laboratory Facilities/Equipment Inventory for Physics, Chemistry and Biology, Assessment Observation Form on Utilization of Instructional Resources and Student's Science Performance Test. The instruments were found reliable and valid for collecting data. Five (5) research questions were developed, of which research questions 1 and 2 were answered using frequency count and simple percentage. The findings revealed that there are adequate instructional resources in senior secondary schools but the resources are inadequately utilized by the science teachers. T-test statistical tool was used for the analysis of three (3) hypotheses. All the null hypotheses tested were rejected and alternative hypotheses were accepted The study revealed that there was significant difference on the availability and utilization of instructional resources between schools with adequate and those with inadequate instructional resources on students performance in science. Based on the above findings, the researcher recommended that Ministry of Education and private school proprietors should make sure that laboratory equipment are supplied to the schools and the quantity should be supplied according to the number of students available in each school. It is also recommended that teachers should make the best use of the available instructional resources.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Science education imparts a method of inquiry and a systematic way of processing knowledge about the physical world to the learners. For this reason, science education provides part of the foundation for any knowledge-based effort to improve health, nutrition, family planning, environmental, agriculture, and industry.

Science education has two broad purposes. The first purpose is to promote scientific literacy among citizens on matters directly affecting their own lives and the society so that they can make decisions based on information and understanding. This is essential for the sustainable development of a modern, technological society. The second purpose is to build up technological capability by equipping the future workforce with essential science-based knowledge and skills, and by preparing students for scientific disciplines in higher education and science-related careers. Given the potential benefits, the provision of quality science education to all children will have far reaching consequences on a country's development prospect.

Practical activities in science education are regarded as one of the necessary elements to promote understanding of scientific principles. To accomplish this goal, the equipment and experiment have to be carefully selected to give students the relevant experiences that they may need. The understanding is enhanced if the examples are coming from the daily life of the students.

Provision of relevant equipment is a necessary, but not sufficient condition for successful science teaching. Other factors such as pre-service and in-service teacher training, technical and educational suitability of equipment, distribution, maintenance and supply of consumable instructional materials influence the quality of practical activities.

Science teaching and learning requires the intensive application of resources that would appeal to all the senses of perception to improve the effectiveness of instruction as well as maximize learning. Ige, (2000) stated that science teaching and learning can only be meaningful and effective if backed up by the necessary resources to enrich instruction. Other researchers have revealed that resources are potent tools, which could be used to effectively communicate science, while enriching the learning experiences of the learners (Ango 2002, & Ngoka, 2000).

School environment has been described as an organization where resources are produced, managed and organized in such a way that enables the students to acquire desirable learning competencies. The process of managing and organizing resources is called resource utilization. The utilization of resources brings about fruitful learning since it stimulates senses as well as motivating them. Denyer (2005) in his study on science games in the United Kingdom reported that games when used as a resource enable less able children to stay on task and remain motivated for longer period.

The instructional resource brings desired improvement in teaching and learning processes by making it effective to the maximum, for cognitive, affective and psychomotor aspects of the learners. It also makes the classroom teaching easy, clear, interesting and scientific. But unfortunately these resources are not available in many secondary schools and those schools where they are available; the teachers are not interested in proper utilization of the available resources (Adetayo 2008). It is presumed that availability and proper utilization of instruction resource materials improved the performance and the output of the educational institutions. This is the reason why science teaching can only be effective when adequate and relevant instructional resources are used (Afolabi, Adeyanju, Adedapo & Falade, 2006).

Akpochafo (2003) defined resources to include "man, machine, students, materials, brains and money" which are to be planned, organized, directed, controlled and coordinated to achieve better teaching. While Achimugu (2005) categorized instructional resources into two categories- Human and Non human. He referred human resources as human beings who directly or indirectly contribute to the achievement of STM educational objectives. These include; the learner/student, laboratory technicians/assistants and the teachers. While non human instructional resources includes pictures, maps, charts, graphs, diagrams, chalkboard, sketches, atlas and painting, textbooks, encyclopedias, magazines, journals, newspapers, etc.

According to Adedayo (2000), and Afolabi (2006) resources for teaching and learning science are not available in most of the secondary schools in Nigeria. Nakashima (2000) reported that, where the materials are available, selection and organization becomes a problem.

There are persisting problems of unqualified and inexperience science teachers and lack of proper funding of schools and improper motivation of teachers by the government. This may probably have contributed to the poor performance of teachers in the discharge of their duties. It has therefore become necessary to find out the effect of the availability and utilization of instructional resources on secondary school students performance in science in Sokoto state.

The main goals of science education are to develop understanding of scientific principles by applying method of scientific inquiry, prepare students to make responsible decision concerning science related issues and inform students about possible science careers (Bybee, Carlson Powell & Trownbridge, 2007). To reach these goals, different learning environment, teaching approaches and methods are important factors to consider. In many studies, attitudes have been found to play an important role in learning such as enjoyment of science, belief on the utility of science and self esteem at science are factors that influence students academic performance.

Many research reports attributed poor performance of students in science to one of the following-

1. Untrained teachers are employed to teach
2. Lack of laboratories in schools.
3. Inadequacy of instructional resources or
4. Lack of knowledge and skills of using instructional resources while teaching etc..

The researcher believe that when adequate instructional resources are supplied to schools and the teachers have the knowledge and skills of selecting and using the appropriate instructional resources during teaching and learning process, the student's academic performance will be enhanced. This is because teaching and learning science is a practical course requires the use of laboratory and equipment, therefore when learner come face to face with the teacher through the proper use of instructional resources the lesson is always effective. The abstract concepts will be clear to the students, the lesson will be interesting and meaningful at the same time students will retain what they have learnt. These would influence student's academic performance positively (Anene, 2002). Also Ugwo (2005), stressing on the problems of effective utilization of instructional resources reported that untrained teachers are employed to teach in our secondary schools and colleges and due to insufficient training, many teachers do not recognize the potential of many simple teaching aids available or how to use them. This may cause poor performance of students in science, because students will not be able to acquire the necessary skills and attitude expected of them and also causes students having negative attitude toward science.

School science laboratory is considered a very important resource for science teaching. This is because the ultimate goal of any instructional activity includes the use of laboratory in order to facilitate effective teaching and meaningful learning through practicals. Therefore, laboratory is a paramount importance for proper translation and implementation of educational policies, curriculum, instructional resources and assessment of school outcomes. To this end, it has been a major reason why science curriculum objectives cannot be achieved unless and until practical activities are carried out in science teaching and learning. This is in line with the findings of Kamar (2007) who stated that, at its early days, the laboratory was used mainly to demonstrate or confirm some previously learnt information. With the shift of emphasis on science education from the acquisition of knowledge to the development of inquiry skills, however, this earlier accepted role of the laboratory in science teaching and learning was challenge and effectiveness of laboratory activities questioned. He asserted that laboratory is now regarded as the core of the science teaching and learning process inquiry oriented activities that enable students to learn the accepted body of knowledge. Indeed, laboratory helps students to carryout practical work, in using their mind and hands.

Practical work is the backbone of effective science teaching and learning. Alebiosu, (2003) emphasized that scientific enterprise is an activity packed one, involving continuous exploration and verification of facts, which is in line with the findings of Ogunkola and Olatoye, (2004) who opined that practical work should be based on investigations, which pupils plan and carry out. He further pointed out three elements of investigation as: (1) asking questions, predicting and hypothesizing, (2) observing, measuring and manipulating variables and (3) interpreting results and evaluating scientific evidences. Hence practical work in science, promote long term memory in students, enhances pupil development of the ethical dimension of science, instill the spirit of collaboration and active participation among learners, exposes learners to scientific experiences that could ultimately help them in developing scientific skills and attitudes, inculcate in the students the spirit of inquiry and scientific mode of thinking (Ogunkola & Olatoye, 2004).

Every school which runs a science laboratory is expected to set up an active committee which should manage the science laboratory effectively. The laboratory requires a competent personnel which included the laboratory technologists/technicians/assistant etc for the management and organization of laboratory effectively.

The functions of laboratory technologists/attendants are as follows:

1. Keeping benches and laboratory clean and tidy: cleaning and drying glass-wire, cleaning out the sink and drainage systems, and emptying main waste boxes daily.
2. Drafting orders for chemicals and apparatus. Checking supplies as they arrive
3. Oiling benches with linseed oil and turpentine or polishing benches.
4. Preparation of stock solutions for reagent bottles and standard solutions.
5. Keeping reagent bottles clean and setting up apparatus for demonstration and class experiments..
6. Replacing loosed or damaged levels on shelves, cardboards, and bottles and covering levels with burnish or wax.
7. Keeping of reagent bottles and chemicals in their correct places, periodic cleaning of metal stands, balance-fans, tungs, painting of retort etc.

8. Keeping the first aid box replenished and keeping record of accidents and treatment.
9. Assisting with visual aid preparation such as charts, diagrams etc and projection of film strips of films.
10. Looking after plants and the animals in the laboratory.
11. Ensuring all Bunsen turners are turned out, electricity and gas turned off and water tap left dropping.
12. Assist in duplicating of materials

According to Agwu (2002) Improvisation is the making or inventing of a piece of science teaching equipment in emergency. It is an essential part of laboratory management for the purpose of maximizing the use of the available resources.

Improvisation is describable in the following instances:

1. When the improvised material would improve the lesson effectiveness.
2. When the locally available materials are available for use.
3. When the improvised materials would serve the same function as the standardized one.

1.2 Statement of the Problem

Over the years, secondary school teachers attributed poor performance of students to non-availability of instructional resources for effective science teaching (Ivowi, 2000). The summary of the West African Examination Council (Waec) result for five (5) years (2009 – 2013) of the sampled schools indicated poor performance of students in physics, chemistry and biology (see appendix 10.). There are varieties of resources which the science teacher can use to enrich learning. These resources should be provided in quality and quantity in the classroom for effective teaching-learning process (Umeoduagu, 2000). Furthermore, research reports have shown that these materials are grossly unavailable in most schools. Few available ones are either inadequate or underutilized (Achimugu, 2005; Okebukola and Jegede, 2002). Teaching and learning could not be effective without adequate and relevant use of instructional resource materials (Grant, 2000). The instructional resources assist students in acquiring clear concept of subject matter, but the unavailability of instructional resources in teaching/learning science may lead to poor performance in science by school children. This is the reason why many teachers cite the unavailability of instructional resources in their schools as reason for not teaching the subject practically. The unavailability of instructional resources in most Nigerian schools have made science teachers not demonstrating phenomena let alone allow pupils to have the opportunity of finding out things for themselves (Ayodele,2000).

It has been noticed that less emphasis is placed on the provision and utilization of instructional resources for teaching and learning science in most secondary schools in Sokoto State. There is the problem of inadequate instructional resources in most of the secondary schools and also there is lack of knowledge and manipulative skills by most of the teachers on how to utilize instructional resources during teaching. These made the subjects very difficult to learn and also causes poor performance in science by the school children The main thrust of this study is to investigate effect of availability and utilization of instructional resources on student’s performance on science in senior secondary schools in Sokoto State.

1.3 Objectives of the Study

The objectives of this study are to:

i. find out the level of availability of instructional resources in senior secondary schools in Sokoto State?

ii. find out the degree to which science teachers utilize the available instructional resources in senior secondary schools in Sokoto State?

iii. find out the difference in the availability and utilization of instructional resources between the schools with and those without available instructional resources on student's performance in science in senior secondary schools in Sokoto State?

iv. find out the differences in the availability and utilization of instructional resources on student's performance in science between male and female public senior secondary schools in Sokoto State?

v. find out the differences in the availability and utilization of instructional resources on student's performance in science between public and private senior secondary schools in Sokoto State?

1.4 Research Questions

This study investigated the following research questions:

i. At what level are instructional resources available in Senior Secondary Schools in Sokoto State?

ii. To what degree science teachers utilize the available instructional resources in senior secondary schools in Sokoto State?

iii. Is there any difference in the availability and utilization of instructional resources between schools with and without adequate instructional resources on student's performance in science?

iv. Is there any difference in the availability and utilization of instructional resources on student's performance in science between male and female students in public senior secondary schools in Sokoto State?

v. Is there any difference in the availability and utilization of instructional resources on student's performance in science between public and private senior secondary schools in Sokoto State?

1.5 Null Hypotheses

The following null hypotheses were tested in this study:

1. There is no significant difference in the availability and utilization of instructional resources between schools with and without adequate instructional resources on student's performance in science.

2. There is no significant difference in the availability and utilization of instructional resources on student's performance in science between male and female public senior secondary schools.

3. There is no significant difference in the availability and utilization of instructional resources on student's performance in science between public and private senior secondary schools.

1.6 Significance of the Study

This study is of great significance to the teachers, students, curriculum planners, educational system and the society at large in so many respects which includes:

i. The study would help enhance teachers' teaching effectiveness and productivity. This is in line with assertion of Ekwueme and Igwe (2001) who noted that it is only the teachers who will guarantee effective and adequate usage of instructional materials and thereby facilitate success. Consequently a teacher who makes use of appropriate instructional materials to supplement his teaching will help enhance students' innovative and creative thinking as well as help them become plausibly spontaneous and enthusiastic. Oremeji (2002) supportively asserts that any teacher who takes advantage of these resources and learns how to use them correctly will find that they make almost an incalculable contribution to instruction. He further says that instructional materials are of high value in importing information, clarifying difficult and abstract concepts, stimulating thought, sharpening observation, creating interest and satisfying individual difference.

ii. To the students, the effective use of instructional materials would enable them to effectively learn and retain what they have learnt and thereby advancing their performance in the subject in question. This is because according to Nwadinigwe (2000), learning is a process through which knowledge, skills, habits, facts, ideas and principles are acquired, retained and utilized; and the only means of achieving this is through the use of instructional materials.

iii. The study is also significant to the educational system and society at large. This is because when teachers solidify their teaching with instructional materials and the learners learn effectively, the knowledge acquired will reflect in the society positively.

iv. The study helps examination bodies such as WAEC and NECO to understand that:

(a) Most of the Senior Secondary Schools have inadequate instructional resources for practical lessons. So, less emphasis should be given on topics with insufficient instructional resources when setting examination questions.

(b) It would enable the examination bodies to set practical questions on alternative basis.

v. The study helps the curriculum planners to know that the curriculum is not being implemented effectively and efficiently. The planners should endeavour to ensure that the teaching students receive is appropriate to their needs.

vi. The study is also significant to science based organizations such as Science Teachers Association of Nigeria (STAN) and Mathematics Association of Nigeria (MAN). As it would enable them to organize seminars and workshops in collaboration with the Ministry of Education Inspectorate Department on the need to supply sufficient laboratory equipment as well as their utilization by science teachers.

1.7 Scope and Delimitations of the Study

This study is focused to determine the effect of the availability and utilization of instructional resources on student's performance in science in senior secondary schools in Sokoto State. The study involves all SS2 students, science teachers, Laboratory facilities and the supply and utilization of instructional materials in Sokoto State Secondary Schools.

1.8 Operational Definition of Key Terms

The relevant terms below were operationally defined relative to their usage in this study.

- **Effect:** This is the change (outcome) that is brought about in a person (s) or something by another person (s) or thing; that is the way in which an event, action or person changes someone or something.
- **Performance**: This is regarded as the display of knowledge attained or skills, shown in the school subjects such achievements are indicated by test scores or by marks assigned by teachers. It is the school evaluation of students' classroom work as quantified on the basis of marks or grades.
- **Utilization:** The act of using something to achieve a purpose
- **Instructional Material:** What the teacher uses to make the lesson more interesting and understandable.
- **Availability:** Something that is ready to be used at any given time.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter presents a review of available literature relevant to this work. Specifically, the review focused on the following areas:-

1. Conceptual Framework
2. Kinds and Categories of Instructional Resources
3. Utilization of Instructional Materials for Science Teaching and Learning
4. Library as Resources for Learning Science
5. School and Industry Linkages as a Resource for Science Teaching and Learning
6. Improvisation with Local Material as Resource in Teaching and Learning of Science
7. Instructional Materials and the Teaching and Learning Process
8. Instructional Materials and Academic Performance of Students
9. Gender and Academic Achievement of Students
10. Summary of the Review and Uniqueness of the Study

2.2 Conceptual Framework

Instructional resources are very vital tools in education. They aid teaching and learning, they include everything that provides information to the teacher as well as the learner. Azikiwe (2003), Explains that instructional resources include all forms of information that are used to promote, encourage and enhance teaching and learning activities with regards to education.

Instructional materials according to Ajelabi (2000) are teaching-learning materials that constitute an integral component of classroom instructions which are utilized in dealing out educational information to the learner. He further notes that it makes the lesson real, concrete and effective as learners are motivated to learn at their own pace, rate and convenience. According to him, our perception and understanding of our environment vary as follows:

- 75% of all information perceived is absorbed by the eye
- 15% is absorbed by the ear
- 10% is equally distributed among the remaining senses- touch, smell and taste.

Also, a Chinese dictum articulates the above words of Ajelabi (2000) thus:

- What I hear I forget
- What I see I remember
- What I do I understand?

Mutebi and Matora (2000) also emphasized the effect of instructional materials utilization on teaching and learning. According to them, we learn and remember 10% of what we hear 40% of what we discuss with others and as high as 80% of what we experience directly or practice. This indicated that students learning could be enhanced effectively by the use of instructional materials.

Instructional materials are employed to widen the scope of understanding in teaching-learning encounter (Onyejemezi, 2002). In conclusion, Onyejemezi listed seven benefits of Instructional materials as follows:

- It supplies concrete basis for conceptual thinking and reduce meaningless response of student.

- It makes lesson more permanent.
- It has a high degree of interest since they are shown physically to aid self-understanding and explanation.
- It offers reality to experience.
- It contributes to the depth and variety of learning.
- It gives readymade answers to questions in the teaching-learning process.
- It adds meaning and explicitness in the teaching-learning process.

Maduekwe (2000) supports Onyejemezi (2002) when he says that the use of instructional materials discourage rote learning. Furthermore, Oremeji (2002) asserts that instructional information materials are of high value in imparting information, clarifying difficult and abstract concepts, stimulating thoughts, sharpening observation, creating interest and satisfying individual difference. All in all, the use of instructional resources cannot be over –emphasized as it forms the integral component of classroom teaching.

Aina (2007) asserts that instructional materials are those materials or resources used in any teaching exercise to promote greater understanding of the learning experience. According to her, they are used to provide the richest possible learning environment which helps the teacher and learners to achieve specific objectives. They also assist the teachers to communicate more effectively and the learners learn more meaningfully and permanently. The same is amplified by Fabiyi (2008) who describes teaching materials as anything that helps the teacher to promote teaching and learning activities.

Sharing the above view, Sifakis (2007) defines teaching aids as things which are intended to help the teacher to teach more effectively or better still which enables the pupils to learn more easily. In the opinion of Ajelabi (2000) and Akinlaye (2003) many educational technologist see instructional materials as devices and resources used in learning situation to supplement written or spoken words in the transmission of knowledge, attitude, ideas or concept and values. Akinlaye (2003) further states that instructional materials have been defined as things or objects brought into play to emphasize, clarify, strengthen, vitalize the teachers instruction. Ajelabi (2000) subtly puts instructional materials as teaching-learning materials that constitute an integral component of classroom instructional process which are utilized in delivering educational information to the learner. He further states that it makes lesson real, concrete and effective. Learners are motivated to learn at their own pace, rate and convenience.

Maduabum (2001) defines resources as equipment and materials, which the teacher can use to help in the achievement of lesson objectives. Dogara and Ahmadu (2000) also referred to resources as anything that helps to bring about success in the classroom. Resources can also be defined as all those sources of help, which may be utilized by an individual or a student for the purpose of achieving the goals of learning. Osiyale (2000), sees resources as all persons and things capable of conveying information, values, processes, experiences and techniques that can be used to actively engage the students in the learning process.

There are various resources that can be used for science teaching. Some of these are;

- Physical resources such as school building, classrooms, school plants, laboratories, libraries, etc.
- Human resources such as teachers, students and supporting staff

- Material resources such as laboratory equipment and chemicals, teaching aids, bulletin board, etc.
- Time resources such as number of periods per week, duration of lesson, school calendar, etc.
- Environmental resources such as items in the locality, household appliances, teaching or storage spaces, industrial resources, etc.
- External resource persons such as carpenters, mechanics, etc.
- Technological resources such as computers, radio/television, projectors, etc.
- Instructional materials such as textbooks, teacher's guides, exercise books, etc.

Today, we are not unaware of the inadequacies of the provision, usage, availability and management of these resources in schools. However, for learning to be effective, the optimal utilization of these resources is of great importance for teaching and learning science subjects.

A global change in science curriculum arising from knowledge explosion and its new wave in science and technological development demands for qualitative science teaching (Eule and Chukwu, 2000). The change calls for the provision and utilization of resources, which tend to enhance the effective teaching and learning of science.

Achimugu (2005) classified resources as human and material resources. Whereas human resources are human beings who directly or indirectly contribute to the achievement of science, technology and mathematics objectives which include the learner or student, laboratory technician and the teacher. Material resources are instructional facilities that are used to ensure effective teaching and learning such as the classroom, laboratories, equipment/supplies, textual materials. The writer is of the view that the utilization of the available instructional resources to facilitate effective teaching and learning of science by the secondary school teachers should be a welcome development. This is in conformity with Okebukola (2002) who asserts that science teachers should work beyond stereotyped science teaching process and utilize the available human and natural resources in the environment to facilitate science teaching and learning process.

The instructional materials possess some inherent advantages that make them unique in teaching. For one thing, they provide the teacher with interesting and compelling platforms for conveying information since they motivate learners to learn more and more. Also by providing opportunities for private study and references, the learner's interest and curiosity are increasingly stimulated. Further, the teacher is assisted in overcoming physical difficulties that could have hindered his effective presentation of a given topic. They generally make teaching and learning easier and less stressful. They are equally indispensable catalysts of social and intellectual development of the learners.

Bolick (2003) pointed to a good relationship between effective teaching and using of instructional materials. He argued that "while some educators have been fascinated by the potential of instructional materials to enhance teaching and learning, teachers lagged behind in using instructional materials during teaching and learning. Others expressed doubts that instructional materials will ever incite teaching reform in social studies for example". Therefore, instructional materials are integral components of teaching-learning situation; it is not just to supplement learning but to complement its process. It then shows that, if there must be an effective teaching and learning activity, utilization of instructional materials will be necessary.

Ema and Ajayi, (2004) asserts that “teaching equipment and materials have changed over the years, not only to facilitate teaching and learning situation but also to address the instructional needs of individuals and groups”. Instructional materials are made up of objects such as printed, audio, visual that aids in the successful delivery of lesson). To this end, instructional materials are said to be objects or things the teacher can use in the classroom while teaching in order to ease off his teaching activities. However, instructional materials cannot address all the teaching and learning problems but it can go a long way in solving them, simply because, they are additional apparatus that can influence the reality of teaching and learning activities.

Also, Onwuakpa and Akpan (1999) reported that teachers in our schools are half baked and square pegs in round holes. Studies such as Akpoklere (2004) have attributed poor quality of education, low performance and poor skill acquisition to unavailability of human and material resources such as qualified teachers, laboratories and equipment. The teaching and learning of science which is a practical course requires the use of laboratories and equipment. Science teachers trained without adequate exposure to activities and experiments cannot be efficient science teachers. For instance, Akano (2005) opine that the exposure of students to laboratory activities and experiments is the hall mark of science education and in fact the future of education in a science discipline both for skill acquisition, understanding of the basic principles and application of science. There is no gainsaying that curriculum without human and material resources back-up would fail to produce the desired result. In other words, adequate human and material resources must be provided in order for the curricular to be translated into meaningful result. However, the present state of infrastructure in the technical institutions leaves more to be desired. There are inadequate number of laboratories, workshops and classrooms to support even the basic core programmes of many technical colleges and secondary schools.

Several science educators and scholars have shown that it is an indisputable fact that resources for teaching and learning of science in Nigerian schools are very much in short supply (Okebukola and Jegede, 2000). Resources could be grouped into human and material resources Achimugu (2005), which can equally be categorized into school based resources and community based resources (Ajayalemi, 2000)

2.2.1 School Based Resources

Cirfat (2000), stated that the school environment is part of the resources. It is described as an organization where resources are produced, managed and organized in such a way that enable the students to acquire desirable learning competencies. School based resources could be teachers, technical staff, classrooms, laboratories, library, etc. the resources are mostly provided by the government, community or proprietors of the school.

2.2.2 Community Based Resources

Uche and Umoren (2001) noted that science is rigorous but exciting; it will take a hardworking and resourceful teacher to integrate the various community resources into science teaching to make learning exciting and rewarding.

Community resources are cheap and easy to obtain because members of the community and organizations will be eager and willing to render services to their community schools. Community resources includes persons of the community with specialized knowledge or expertise e.g. doctors, microbiologists, nurses, agriculturalists, gold smiths, carpenters, bankers, scientists, ophthalmologists, etc. Use of resource persons for instance is employed for topics that require special treatment. For instance, a doctor or nurse invited to teach public health as a topic in biology, an engineer or physicist invited to teach machines in physics, etc. visits to industries help students to know the link between industrial establishments and the school and also in their career choices. Their exposure to the world of work in various industries and establishments is necessary for a balanced academic growth.

The use of community resources for teaching science will help to bridge the gap between within school and out of school experiences. The science learnt in school should be made relevant to the life of students outside the school (e.g. homes, workplaces, market places, etc.) and must be applied to real life situations to solve environmental and community problems.

2.2.3 Human Resources

Human resource is one of the resources that have to be mobilized and deployed by an organization to attain its goals. It is significant, because this is the only resource that can manipulate all the resources to make them productive. Plant, equipment and tools have to be operated by persons. Money and materials will be useless to any organization if there are no persons to make them work for the organization. It is for this reason that great importance has to be accorded to management of human resources in an organization.

At the secondary school level, a teacher is perhaps the most important in which he must be qualified and knowledgeable enough to utilize the available instructional resources in order to make teaching and learning of science effective and efficient. Others include administrative staff such as principal, head of departments, school bursar, etc. who are responsible in making sure that adequate resources are provided to the teacher for effective instructional delivery.

Without human resources teaching and learning will not take place effectively. On the other hand, a teacher can only achieve his objectives in science teaching if enough resources are available to him. More importantly in science teaching we need teaching resources that will ensure that the learner is exposed to learning experience that ensures the cultivation of scientific spirit.

2.3 Kinds and Categories of Instructional Resources

According to Medayese (2000) different types and variety of instructional materials are available to be used in teaching any subject effectively. However, it is not all topics that require the same type and quantity of materials. These materials could be purchased, locally made or improvised, imported from other countries when necessary for the effective instructional delivery.

Adekeye (2008) summarized instructional materials available for instruction into four major categories:

a. **Visual Aids:** These include pictures, maps, charts, graphs, diagrams, chalkboard, sketches, atlas and painting.

b. **Audio Visual Aids:** Such as television, computer programmes, film trips, video recording and projectors.

c. **Auditory Aids:** These include audio recordings, radios, records or cassette tapes, music.

d. **Printed Materials:** These include encyclopedias, textbooks, magazines, journals, newspapers, pamphlets, novel poems, simulation games, government records and publications almanacs, biographic, editorial cartoons and case studies.

Notable criteria abound in literature on the taxonomical basis of instructional media. Such criteria for classifying instructional materials or teaching aids include the degree of expertise/technical skills needed for production, nature of materials, physiological parameter or sensory modality, whether or not projection is involved, place the material is produced, and miscellaneous characteristics. In terms of degree of expertise, we have high technology materials such as computers, television, internet, etc. and low technology materials such as pictures, globes, printed (such as textbooks), and non printed materials such as radio. On the basis of physiological parameters, we consider the particular sensory modality of the learner, and thus classify instructional materials into auditory, visual, audio-visual, tactile, olfactory, and kinesthetic materials.

Visual materials appeal to the sense of vision (the eye), such as still pictures. Auditory materials appeal to the sense of hearing (the ears), such as radio. While audio-visual materials appeal to both senses of hearing and vision, such as the television. Tactile materials appeal to the sense of touching (the skin), such as the Braille, while olfactory materials appeal to the sense of smell (the nose), such as some chemical specimen. Gustatory materials involve the sense of taste (the tongue), such as sample food, while kinesthetic materials involve sense of muscular coordination (the muscles) with game materials, such as football as the media example.

In view of this, the kinds and categories of instructional materials/teaching aids used in effective delivery of instructions can be summarized under the following categories:

1. Projected and electronic materials
2. Non-projected materials
3. Phenomenal and manipulative materials

2.3.1 Projected and Electronic Materials

Projected and electronic materials are forms of media which could be visual, audio and audio-visual in nature that requires projection and electricity in their using process for teaching and learning situation. Projected and electronic media can further categorize into: film/film projectors, video cassette/video disc machines, tape recorders/recordings, radio, slide projectors, overhead transparencies/overhead projectors opaque projectors (Episcope) and computer instructional system.

The computer has now been found to be the most suitable, and versatile medium for individualized learning because of its immense capacity as a data processor, using for different games for the children. And can perform numerous mathematical and logical operations without any intervention by men. Computer as an instructional material is used in many ways for effective instructional delivery, such as mass instruction, group learning, individualized instruction, and computer conferencing system among others. Olulube (2006) acknowledge three broad ways by which computer contributed to teaching and learning situations. And these are mass instruction individualized instruction and group learning.

The computer technology has made it possible for teachers and students to avail themselves of internet facilities. Websites abound where instructors and learners can visit in order to obtain needed information. Efficient teachers of higher learning have effectively impacted their students by referring them to designated websites where they receive instructions. Many libraries are now going on-line with the effect that learners and researchers can visit them electronically by means of computers instead of having to go physically to such centers. This is highly innovative.

2.3.2 Non Projected Materials

Anyanwu (2003) assert that, non-projected materials are those materials that do not require any form of projection before they can be utilized. Non projected materials are different forms of instructional materials that did not require process of projection before its operation can take place. This could include the following, textual and non-textual, chalkboard, magnetic board/soft board, flip-chart, specimen, model, etc. Textual materials and non-textual materials refer respectively to all the print and non –print materials that are used by the teachers and learners for instructional process. The print materials are the textbooks, magazines, periodicals, journals, and newspapers, among others while the non-print materials includes charts, chalkboard, radio television, films, video tapes, audio tapes, festivals and games. He further expressed that together they assist the students in acquiring clear concepts of subject matter they are also students' best single academic friends. Moreover they can provide security for the unprepared teacher and an escape hatch for one who is instructing outside his field of specialization.

2.3.3 Phenomenal and Manipulative Materials

Phenomenal according to Uche and Umoren (2001) are instructional media like features, things, events, festivals, settings and other community resources which the learner grasp at their natural or semi natural habitat. They enable the learner to have direct contact with learning experiences that will far out-weigh weeks or months of copied notes and rote learning. Despite the fact, of these positive ends, field trips and schools journeys that normally bring learners into contact with the phenomenal are underutilized because of time, finance, knowledge of the teacher, inflexibility of the school timetable and other infrastructural problems. Effective teachers are expected to explore and widely utilize the phenomenal because these can stimulate aesthetic talents, promote, tactile stimulus and enhances identification and attachment not only with nature but also with the particular learning situation that they facilitate socialization process. These classes of instructional materials deal mostly with the effective domain but do not preclude the psychomotor and the cognitive domains.

Advantages of Using Phenomenal Resources for Science Teaching

The use of phenomenal resources for teaching science will:

- Enable students to learn faster because of exposure to real life situations.
- Promotes co-operation and better understanding between the school and the community.
- Give students first hand and on the spot experience of the phenomenon which cannot be transferred into the classroom.
- Promote retention of what is learnt because of the opportunity to interact with people, real life object, things and situations.
- Help students to identify and pursue careers of interest as they interact or come in contact with specialist and establishments.
- Promote development of science process skills and scientific attitudes.
- Initiate and strengthen inter-personal relationships between the students and their teachers and even among students themselves.
- Afford opportunity to explore and learn more about the environment.

However, the use of phenomenal resources is limited because it is time-consuming. A lot of time is needed to plan and execute the activities and that may probably be why many science teachers shy away from it.

Manipulative materials are instructional materials that the learner actually handle skillfully, deal with, and manage expertly to bring about the desired behavioral changes. They are important for the development of skill in professional training (Ololube, 2007). They promote complete mastery of the content materials and the specific objectives. They also form part of both the instructional and performance evaluation. The greatest significant of these materials is that, without them neither the required learning nor objectives evaluation can be adhere. Manipulative materials express the channel through which the required learning takes place. They cut across all aspects of skills development and mastery learning. These materials are vital for effective instructional delivery because such skills as communication, tolerance, patience, and assertiveness are easily demonstrated, learnt and observed through instructional games. They are embedded in card and board games that have specific instructional values in order to enhance basic and logical reasoning among learners.

2.3.4 Selection of Instructional Materials

There are many instructional materials from various sources. It is therefore very important for science teachers to note and bear in mind that every instructional material has its definite unique strength in teaching and learning situation. It is also necessary to note that through effective communication, better teaching and faster learning can only be facilitated or guaranteed by careful selection and skillful utilization of appropriate instructional materials by the users. However, availability of the instructional materials, teachers experience, terms of preference and the volume of instructions should constitute intrinsic consideration in their selection decision. The following principles should guide an effective science teaching and learning in the selection of instructional materials:

i. **Instructional Tasks:** The behavioral objectives, contents, learning activities, evaluation instruments and techniques as element of instructional tasks, should be taken into cognizance by an effective teacher in the selection and development of instructional materials.

ii. **Target Audience Attributes:** These consists the learners features and their level of understanding, their developmental stages such as age, sex, physical skills, attitude towards self and others, the learners experiences, socio-economic background should be considered.

iii. **The Economy:** The available resources, financial factors, technological advancement, economic climate of the society where the materials should be operated, the socio-cultural level of the materials users, degree of urbanization, feasibility and acceptability of the selected instructional materials are equally considered in the selection and development decision.

iv. **Dynamic Variables:** These variables constitute the concentration and size of the target audience, the desired level of learners response and participation, the classroom social climate, sitting, viewing and listening arrangement, available time, space, teacher competence among others are to be seriously considered in the selection, decision and development.

v. **The Environmental Factor:** These consists the educational community and the available educational infrastructure. Such as people, facilities, equipped library, workshops, laboratories, electricity, water supply and personnel should equally be considered in the selection and development.

Bozimo (2002) also posited the following criteria in the selection of instructional materials:

i. Appropriateness of the materials to instructional objectives.

ii. Freedom of the content from bias

iii. Degree of the quality variety of the materials

iv. Quality of the format, print, sound or photography

v. Availability of the materials to clarify objectives of and how to operate the materials.

vi. How reasonable the time, effort and expenses are for both the students and the teachers.

2.4 Utilization of Instructional Materials for Science Teaching and Learning

According to Offorma (2002), instructional materials include those that facilitate teaching and learning activities and consequently the attainment of the lesson objectives. Therefore, one can rightly say that instructional materials are the materials, which the teacher uses in teaching in order to make his teaching real and meaningful.

The use of instruction materials depend on what the teacher makes of them (Onyejemezi, 2002). By implication, instructional materials do not achieve any of the attributed values on their own rather, their usefulness depends on what the teacher makes of them. If the science teacher does not have the knowledge and manipulative skills of using these instructional materials in teaching, the learner will definitely find it difficult to learn. A good science teacher should possess the skill of designing, developing and utilization of instructional materials to bring meaning to the door posts of the learners. When learners come face to face with the teacher through the proper use of instructional materials the lesson is always effective. Most of the instructional materials are available in schools, homes, markets, information centers, libraries and even on the road. For a school to conduct an effective teaching and learning of science, laboratory equipment and resource materials must be available for the science teacher who himself must be professionally competent in coordinating the functions of these materials.

Research has shown that learning is facilitated significantly by the use of instructional materials provided that the conditions of learning are identified, the objectives well stated, the abilities of the students are matched with the instructional functions of the materials (Miyake, A. Friedman, N.P. & Emerson, M.J. 2000). Anyanwu (2003) identify three ways by which the teacher should prepare for the use of instructional materials, these are; by previewing before they brought to the class, the teacher has to have a first knowledge by using it him/her self before the class. First knowledge – the teacher should have a full knowledge of the parts, names operational level of the intended instructional materials and actual presentation – this is the period the teacher operates and uses these materials in instructing the children.

The following however, are the basic guidelines and requirement for utilization and use of instructional materials in effective instructional delivery.

i. **Specification of Objectives:** Clear objectives which are behaviorally stated are user ring guides in instructional materials using process; they direct the sequence, methods, content and techniques of instructional processes. They provide scientific basis of valid evaluation instruments construction and administration.

ii. **Maximal Fit with Instructional Tasks:** Instructional materials must be appropriate to be situationally determined and individually responsive.

iii. **Preparation and Preview:** For effective and successful use of teaching for proper teaching-learning situation, the teacher must in advance prepare himself, the learners and the environment, the materials as a matter of must should be previewed by the teacher in order to follow its process of presentation sequentially.

iv. **Multi-Dimensional Presentation:** Proper and creative use of a variety of instructional materials at different level of lesson planning can be adequate in achieving various instructional objectives, reason because it will enrich variety of learners mind as they attain better goals more easily than with the use of a single medium.

v. **Environmental Situation:** The environmental variables such as physical, cultural and social in which the instructional materials are utilized for learning have significant effect on their effectiveness. Sound-motion films for instance with their attention – complex properties can be successfully presented in less quite environment.

vi. **Measure for Outcomes:** Instructional materials should be evaluated in terms of their suitability, practicability to the instructional objectives, appeal to the cost effectiveness, learner achievement level, consistency with content call for improvement in utilization techniques, etc.

The following are some of the instructional materials that science teachers should be familiar with and constantly make use of when teaching.

2.4.1 Curriculum Materials

According to Odusina (2003) as cited by Ephraim (2005), these are published materials ranging from the curriculum document itself to students text and workbooks, teachers guides, reference books, and supplementary readers based on the curriculum. All these are to aid the teacher in planning instruction, and the function of each is apparent. Odusina (2003), Educational process all over the world today is largely dependent upon the printed world and has made reading the centre of school experience and method through which the students can learn about his environment.

Text books therefore are parts of the printed world and by far the most widely used resource material in schools. According to McGraw (2000), a text book is a standard work used for instruction, and arranged so as to develop an understanding of the branch of knowledge rather than to impart information for its own sake. The text book, for instance, is a good source of previous knowledge. If intelligently used by the teacher, it can serve to organize knowledge and emphasize important concepts for student, as well as direct class activity. However, the text book is perhaps the most widely used and abused by both the teacher and students, while it is accepted that text books are essential, even in science teaching, their limitation must be recognized by the teacher.

A text book would usually summarize conclusion arrived at from scientific inquiry in a certain discipline, with few supporting data and little or no reference to the rigors of the processes preceding those conclusions. Scientific conclusions are thereby presented as universal "truth" in many books, but we all know that to be the opposite, scientific knowledge are dynamic and prone to obsolescence.

If a teacher strictly adheres to a particular textbook with such a false image of science for planning his/her lesson, following it chapter by chapter, his/her lesson tends to become extremely theoretical, didactic and authoritarian. Students in turn tend to blindly accept such information presented by the text book as the real subject, rather than to think of science as occurring from a process of inquiry. This often leads to rote memorization on the part of students.

By using several text books simultaneously, Agarwal (2000) has suggested that the teacher may reduce the problem of authoritarianism since effective teaching and learning of science cannot be separated from the use of adequate science textbooks. It is therefore important that science teachers should always and constantly use science textbooks that have sufficient topics coverage of the curriculum, provide adequate student's activities contain numerous study questions, illustrations, exercises and chapter summaries. In addition, students should not be allowed to continue to learn science without possessing the recommended textbooks. Science teachers should also select textbooks that are appropriate for the reading level of their students.

2.4.2 Laboratory Materials

Science is a very important aspect in the development of any nation. One of the ways of appreciating science teaching and learning is through effective laboratory instruction. The laboratory has long been a distinctive feature in science education. Its introduction has proved successful because students will go out from the laboratories able to "see and do" (Hoftein and Lunetta, 2004). When students are taught in a school with adequate facilities, they tend to perform better than they would have done without these facilities (Hilgard and Alkinson, 2000). The availability of teaching facilities makes science lesson concrete and stimulating and helps to enhance the achievement of students in secondary schools (Farrant, 2000). A laboratory has always been conceived as place where scientific activities take place.

Scientists investigate nature and the environment not only by discussing theoretically or abstractly but mainly through various experiments. Experiment generally requires the use of certain techniques, tools and materials. These may take place in the laboratory or outside it, however, provision of adequate laboratory space is necessary for the science and technology.

Similarly, when we teach any of these subjects as it should be taught they emphasize students active involvement in experimentation and practice activities. This is more so as it is known that through manipulation of actual object, models equipments, or living specimens during practical activities, a phenomenon becomes concrete for most students and thus easier to learn. Of utmost importance however, is the realization of a main goal of science and technology education, the acquisition by students of the process skills of science. This may not be effectively achieved without the active manipulation of equipment and materials by student. Since the use of the laboratory is a pre-requisite in the teaching of science subject, laboratory materials have been developed as necessary aids to the teachers.

Group activities in the laboratory foster cooperative attitude among students, this is the reason why. Many teachers would cite the unavailability of these laboratory facilities in their schools as reasons for not teaching the subjects practically. Ajayalemi (2001), conducted a study in Lagos with 540 students, in his effort to find out whether there was available laboratory resources in their schools. Questionnaire was used to investigate the adequacy or inadequacy of the learning materials. His findings reveal that the resources for teaching science in the schools were actually inadequate.

However, the adequacy or lack of the standard equipment or consumable materials does not preclude the industrious teacher from improvising by using locally available materials. Akpan (1999) conducted a study in Plateau State on science laboratory practicals, 450 students and 45 teachers responded to a 20 – item questionnaire. Result of the study showed that science teachers and students in Plateau State have favorable attitude towards science. The science practical work not regularly conducted is mainly due to lack of materials..

2.5 Library as Resources for Learning of Science

The school library facility is also another resource for effective learning of science and technology. Unfortunately, not many science teachers care to refer their students to make use of their library facilities.

According to Richard (2002), a library has the following important roles to play:

i. The library is a participant in the education at work

ii. The library is a provider of information.

Therefore, the library is highly useful document resource centre, which contains the Following:

i. Primary sources of information such as journals, technical reports, magazines, proceedings, monographs, newspaper, etc.

ii. Secondary sources of information which consist of more organized work and completion such as science encyclopedia, science handbooks which gives details of formulae illustrations, table of constants, science dictionaries which contain definitions of various concepts, laws, materials and principles, etc.

2.6 School and Industry Linkages as a Resource for Science Teaching and Learning

According to Carsten (2004), science teaching must be tied to industries. Teachers should use industries such as oil companies, car assembly plants, soap, fertilizers and breweries to teach their students. The teachers would collect information on the mode of operation of such industries and the science involved in the production of certain materials. Excursions could be organized for students to visit such places and have direct contact with science at work technologically.

In every community there are places to see and explore that will add meaning to the science programme. Field trips to these places should help pupils to gain information, solve problems and develop appreciations. When teachers identify resources in their school communities, they could organize learning experiences to include visits to such resources outside the classroom such learning experiences according (Umeoduagu ,2000) should incorporate an activity pack which every student should use to make observations, record observations and answer questions based on their experiences in the place of visit.

2.7 Improvisation with Local Materials as Resource in the Teaching and Learning of Science

Improvisation is a concept that challenges a teacher to look inward and produce unavailable real instructional materials from the resources within his environment. The concept emphasizes that the teacher should not be in-want when he can produce the instructional material on his own.

Adekemi (2001) refers to improvisation to the use of substitute material for the purpose of teaching a concept when the real materials that should be used is not available. He further stated that the non-availability of such material might be as a result of being too costly or as a result of physical scarcity. Whatever the reason may be, achieving the aims and objectives of the lesson by making the best use of available resources is the ultimate end.

According to Wasagu, (2000) improvisation is the sourcing, selection and deployment of relevant instructional elements of the teaching and learning process in the absence or shortage of standard teaching and learning resources for meaningful realization of specified educational goals and objectives. Improvisation is the act of using materials obtainable from the local environment or design by the teacher or with the help of local personnel to enhance instruction. Improvisation enables the teacher to think and research for cheaper, better and faster methods of making the teaching/learning process easier for students, thereby promoting creativity and self reliance. It enables the teacher and learner to develop mathematical skills and attitude needed to function effectively in the society as a mathematician. Improvisation serves as a way of alternative to unavailability and inadequate to materials. It is necessary or a way of widening inquiry, curiosity, creativity and productive application of intellect. It also presents next to real situation to students in the absence of the real thing.

Ogwo (2004) states that improvisation for effective instruction is not for the faint-hearted. Improvisation is part of the job of a teacher. It is part of the training he has had. However, there is nothing wrong if students are asked to produce certain equipment under the supervision of the teacher. Students may be asked to source for materials locally for the production of the equipment. Local artisans like carpenters, cabinetmakers, welders, etc. could also be of help in constructing some equipment. However, whether students or artisans are used, the science teacher must supervise the production. He must have a good knowledge of the specifications of the materials to be improvised.

Production of improvised material is labour-intensive. A good science teacher needs to be internally motivated; otherwise, he may feel that the efforts or pain is not worth it. There is no improvised material that can be produced without application of simple or complex skill. A science teacher must be creative, resourceful and curious. Positive attitude of science teachers towards improvisation also make science teachers and learning effective.

According to Maduabum (2001), there are two major types of improvisation. These are:-

i. **Role Substitution:** In which the original materials are slightly modified in order to perform novel functions in an experimental setting e.g. glass tumbler as a beaker, or stove as Bunsen burner.

ii. **Role Simulation:** In which the actual comparison of the apparatus is too expensive or not available e.g. constructing a tripod stand.

2.8 Instructional Materials and the Teaching-Learning Process

The impact of instructional materials on teaching and learning needs not be over emphasized. It is through instructional materials that the teacher drives home his or her point during lesson. In the process of using instructional materials, students can see, feel and touch the materials and this aids retention. Ikonta (2006) views the media as having vital role to play towards the teaching and learning. He refers to the media here as the television, radio, journals, newspaper and magazines. All these help to educate students and help them gather educative information through listening, reading and speaking thereby increasing widening the horizon of their knowledge.

2.9 Instructional Material and Students' Academic Performance

Essentially, the way to facilitate learning is by doing. This is the more reason why teachers should employ the use of instructional materials to practically explain their lessons to students for better comprehension. Looking at the importance and advantage of instructional materials in the teaching and learning of science, one will not be wrong to infer that students' academic performance will be enhanced if appropriate instructional materials are used during teaching-learning processes. This is because when students learn and retain better, they perform better in their academic work (Onyejemezi, 2002). Maduekwe (2000) also notes that the use of appropriate instructional materials influences students' performance in the following ways:

- It helps in focusing attention and motivating learners. When appropriately instructional materials are used to introduce, develop or conclude a teaching-learning session, learners' interests are aroused and developed throughout the lesson.
- Instructional materials lend support and authenticity to whatever the teacher says through the use of media, the learner will be made to confirm or refute the teacher's assertion.
- It makes learning to become real and concrete. It adds aural and visual dimensions to learning thus discouraging rote learning. Use of motion pictures and real objects can concretize learner's experience, thereby making learning to become real, concrete and immediate. Computer Assisted Programmed Instruction helps individualization of instruction possible. Learners can go at their own pace, rate and convenience.
- Learning effectiveness is increased. Learners are likely to retain recall with ease a greater percentage of what they hear, see and manipulate.

2.10 Gender and Academic Achievement

Gender has no any influence on student's academic achievement (Ogbonna, 2005). He further stressed that the differences in scores seen between two or more schools was due to the classroom overcrowding not because of gender.

Generally, individuals have different weaknesses and strength, therefore, resourcefulness in teaching and learning science demands that the science teacher should focus attention on the assets of particular learner and match these against the requirement of the scientific concept under discussion. This approach has the potential of enhancing learners moral, zeal, interest and achievement because it capitalizes on the functional roles of such curriculum element in order to enhance learners understanding, positive feeling will be encouraged, negative attitude toward science will be reduced. Adegegoke (2005) contends that gender is the behavioral, cultural or psychological traits typically associated with one sex-ferminity, muscularity. Blog (2004) indicated factors responsible for the disparity in science achievement to genetic rather than personality traits. But Davis and Rimm (2004) attributed the disparity to both internal and external factors. The external factors include sexism and lack of resources. The internal is that women remain primary responsible for childcare and these compelled them to achieve less than their actual potential.

2.11 Summary and Uniqueness of the Study

The researcher tried to review some areas in the availability of resources for teaching of science and their level of utilization as well as its effect to the performance of students in science teaching in secondary schools in Sokoto. Available literature in this work agreed that resources could be grouped into human and material resources Achimugu (2005). Resources could also be described as anything that helps to bring success in the classroom (Dogara and Ahmadu, 2000). On the relationship between using of available instructional resources and performance of students, Bolick (2003) pointed to a good relationship between effective teaching and using of instructional materials. It is then shows that, if there must be an effective teaching and learning activity, utilization of instructional materials will be necessary. Maduekwe (2007) also noted that the use of appropriate instructional materials influences students' performance several science educators and scholars have shown that it is an indisputable fact those resources for teaching and learning of science in Nigerian schools are very much in short supply (Okebukola and Jegede, 2000). These stressed the need for the science teachers to improvise by using local available materials in the absence of standard ones in order to achieve the objectives of the lesson (Adekemi, 2001).

The uniqueness of this study from other researches is that several attempts have been made to write on the followings: Assessment of the Availability and Utilization of Laboratory Facilities in Schools, Availability and Utilization of Instructional Resources and its effects on Students Academic achievement for five (5) years in Physics, Chemistry or Biology only. But there has never been a detailed study which compared the performance of students in Physics, Chemistry and Biology by administering a test with the level of the available instructional resources and the degree to which teachers utilize available instructional resources in senior secondary schools in Sokoto State.

Finally, according Ugwu (2005), stressing on the problems of effective utilization of instructional materials, stated that in our present educational system, untrained teachers are employed to teach in our secondary schools and colleges. Due to insufficient training, many teachers do not recognize the potential of many simple teaching aids available at very little cost or how to use them. Therefore, it has become necessary to carry out this study since all the reviewed of the previous researches did not compare the availability and utilization of instructional resources and students performance in any school.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology adopted for this study. It consists of:

3.2 The Research Design

3.3 Population of the Study

3.4 Sample and Sampling Procedures

3.5 Instrumentation

3.6 Validity of the Instruments

3.7 Reliability of the Instruments

3.8 Data Collection Procedures

3.9 Method of Data Analysis

3.2 Research Design

A descriptive survey design was used for this research. A descriptive research is a study to determine the nature of a situation as it exists at the time of the study (Clandinin, 2000). According to Kerlinger (2000), a descriptive survey research attempts to determine the incident, distribution and interpretation among sociological and psychological variables. Simon (2000) also observed that the descriptive survey method enables the researcher to obtain opinion from the representative sample of the target population so as to be able to infer the perception of the entire population. Therefore a descriptive survey method was considered appropriate for this study to evaluate the effect of the availability and utilization of instructional resources on student's performance on science in senior secondary schools in Sokoto State.

3.3 Population of the Study

The population of the study comprised all the science teachers and students in science secondary schools in Sokoto State. According to the Department of Planning Research and Statistics, Ministry of Science and Technology Sokoto, there are five (5) Science Secondary Schools in Sokoto State with a population of one hundred and eighty five (185) teachers, in which forty three (43) teachers out of the total number are science teachers. While the numbers of teachers for the two (2) selected private schools are forty one (41), in which six (6) of them are science teachers (three teachers from each school). This constituted the number of science teachers to forty nine (49) and one thousand six hundred and twenty eight (1628) senior secondary school two (SSII) students, which serves as the population of the study. Table 3.1 shows the population of schools, science teachers and students for this study

Table 3.1: Showing the population of the study

No. of Schools	No. of Science Teachers	No. of SSII Students
7	49	1628

3.4 Sample and Sampling Techniques

Forty seven (47) science teachers in the sampled schools and three hundred and thirteen (313) senior secondary school two (SSII) students constituted the sample for this study. The samples are drawn from seven (7) senior secondary schools across six (6) educational zones in the state. The schools include one (1) Girls school, four (4) Boys schools (public) and two (2) Boys and Girls schools (private), which serves as the target population. The zones are Sokoto central zone, Sokoto North/Kware zone, Goronyo zone, Gwadabawa zone, Bodinga zone and Yabo zone. Stratified sampling and random sampling techniques were used to select the sampled schools. And the essence is to ensure good representation of the entire population.

Table 3.2: Showing the Samples Selected for the Study

S/N	Number of Schools	No. of Science Teachers	No. of Students
1	Government Girls College, Sokoto	11	46
2.	Nagarta College Sokoto	12	53
3.	Ahmad Adamu Mu'azu Model Science Secondary School, Goronyo	5	97
4.	Government Science Secondary School, Gwadabawa	7	40
5.	Government Science Secondary School, Yabo	6	38
6.	Minarat Schools	3	20
7	Blue Crescent	**3**	**19**
	TOTAL	**47**	**313**

3.5 Instrumentation

Three instruments were used in this study which comprises of Physics, Chemistry and Biology Laboratory Facilities/Equipment Inventory, an Assessment Observation Form for Utilization of Instructional Resources by Science Teachers and Performance test named Students Science Performance Test (SSPT)

The first instrument was divided into three sections. Section A consists of Physics laboratory facilities/equipment inventory, section B consists of Chemistry laboratory facilities/equipment inventory and section C consists of Biology laboratory facilities/equipment inventory respectively with the aim of obtaining information on the availability of instructional resources for teaching and learning science in secondary schools. The second instrument is Assessment Observation form also has three sections which were used to obtain information on utilization of instructional resources by science teachers.

Similarly the SSPT which is the third instrument also has three sections, where section A is Physics, B Chemistry and C Biology which were used to obtain information on the performance of students. The researcher constructed ten (10) fill in the blank questions on each subject area in order to measure student's knowledge, understanding and high order thinking skills.

An Observational technique was used to observe the availability and utilization of instructional resources in each of the sampled schools. The essence of observation method was to record what actually happened rather than people's opinion. That is it gives first hand information.

3.6 Validity of the Instruments

Physics, Chemistry and Biology Laboratory Facilities/Equipment Inventory, Assessment Observation Form and SSPT are the three instruments designed by the researcher for this study. Ugo (2000) suggested that instruments should be given to expert to review the items and also make comments. This is to ensure not only the face validity of the instrument but also its content validity. Thus, all the three instruments were taken to my supervisors: (1) Professor M. A. Wasagu (major supervisor) and (2) Dr. (mrs) R. Muhammad (co-supervisor 1) from Science and Vocational Education Department, Faculty of Education and Extension Services (3) Professor T. Adamu (co-supervisor 2) from the Department of Biological Sciences (zoology unit) Faculty of Sciences Usmanu Danfodiyo University, Sokoto for vetting and criticisms after which the instruments were considered good enough for use.

3.7 Reliability of the Instrument

The reliability of the instrument was determined after a pilot study conducted with seven (7) schools that are not involved in the study. The reliability coefficient of the SSPT was obtained using split half method and the result of the two halves were correlated using Pearson product moment correlation coefficient then Spearman Brown formula was used to calculate the reliability for the full instrument and obtained the correlation of 0.84 (see appendix 9). This agrees with the opinion of Balogun (2000) who said that any reliability index ranging from 0.5 and above can be taken to be high enough for use. Therefore the instrument was found suitable and consistent for the intended research.

3.8 Data Collection Procedure

The researcher prepared a visit schedule which indicated the number of days the researcher visited each sampled school. The researcher had earlier sought for permission from the principals of the selected schools. First instrument on laboratory facilities/equipment inventory for physics, chemistry and Biology was personally handled by the researcher himself with the help of the respective teachers. The researcher went to each laboratory, observed and collected necessary information on the available facilities in each of the laboratories. This enabled the researcher to obtain first hand information on the materials available in all the laboratories.

While the second instrument was an Assessment Observation form which was also handled by the researcher. The percentages were obtained on the utilization of each instructional resource by science teachers for Physics, Chemistry and Biology. This helped the researcher to obtain information on the extent of utilization of instructional resources by science teachers.

The SSPT which is the third instrument was administered to the SSII students of the sampled schools by the researcher. The aim was to collect data on student's performance. The scoring of the checklist of laboratory equipment inventory for physics, chemistry and biology ranges from 0 to 1. For instance the equipment that are not available had a zero [0] score, while the available equipment had a score of one [1]. The scoring of SSPT also ranges from 0 to 1. That is incorrect answer had 0 mark while correct answer had 1 mark.

3.9 Method of Data Analysis

The researcher used frequency count and simple percentage to answer research question one (1) to classify the schools into three (3) categories, that is, inadequate (0-39%), fairly adequate (40-49%) and adequate (50% and above), in order to determine schools with inadequate, fairly adequate and adequate instructional resources. The degree of utilization of instructional resources by science teachers (research question two) was also determined using frequency count and simple percentages While the hypotheses which stated that: (1) There is no significant difference in the availability and utilization of instructional resources between the schools with and without adequate instructional resources on student's performance in science. (2) There is no significant difference in the availability and utilization of instructional resources on student's performance in science between male and female public senior secondary schools. (3) There is no significant difference in the availability and utilization of instructional resources on student's performance in science between public and private senior secondary schools. T-test statistical tools was used for the analysis of the three (3) hypotheses (by using SPSS 2010 version).

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter presents and analyze the data collected from the three instruments (the Laboratory facilities/equipment inventory, Assessment Observation form and Student Science Performance Test) in order to determine the effect of the availability and utilization of instructional resources on students performance on science in senior secondary schools in Sokoto State.

4.2 Data Presentation

Research Question 1

To what level are instructional resources available in senior secondary schools in Sokoto State?

The availability of physics facilities/equipment (see appendix 2) in the sampled schools indicated that the first school had 66 out of 79 physics laboratory equipment available. The second school had 73 out of 79, 74 out of 79 for the third school, 59 out of 79 for the forth school, 51 out of 79 for the fifth school, 28 out of 79 and 26 out of 79 for the sixth and seventh schools respectively. This indicated that there are adequate physics instructional resources for teaching and learning physics in senior secondary schools.

The availability of Chemistry laboratory facilities/ equipment (see appendix 3) indicated that the first school had 55 out of 59 Chemistry Laboratory Equipment. The second school had 52 out of 59, the third school, had 57 out of 59 the forth school had 54 out of 59, the sixth school had 16 out of 59 laboratory equipment which indicated that the school had inadequate laboratory equipment while the seventh school had 35 out of 59 which indicated that it has fairly adequate laboratory equipment respectively. This also indicated that there is adequate chemistry facilities/equipment for teaching and learning science in senior secondary schools in Sokoto state.

Similarly the availability of the Biology laboratory/facilities equipment (see appendix 4) indicated that the first school had the total of 83 out of 102 Biology equipment, the second school had 91 out of 102, the third school had 98 out of 102, the fourth school had 90 out of 102, the fifth school had 99 out of 102 while the sixth and seventh schools had 31 and 30 out of 102 Biology laboratory equipment respectively. This also showed that Biology laboratory facilities/equipment for teaching and learning Biology is adequate in senior secondary schools in the state.

The total number of available instructional resources in the sampled school was used to calculate the percentage in order to classify the schools into three categories. First categories are schools with 0-39% considered schools with inadequate instructional resources. Similarly, the second categories are schools with 40-49% considered fairly adequate, while those with 50% and above are considered schools with adequate instructional resources.

Table 4.1: Showing the Percentage of Available Instructional Resources in the Sampled Schools

S/N	Schools	Physics	Chemistry	Biology	Average	Remark
1.	GGC	83%	93%	81%	86%	Adequate
2.	NAGARTA	92%	88%	89%	90%	Adequate
3.	AAMMSS	94%	96%	96%	95%	Adequate
4.	GSSS GWD	75%	92%	88%	85%	Adequate
5.	GSSS YABO	65%	86%	97%	83%	Adequate
6.	MINARAT	35%	27%	30%	31%	Inadequate
7.	BLUE CRES	26%	35%	30%	30%	Inadequate

Table 4.1 indicated that only two (2) schools out of the seven sampled schools had 30 and 31% which indicated that there are inadequate instructional resources in those schools. Similarly the remaining 5 schools obtained the percentage which ranges from 83% to 95% which indicated that there are adequate instructional resources in these schools.

Research Question 2

To what degree do Science Teachers Utilizes available instructional resources in their schools?

Table 4.2: Frequency of the utilization of Physics Instructional Resources by Science Teachers

S/N	Responses	Frequency	Percentage (%)
1	Adequate	20	20%
2	Fairly Adequate	50	50%
3	Inadequate	30	30%
	TOTAL	**100**	**100%**

Table 4.2 revealed that 50% of the total number of the available Physics instructional resources are fairly adequately utilized by science teachers in the sampled schools. The table also indicated that 20% are adequately utilized while 30% are inadequately utilized.

Table 4.3: Frequency of the Utilization of Chemistry Instructional Resources by Science Teachers

S/N	Responses	Frequency	Percentage (%)
1	Adequate	10	10%
2	Fairly Adequate	55	55%
3	Inadequate	35	35%
	TOTAL	**100**	**100%**

Table 4.3 indicated that 55% of the total number of the available chemistry instructional resources are fairly adequately utilized by the science teachers. The table also indicated that 35% are inadequately utilized while only 10% are adequately utilized by the science teachers.

Table 4.4: Frequency of the Utilization of Biology Instructional Resources by Science Teachers

S/N	Responses	Frequency	Percentage (%)
1	Adequate	15	15%
2	Fairly Adequate	61	61%
3	Inadequate	24	24%
	TOTAL	**100**	**100%**

Table 4.4 revealed that 61% of the total number of the available Biology instructional resources are fairly adequately utilized by the science teachers. The table also indicated that 24% are inadequately utilized while only 15% are adequately utilized by the science teachers in the sampled schools.

4.3 Hypothesis Testing

4.3.1 Null hypothesis 1

There is no significant difference on the availability and utilization of instructional resources between schools with adequate and those with inadequate instructional resources on student's performance in science

Table 4.5: Summary of T-test Analysis between schools with adequate and those with inadequate instructional resources on student's Performances in science.

Variables	N	Mean	SD	df	t_{cal}	t_{crit}	Sig.
001	274	17.12	5.4				
				313	2.01	1.65	0.05
002	39	15.28	4.8				

Key: 001 stands for students from schools with adequate instructional resources

002 stand for students from Schools with inadequate instructional resources

Table 4.5 Indicated that schools with adequate instructional resources had a mean of 17.12 and those with inadequate instructional resources had a mean of 15.28 with a standard deviation of 5.4 and 4.8 respectively, and t calculated value of 2.01 and t-crit 1.65 at 0.05 level of significance and degree of freedom 313. Since t-calculated is greater than t-critical i.e tcal 2.01> tcrit 1.65, the null hypothesis is rejected and alternative hypothesis is accepted and concluded that there is significant difference on the availability and utilization of instructional resources between schools with adequate and those with inadequate instruction resources on students performance in science in favour of schools with adequate instructional resources.

4.3.2 Null hypothesis 2

There is no significant difference on the availability and utilization of instructional resources on student's performance in science between male and female public senior secondary schools in science.

Table 4.6: Summary of T-test Analysis between Male and Female Public Secondary Schools on Students Performance in Science

Variables	N	Mean	SD	Df	t_{cal}	t_{crit}	Sig
001	237	17.21	5.5				
				313	2.01	1.65	0.05
002	48	16.68	4.8				

Key- 001 stands for students from male public secondary schools

002 stand for students from female public secondary school.

Table 4.6 indicated that students of male public secondary schools had a mean of 17.21 and those from female secondary school had a mean of 16.68 with standard deviation of 5.5 and 4.8 respectively, and t-calculated value of 2.01 and t-critical value of 1.65 at 0.05 level of significance and degree of freedom 313. Since t-calculated is greater than t-critical i.e tcal 2.01> tcrit 1.65, the null hypothesis is rejected and alternative hypothesis is accepted and concluded that there is significant difference on the availability and utilization of instructional resources between male and female public secondary schools on students performance in science in favour of male secondary schools.

4.3.3 Null hypothesis 3

There is no significant difference on the availability and utilization of instructional resources on student’s performance in science between public and private senior secondary schools.

Table 4.7: Summary of T-test Analysis between Public and Private Senior Secondary Schools on Student’s Performance.

Variables	N	Mean	SD	df	t_{cal}	t_{crit}	Sig.
001	274	17.12	5.4				
				313	2.01	1.65	0.05
002	39	15.28	4.8				

Key- 001 stands for students from public secondary schools

002 stand for students from private secondary schools

Table 4.7 indicated that students from public secondary schools had a mean of 17.12 and those from private secondary school had a mean of 15.28 with standard deviation of 5.4 and 4.8 respectively, and t-calculated value of 2.01 and t-critical value of 1.65 at 0.05 level of significance and degree of freedom 313. Since t-calculated is greater than t-critical i.e tcal 2.01> tcrit 1.65, the null hypothesis is rejected and alternative hypothesis is accepted and concluded that there is a significant difference on the availability and utilization of instructional resources between public and private secondary schools on students performance in science in favour of public secondary schools.

4.4 Summary of the Major Findings

The followings are the major findings of this study

1. There are adequate instructional resources for teaching and learning science in senior secondary schools in Sokoto State.
2. The available instructional resources are inadequately utilized by the science teachers in Sokoto State.
3. There is significant difference in the availability and utilization of instructional resources between schools with adequate and those with inadequate instructional resources on students performance in science.
4. There is significant difference in the availability and utilization of instructional resources between male and female public senior secondary schools on student's performance in science.
5. There is significant difference in the availability and utilization of instructional resources between public and private senior secondary schools on student's performance in science.

4.5 Discussion of the Findings

Based on the findings of the research question one regarding the availability of the instructional resources' for teaching and learning sciences in Sokoto State, the result on the appendices 2, 3, and 4 of the laboratory equipment inventory for Physics, Chemistry and Biology indicated that five (5) schools (public) out of the seven (7) sampled schools had adequate laboratory equipment for practicals. This is due to the fact that these schools are given special treatment by the Ministry of Science and Technology being the only Science Secondary Schools under the Ministry. While the remaining two (2) schools are private schools owned by private individuals which had inadequate instructional resources as shown in the appendices 2, 3, and 4. This is a clear indication that government owned schools had more instructional resources compared to the school owned by private individuals in the state. It was also discovered that most of the instructional resources are not adequately available in all the schools, the equipment are few in quantity, and so made it very difficult for teachers and students to use them effectively. This made the practical lessons to consume much time and also made Science laboratory activities boring due to the inadequacy of instructional resources which is one of the major constrains militating against the conduct of practical work. This agreed with the findings of Kamar (2007) which revealed that lack of laboratory equipment, chemicals and laboratory assistant are reported by teachers as the major constraints militating against the conduct of practical work in Sokoto State. Similarly, Table 4.1 indicated how the scores obtained from laboratory equipment inventory are converted into percentage to classify the schools into three categories. The study revealed that five (5) out of the seven (7) schools obtained the percentage ranges from 83% to 96% compared to the remaining two (2) schools which had only 30% and 31% respectively. This revealed that there are adequate instructional resources for teaching and learning sciences in senior secondary schools in Sokoto State which is in line with the findings of Anene (2002). stressed that availability of laboratory equipments seems to influence students' performance positively in the Schools Certificate Examination as such it affect the attainment of stated objectives.

Evidence from Tables 4.2, 4.3, and 4.4 indicated that only few instructional resources were utilized by the science teachers. This may be due to the lack of knowledge and experience on how to utilize some of these instructional resources during teaching. This is in line with the findings of Ugwu (2005), stressing on the problems of effective utilization of instructional materials. He reported that untrained teachers are employed to teach in our secondary schools and colleges and due to insufficient training, many teachers do not recognize the potential of many simple teaching aids available at very little cost or how to use them. The implication of this is that the student will not be able to acquire the necessary skills and attitude expected of them at this level of education. This may also result in students having negative attitude towards science which can affect the student's choice of science as a course at higher levels.

The first hypothesis tested stated that there is no significant differences on the availability and utilization of instructional resources between schools with adequate and those with inadequate instructional resources on students performance in science. The result in Table 4.5 indicated that t-calculated is higher than t crit which led to the rejection of the hypothesis and accepted the alternative hypothesis and implies that there is significant differences on the availability and utilization of instructional resources between schools with adequate and those with inadequate instructional resources on students performance in science.

The second hypothesis tested stated that there is no significant difference on the availability and utilization of instructional resources between male and female public secondary schools on student's performance in science. The result in Table 4.6 indicated that t-calculated value is higher than t-critical value which led to the rejection of the hypothesis and accepted the alternative hypothesis and implies that there is significant difference on the availability and utilization of instructional resources between male and female public secondary schools on student's performance in science.

The third hypothesis tested stated that there is no significant difference on the availability and utilization of instructional resources between public and private senior secondary schools on student's performance in science. The result in Table 4.7 indicated that t-calculated is higher than t-critical which to the rejection of the hypothesis and accepted the alternative hypothesis and implies that there is a significant difference on the availability and utilization of instructional resources between public and private senior secondary schools on student's performance in science. This agreed with the findings of Maduekwe (2007) and Anene (2002) who stressed that availability and use of laboratory equipment seem to positively influence the students performance in school Certificate examination as such it affect the attainment of stated objectives.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this chapter, the summary of the research and its major findings are presented. Implications of the study, conclusions and recommendations are also presented with the suggestion of the study.

5.2 Summary of the Study

The primary issue on which the study focused was to find out the effect of the availability and utilization of instructional resources on student's performance in science in senior secondary schools in Sokoto State. In chapter one (1), the study started with the background, statement of the problem, objectives of the study followed by formulation of research questions and hypotheses. Significance, scope, and delimitation of the study are also presented. The research questions for this study are:

1. At what level instructional resources available in senior secondary schools in Sokoto State?
2. To what degree science teachers utilize the available instructional resources in senior secondary schools in Sokoto State?
3. Is there any difference in the availability and utilization of instructional resources between schools with and without adequate instructional resources on student's performance in science?
4. Is there any difference in the availability and utilization of instructional resources on student's performance in science between male and female students in public senior secondary schools in Sokoto State.

5. Is there any difference in the availability and utilization of instructional resources on student's performance in science between public and private senior secondary schools in Sokoto State?

The hypotheses tested in this study are:

1. There is no significant difference in the availability and utilization of instructional resources between schools with and without adequate instructional resources on student's performance in science.
2. There is no significant difference in the availability and utilization of instructional resources on student's performance in science between male and female public senior secondary schools.
3. There is no significant difference in the availability and utilization of instructional resources on student's performance in science between public and private senior secondary schools.

The study was limited to seven (7) senior secondary schools across six educational zones in the state.

In chapter two (2), related literatures were reviewed under the following headings:

Conceptual Framework, Kinds and Categories of Instructional Resources, Utilization of Instructional Materials for Science Teaching and Learning, Library as Resources for Learning Science, School and Industry Linkages as a Resource for Science Teaching and Learning, Improvisation with Local Material as Resource in Teaching and Learning of Science, Instructional Materials and the Teaching and Learning Process, Instructional Materials and

Academic Performance of Students, Gender and Academic Achievement of Students, Summary of the Review and Uniqueness of the Study.

In most of the researches cited it was revealed that the instructional resources availability and utilization by science teachers assist students in acquiring clear concept of the subject matter, but the unavailability of instructional resources causes poor performance in science.

Similarly, chapter three (3) was summarized under the following headings: Research Design, Population of the Study, Sample and Sampling Procedure, Instrumentation, Validity of the Instrument, Reliability of the Instrument, Data Collection Procedures and Method of Data Analysis. Three instruments were designed; which included the laboratory facilities/equipment inventory handled by the researcher which is aimed at finding out the availability of instructional resources in the sampled schools. The assessment observation form on utilization of instructional resources by science teachers with the aimed of finding out the degree to which teachers utilizes available instructional resources, and the students performance test which was administered to the students with the aimed of obtaining data on students performance. The sample for this study was forty seven (47) science teachers and three hundred and thirteen (313) SS Two students across seven (7) sampled schools in the state. Two (2) research questions and three hypotheses were tested in this study. Research questions were answered using frequency count and simple percentage while T- test was used for the analysis of three (3) null hypotheses.

In chapter four (4), result analysis was presented and the findings of this study revealed that there are adequate instructional resources for teaching and learning science in Sokoto State. Most of the available resources are few in quantity which caused the practical lesson to be boring and time consuming. The study also revealed that the available instructional resources are inadequately utilized by the science teachers The percentages of some instructional resources that are inadequately utilized by the science teachers include Physics 30%, Chemistry 35% and Biology 24% respectively. This may probably be due to the lack of knowledge and experience of some teachers on how to utilize some instructional resources during teaching. It was also discovered that there was significance difference on the availability and utilization of instructional resources between schools with adequate and those with inadequate instructional resources on students performance in science. The findings also revealed that there was significant difference on the availability and utilization of instructional resources between male and female secondary schools on student's performance in science. The study also revealed that there was significant difference on the availability and utilization of instructional resources between public and private senior secondary schools on student's performance in science. This showed that public schools owned by government are provided with more instructional resources than the schools owned by private individuals in the state.

5.3 Conclusions

Based on the findings of this study it was concluded that:-

1. Senior secondary schools in Sokoto State have adequate instructional facilities.
2. But the facilities are inadequately utilized by the science teachers. The study shows that when students are taught with available instructional resources, they tend to perform better than they would have done without instructional resources. This is in line with the findings of Maduekwe (2007) who stressed that availability and use of instructional resources seem to positively influence students performance, as such it affect the attainment of stated objectives.

3. The study also indicated that male students from schools with adequate instructional facilities performed better than female from school with adequate facilities.
4. Public senior secondary schools have more instructional facilities than private schools in the State.

5.4 Implications of the Study

Implications of these findings include the following::

i. Inadequacy of instructional resources will make students not be able to acquire the necessary scientific skills and attitudes expected of them. This may result in students having negative attitudes toward science.

ii. Inadequacy of instructional resources make practical lesson boring and consumes much time.

iii. Low provision of instructional resources causes poor performance in science by students.

iv. Lack of knowledge and skills of using instructional resources while teaching by some science teachers make it difficult for the learners to learn effectively.

5.5 Limitations of the Study

The following are the limitations of the study

i. The research was conducted using only senior secondary schools two students in Sokoto state

ii. The study covers only seven senior secondary schools (five public and two private) due to the time factor and financial constraint.

iii. The scope of generalization of this study is limited to the population used in this research.

5.6 Recommendations

On the basis of the above findings the following recommendations are made:-

1. The Ministry of Education officials and private schools proprietors should make sure that laboratory equipment are supplied to schools and the quantity should be supplied according to the number of students available in each school.

2. The Ministry of Education should make it compulsory to all the proprietors of the private schools to provide adequate science laboratory facilities/ equipment to their schools for the successful conduct of practicals, or else refuse registration of schools refused to comply.

3. Ministry of Education should make appropriate plan to expose science teachers to training workshop on improvisation in order to update their techniques and also attend conferences, seminars and workshops on material resources production, utilization and management.

4. Teachers should be encouraged to commit themselves into the effective use of instructional materials in all their instructional delivery.

5.7 Suggestions for Further Studies

1. Similar research should be conducted to cover at least three (3) States in order to see if similar result could be obtained

2. Similar study should be conducted to cover both science and non-science oriented schools to correlate these findings.

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APPENDIX I

DEPARTMENT OF SCIENCE AND VOCATIONAL EDUCATION
FACULTY OF EDUCATION AND EXTENSION SERVICES
USMANU DANFODIYO UNIVERSITY, SOKOTO

This inventory is designed to enable the researcher obtain information that would guide this research. It is designed to gather information on the availability of instructional resources for teaching/learning science in secondary schools in Sokoto State.

Section A:

Physics Laboratory Facilities/Equipment Inventory

S/N	Items	Available	Not available	No of Equipment Available
1.	Retort stand with clamp			
2.	Spring balance			
3.	Thread			
4.	Flat bottom plastic petri-dish			
5.	Syringe (0 – $10cm^3$)			
6.	Potentiometer ((0 – $100cm^3$)			
7.	Ammeter (0 – 3A) and (0 – 5A)			
8.	Voltmeter (0 – 5v)			
9.	Jockey			
10.	Standard resistors (20hms, 50hms)			
11.	Rheostart			
12.	Dry cell			
13.	Connecting wires			
14.	Vernier calipers			
15.	Vertical scale ruler (Plastic)			
16.	Resistance box capable of reading (0 – 100ohms)			
17.	Metre bridge			
18.	Zero centred galvanometer			
19.	Plug key			
20.	Crocodile clip			
21.	Wire gauze			
22.	Bunsen burner			
23.	Stop clock			

24.	Pendulum bob			
25.	Rectangular glass block			
26.	Triangular glass prism			
27.	Object pins			
28.	Image pins			
29.	Set of mass 50g			
30.	Set of mass 10g			
31.	Set of mass 100g			
32.	Set of mass 150g			
33.	Set of mass 200g			
34.	Set of mass 250g			
35.	Set of mass 500g			
36.	Set of mass 1000g			
37.	Set of mass 1500g			
38.	Set of mass 2000g			
39.	Beaker 100cm^3			
40.	Beaker 250cm^3			
41.	Beaker 400cm^3			
42.	Beaker 500cm^3			
43.	Beaker 1000cm^3			
44.	Concave mirror			
45.	Convex mirror			
46.	Concave lens			
47.	Convex lens			
48.	Gas cylinder			
49.	Wet cell			
50.	Plasticine			
51.	Iron fillings			
52.	Locopodium prouder			
53.	Lamp holder			
54.	Lamp			
55.	Screen			
56.	Ray box			
57.	Pin – hole camera			
58.	Constantin wire			
59.	Transformer			
60.	Electric door bell			
61.	G-Cramp			
62.	Bench vise			

63.	Spiral spring			
64.	Pulleys			
65.	Metre rule			
66.	Thermometer			
67.	Sonar			
68.	Wind vane			
69.	Barometer			
70.	D.C Generator			
71.	A.C Generator			
72.	Cork			
73.	Calorimeter			
74.	Magnet			
75.	Horse shoe magnet			
76.	Switch			
77.	Turning fork			
78.	Razor blade			
79.	Amplifier			

SECTION B:

Chemistry Laboratory Facilities/ Equipment Inventory

S/N	Items	Available	Not available	No of Equipment available
1.	Spatula			
2.	Filter paper			
3.	Beakers			
4.	Flasks (conical, flat, bottom			
5.	Testubes			
6.	Boiling tubes			
7.	Ignition tubes			
8.	Bunsen burner/stove			
9.	Funnel (glass/rubber)			
10.	Wash bottles			
11.	Test tube racks			
12.	Test tube holder			
13.	Reagent bottles			
14.	Retort stand			
15.	Burrette			
16.	Pipette			
17.	Litmus paper			
18.	Standard table			
19.	Tripod stand			
20.	Wire gauze			
21.	Glass rod/stimmer			
22.	Calculation/mathematical table			
	INDICATORS			
23.	Methyl indicator (Orange)			
24.	Methyl indicator (Blue)			
25.	Methyl indicator (Red)			
26.	Phenolphthalene			
	REAGENTS			
27.	Aqueous Amonia			
28.	Dilute Hydrochloric aid			
29.	Dilute Sodium Hydroxide			
30.	Dilute Barium Chloride			
31.	Silver nitrate (v) solution			
32.	Ammonium sulphate			

33.	Iron (III) chloride			
34.	Lead nitrate			
35.	Lime water			
36.	Potassium permanganate			
37.	Potassium iodide			
38.	Zinc carbonate			
39.	Aluminium potassium sulphate Alk			
40.	Calcium carbonate			
41.	Ammonium chloride			
42.	Sodium nitrate			
43.	Sodium chloride			
44.	Ammonia solution			
45.	Tetraoxosulphate (vi) acid			
46.	Methanol			
47.	Ethanol			
48.	Acetic acid			
49.	Aluminum chloride			
50.	Calcium carbide			
51.	Calcium chloride			
52.	Zinc chloride			
53.	Sodium Hydrogen			
54.	Sodium carbonate			
55.	Cupper sulphate			
56.	Methylated spirit			
57.	Zinc nitrate			
58.	Distilled water			
59.	Masking tape/marker			

Section C:

Biology Laboratory Facilities/ Equipment Inventory

S/N	Items	Available	Not available	No. of Equipment available
1.	Light microscope			
2.	Aspirator			
3.	Spatula			
4.	Triple beam balance with supplementary mass			
5.	Double beam balance with supplementary mass			
6.	Water bath			
7.	Beaker, 100 cm^3			
8.	Beaker, 250 cm^3			
9.	Beaker, 400cm^3			
10.	Conical flask 250cm^3			
11.	Vacuum flask 100cm^3			
12.	Measuring cylinder 10cm^3			
13.	Measuring cylinder 100cm^3			
14.	Measuring cylinder 1000cm^3			
15.	Test tube			
16.	Boiling tube			
17.	Petri dish			
18.	Evaporating dish			
19.	Suffocating bottle			
20.	Bunsen burner			
21.	Tripod stand			
22.	Gas jar			
23.	Clinostat			
24.	Crocodile clip			
25.	Desicator			
26.	Dissecting set			
27.	Dissecting board			
28.	Filter paper, 100mm diameter			
29.	Filter paper, 185mm diameter			
30.	Filter funnel, 90mm diameter			
31.	Filter funnel, 140mm diameter			
32.	Wire guaze with ceramic centre			
33.	Magnifier hand lens			
34.	Hygrometer			

35.	Meter rule			
36.	Measuring tape			
37.	Quadrant			
38.	Wind vane			
39.	Photentiometer			
40.	Thermometer			
41.	Stop clock			
42.	Anemometer			
43.	Insect net			
44.	Spring balance			
45.	Test tube rack			
46.	Test tube holder			
47.	Retort stand			

MICROSCOPE SLIDES AND MODELS OF ORGANS

S/N	Type of Slide	Available	Not available	No. of Equipment Available
48.	T.S Monocotyledonous stem			
49.	T.S Dicotyledonous stem			
50.	T.S Monocotyledonous root			
51.	T.S Dicotyledonous root			
52.	T.S Leaf			
53.	T.S Mammalian skin			
54.	Male sperm			
55.	Female ovum			
56.	Stages of embryo development in flowering plants			
57.	Conjugation of gamete			
58.	Hydra			
59.	Paramecium			
60.	Euglena			
61.	Amoeba			
62.	Chlamydomanos			
63.	Neurone cell			
64.	Model of heart			
65.	Model of skin			
66.	Model of ear			
67.	Model of eye			
68.	Model of human skeleton			
69.	Model of lungs			
70.	Model of kidney			

CHEMICALS

S/N	Type of Chemical	Available	Not available	No of Equipment Available
71.	Agar powder			
72.	Ammonia solution			
73.	Ammonium hydroxide			
74.	Benedict's solution			
75.	Calcium nitrate			
76.	Calcium sulphate			
77.	Calcium hydroxide			
78.	Congo red			
79.	Chloroform			
80.	Diastase			
81.	Copper sulphate			
82.	Ethanol			
83.	Fehling's solution A			
84.	Fehling's solution B			
85.	Formalin (methanol)			
86.	Glycerine			
87.	Hydrochloric acid			
88.	Iodine solution			
89.	Iron (III) chlorine			
90.	Magnesium chloride			
91.	Magnesium sulphate			
92.	Methylated sprit			
93.	Millions reagent			
94.	Potassium chloride			
95.	Potassium phosphate			
96.	Pepsin			
97.	Sodium carbonate			
98.	Sodium hydroxide			
99.	Sudan III			
100.	Trypsin			
101.	Universal indicator test paper			
102.	Yeast powder			

APPENDIX II

Showing the Number of Available Physics Laboratory Facilities/Equipment in the Sampled Schools

S/N	Laboratory Equipment	1		2		3		4		5		6		7	
		GGC	No of equip	NG	No of equip	A.A M.G	No of equip	G.S.SG	No of equip	GSSY	No of equip	MS	No of equip	Blue Cresce	No of Equip
1.	Retort stand with clamp	1	100	1	80	1	120	1	150	1	80	1	10	1	15
2.	Spring balance	1	80	1	76	1	100	1	120	1	75	1	05	-	-
3.	Thread	1	150	1	50	1	10	1	80	1	130	-	-	1	2
4.	Flat bottom plastic petri-dish	1	65	1	57	1	115	1	60	1	75	-	-	1	1
5.	Syringe (0 – 10cm^3)	1	20	1	29	1	20	-	-	1	100	1	02	-	-
6.	Potentiometer ((0 – 100cm^3)	1	52	1	21	1	18	1	72	1	80	1	01	-	-
7.	Ammeter (0 – 3A) and (0 – 5A)	1	85	1	59	1	56	1	84	1	72	1	01	1	03
8.	Voltmeter (0 – 5v)	1	76	1	53	1	93	1	60	1	65	1	01	1	02
9.	Jockey	1	42	1	35	1	23	1	53	1	50	1	03	-	-
10.	Standard resistors (20hms, 50hms)	1	56	1	45	1	50	1	54	1	65	1	02	-	-
11.	Rheostart	1	48	1	60	1	38	1	40	1	25	-	-	1	02
12.	Dry cell	1	25	1	42	1	10	1	30	1	30	1	04	-	-
13.	Connecting wires	1	21	1	30	1	05	1	25	1	100	-	-	-	-
14.	Vernier calipers	1	60	1	40	1	45	1	75	1	52	-	-	1	03
15.	Vertical scale ruler (Plastic)	1	120	1	68	1	62	1	95	1	72	1	05	-	-
16.	Resistance box capable of reading (0 – 100ohms)	1	23	-	-	1	15	1	70	1	35	-	-	-	--
17.	Metre bridge	1	20	1	35	1	10	1	30	1	50	-	-	-	-

18.	Zero centred galvanometer	1	61	1	20	1	38	1	65	1	28	-	-	1	02
19.	Plug key	1	20	1	55	1	18	1	36	1	60	1	03	-	-
20.	Crocodile clip	1	34	1	69	1	30	-	-	-		-	-	-	-
21.	Wire gauze	1	26	1	78	1	55	1	42	1	150	-	-	1	02
22.	Bunsen burner	1	69	1	42	1	72	1	75	1	84	-	-	1	06
23.	Stop clock	1	30	1	69	1	88	1	60	1	150	1	03	1	06
24.	Pendulum bob	1	78	1	56	1	105	1	100	1	100	1	02	1	10
25.	Rectangular glass block	1	26	1	70	1	63	1	64	1	120	1	02	-	-
26.	Triangular glass prism	1	79	1	88	1	54	1	79	-	-	1	01	1	02
27.	Object pins	-	-	1	102	1	10	1	80	1	200	-	-	1	01
28.	Image pins	1	06	1	105	1	15	-	--	1	150	-	-	-	-
29.	Set of mass 50g	1	49	1	70	1	20	1	32	1	120	1	02	-	-
30.	Set of mass 10g	1	20	1	88	1	35	1	63	1	60	-	-	-	-
31.	Set of mass 100g	1	26	1	79	1	42	1	30	1	54	-	-	-	-
32.	Set of mass 150g	1	32	1	89	1	15	1	35	1	65	-	-	1	01
33.	Set of mass 200g	1	21	1	78	1	10	1	53	1	46	-	-	-	-
34.	Set of mass 250g	1	19	1	100	1	18	1	25	-	-	-	-	1	02
35.	Set of mass 500g	1	36	1	89	1	21	1	34	1	18	-	-	1	01
36.	Set of mass 1000g	1	15	1	25	1	10	1	20	-	-	-	-	-	-
37.	Set of mass 1500g	-	-	1	15	-	-	-	-	-	-	-	-	-	-
38.	Set of mass 2000g	-	-	1	100	1	15	-	-	-	-	-	-	-	-
39.	Beaker 100cm^3	1	102	1	67	1	10	1	183	1	180	1	05	-	-
40.	Beaker 250cm^3	1	55	1	73	1	80	1	120	1	200	1	03	1	03
41.	Beaker 400cm^3	1	29	1	45	1	62	1	86	1	85	-	-	-	-
42.	Beaker 500cm^3	1	15	1	39	1	15	1	72	1	72	-	-	-	-
43.	Beaker 1000cm^3	-	-	1	60	1	10	1	30	-	-	-	-	-	-

44.	Concave mirror	1	20	1	64	1	26	1	50	1	90	-	-	1	02
45.	Convex mirror	1	26	1	45	1	30	1	45	1	95	-	-	-	-
46.	Concave lens	1	49	1	52	1	32	-	--	1	82	-	-	-	-
47.	Convex lens	1	39	1	02	1	32	1	36	1	78	-	-	-	-
48.	Gas cylinder	1	02	1	03	1	04	1	02	1	03	1	02	1	03
49.	Wet cell	-	-	1	05	1	05	1	02	-	-	1	01	-	--
50.	Plasticine	1	05	-	-	1	10	-	-	1	10	-	-	1	02
51.	Iron fillings	1	02	-	-	1	02	-	-	1	05	-	-	-	-
52.	Locopodium prouder	-	-	1	05	-	-	-	-	-	-	-	-	-	-
53.	Lamp holder	1	06	1	10	1	25	-	-	1	38	1	03	-	-
54.	Lamp	1	06	1	10	1	25	1	05	1	40	1	03	-	-
55.	Screen	-	-	1	01	1	10	-	-	1	30	-	-	-	-
56.	Ray box	1	03	-	-	1	06	1	02	1	02	-	-	-	-
57.	Pin – hole camera	1	06	1	10	1	15	1	03	1	46	-	-	-	-
58.	Constantin wire	-	-	1	05	1	03	-	-	-	-	-	-	-	-
59.	Transformer	-	-	-	-	1	02	-	-	-	-	-	-	1	01
60.	Electric door bell	1	05	1	43	1	20	1	06	-	-	-	-	-	-
61.	G-Cramp	1	08	1	32	1	15	1	10	1	20	1	03	1	06
62.	Bench vise	1	06	1	16	1	55	1	05	1	05	-	-	-	-
63.	Spiral spring	1	10	1	20	1	50	-	-	1	48	-	-	-	-
64.	Pulleys	1	58	1	34	1	62	1	30	1	50	-	-	1	01
65.	Metre rule	1	130	1	65	1	78	1	100	1	100	1	15	-	-
66.	Thermometer	1	06	1	42	1	25	1	25	1	38	1	05	1	04
67.	Sonar	-	-	1	40	-	-	-	-	-	-	-	-	-	-
68.	Wind vane	1	26	-	-	1	18	-	-	-	-	-	-	-	-
69.	Barometer	1	52	1	30	1	30	1	50	1	15	-	-	-	-

70.	D.C Generator	-	-	-	-	-	-	-	-	-	-	-	-	1	01
71.	A.C Generator	1	06	1	02	1	03	1	02	-	-	1	01	-	-
72.	Cork	1	100	1	80	1	90	1	120	1	100	-	-	-	-
73.	Calorimeter	1	12	1	40	1	48	1	52	1	60	-	-	-	-
74.	Magnet	1	29	1	29	1	27	-	-	1	67	-	-	-	-
75.	Horse shoe magnet	-	-	1	20	1	10	-	-	-	-	-	-	-	-
76.	Switch	1	20	1	11	1	10	1	25	1	06	1	03	-	-
77.	Turning fork	1	50	1	70	1	78	1	57	1	63	-	-	-	-
78.	Razor blade	1	06	1	10	1	10	1	10	1	05	-	-	-	-
79.	Amplifier	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	**66**		**73**		**74**		**59**		**51**		**28**		**26**	

APPENDIX III

Showing the number of Available Chemistry Laboratory Facilities/Equipment in the Sampled Schools

S/N	Laboratory Equipment	1		2		3		4		5		6		7	
		GGC	No of equip	NG	No of equip	A.A. M.G	No of equip	GSSG	No of equip	GSSY	No of equip	MS	No of equip	Blue Cres	No of equi
1.	Spatula	1	120	1	100	1	120	1	100	1	78	-	1	1	1
2.	Filter paper	1	30	1	200	1	200	1	25	1	300	1	20	1	20
3.	Beakers	1	300	1	300	1	150	1	200	1	180	1	10	1	10
4.	Flasks (conical, flat, bottom	1	350	1	200	1	200	1	240	1	195	1	05	1	05
5.	Testubes	1	400	1	350	1	300	1	300	1	200	-	-	1	01
6.	Boiling tubes	1	100	1	200	1	100	1	120	1	100	-	-	-	-
7.	Ignition tubes	1	60	-	-	1	150	1	50	1	120	-	-	1	02
8.	Bunsen burner/stove	1	40	1	200	1	50	1	35	1	89	1	01	1	01
9.	Funnel (glass/rubber)	1	250	1	100	1	100	1	210	1	180	-	-	-	-
10.	Wash bottles	1	300	1	200	1	150	1	210	1	158	-	-	1	01-
11.	Test tube racks	1	170	1	260	1	300	1	300	1	132	-	-	-	-
12.	Test tube holder	1	120	1	270	1	120	1	150	1	120	-	-	1	04
13.	Reagent bottles	1	300	1	260	1	150	1	200	1	80	-	-	-	-
14.	Retort stand	1	120	1	200	1	120	1	250	1	192	1	03	1	03
15.	Burrette	1	260	1	150	1	150	1	202	1	183	1	02	1	02
16.	Pipette	1	250	1	100	1	125	1	220	1	133	1	03	1	03

17.	Litmus paper	1	100	1	120	1	50	1	10	-	-	-	-	-	-
18.	Standard table	1	06	1	05	1	05	1	04	1	04	-	-	-	-
19.	Tripod stand	1	400	1	89	1	250	1	015	1	110	1	04	1	04
20.	Wire gauze	1	200	1	200	1	29	1	200	1	109	-	-	-	-
21.	Glass rod/stimmer	1	300	1	180	1	110	1	110	1	84	-	-	-	-
22.	Calculation/mathematical table	1	60	1	90	1	200	1	120	1	102	1	10	1	10
23.	Methyl indicator (Orange)	1	03	1	100	1	10	1	02	-	-	-	-	-	-
24.	Methyl indicator (Blue)	-	-	1	100	1	05	1	02	1	13	-	-	1	02
25.	Methyl indicator (Red)	1	05	1	100	1	05	-	-	-	-	-	-	-	-
26.	Phenolphthalene	1	03	1	84	1	02	1	02	1	02	-	-	1	03
27.	Aqueous Amonia	-	-	1	05	1	03	1	03	1	03	-	-	-	-
28.	Dilute Hydrochloric aid	1	06	1	06	1	05	1	02	1	04	1	01	1	01
29.	Dilute Sodium Hydroxide	1	10	1	04	1	05	1	03	1	01	1	01	1	01
30.	Dilute Barium Chloride	1	05	1	02	1	05	1	02	1	02	-	-	-	-
31.	Silver nitrate (v) solution	1	03	1	04	1	05	1	03	1	02	-	-	1	02
32.	Ammonium sulphate	1	04	1	10	1	02	1	02	-	-	-	-	1	01
33.	Iron (III) chloride	1	02	1	03	1	01	1	02	1	03	-	-	-	-
34.	Lead nitrate	1	03	-	-	1	02	-	-	1	01	-	-	1	01
35.	Lime water	-	-	-	-	1	02	1	02	1	03	-	-	-	-
36.	Potassium permanganate	1	05	1	06	1	03	1	04	1	02	-	-	1	01
37.	Potassium iodide	1	03	-	-	-	-	1	03	1	02	-	-	1	01-
38.	Zinc carbonate	1	02	-	-	1	03	1	02	-	-	-	-	1	02

39.	Aluminium potassium sulphate Alk	1	03	-	-	1	02	1	02	1	01	-	-	-	-
40.	Calcium carbonate	1	04	1	10	1	05	-	-	1	01	-	-	1	01
41.	Ammonium chloride	1	02	1	05	1	03	1	03	1	02	-	-	1	01
42.	Sodium nitrate	1	05	1	02	1	03	1	02	1	01	1	01	1	01
43.	Sodium chloride	1	06	1	06	1	02	1	01	1	03	1	01	-	-
44.	Ammonia solution	1	10	1	05	1	03	1	03	1	02	-	-	1	03
45.	Tetraoxosulphate (vi) acid	1	04	1	02	1	05	1	04	-	-	-	-	-	-
46.	Methanol	1	03	1	05	1	02	1	02	1	03	-	-	1	02
47.	Ethanol	-	-	1	07	1	03	1	06	1	03	-	-	-	-
48.	Acetic acid	1	03	1	06	1	03	-	-	1	02	-	-	1	04
49.	Aluminum chloride	1	05	1	03	1	05	1	02	-	-	-	-	-1	02-
50.	Calcium carbide	1	02	1	07	1	05	1	03	1	01	-	-	-1	13
51.	Calcium chloride	1	03	1	03	1	03	1	02	1	02	-	-	-	-
52.	Zinc chloride	1	02	1	02	1	01	1	03	1	03	-	-	1	03-
53.	Sodium Hydrogen	1	04	1	06	1	03	1	02	1	03	-	-	-	-
54.	Sodium carbonate	1	02	1	05	1	05	1	02	1	03	1	01	1	01
55.	Cupper sulphate	1	03	1	01	1	02	1	01	1	02	1	01	-	-
56.	Methylated spirit	1	02	1	20	1	02	1	03	1	03	1	03	1	03
57.	Zinc nitrate	1	03	1	04	1	02	-	-	1	01	-		-	
58.	Distilled water	1	02	1	02	-	-	1	02	-	-	-	-	-	-
59.	Masking tape/marker	1	03	1	10	1	01	1	02	1	02	-	-	-	-
	TOTAL	**55**		**52**		**57**		**54**		**51**		**16**		**35**	

APPENDIX IV

Showing the Number of Available Biology Laboratory Facilities/ Equipment in the Sampled Schools

S/N	Laboratory Equipment	1		2		3		4		5		6		7	
		GGC	No of equip	NG	No of equip	A.A. M.G	No of equip	GSS G	No of equip	GSS Y	No of equip	MS	No of equip	Blu Cre	No of Equi
1.	Light microscope	1	60	1	59	1	80	1	60	1	50	1	01	1	04
2.	Aspirator	-	-	-	-	1	02	1	01	1	01	-	-	-	-
3.	Spatula	1	90	1	150	1	200	1	100	1	120	1	05	-	-
4.	Triple beam balance with supplementary mass	1	10	1	05	1	60	1	20	1	11	-	-	1	03
5.	Double beam balance with supplementary mass	1	12	1	10	1	59	1	10	1	12	-	-	-	-
6.	Water bath	1	35	1	50	1	05	1	04	1	12	1	01	1	05
7.	Beaker, 100 cm^3	1	70	1	69	1	300	1	250	1	04	1	30	-	-
8.	Beaker, 250 cm^3	1	62	1	70	1	160	1	150	1	300	1	20	-	-
9.	Beaker, 400cm^3	1	93	1	100	1	250	-	-	1	250	-	-	1	03
10.	Conical flask 250cm^3	1	50	1	59	1	120	1	140	1	60	1	05	-	-
11.	Vacuum flask 100cm^3	1	25	-	-	1	95	1	160	1	150	1	02	1	02
12.	Measuring cylinder 10cm^3	1	60	1	88	1	200	1	210	1	100	-	-	-	-
13.	Measuring cylinder 100cm^3	1	59	1	150	1	110	1	100	1	200	-	-	1	01
14.	Measuring cylinder 1000cm^3	-	-	1	50	1	78	-	-	1	120	-	-	1	05
15.	Test tube	1	180	1	250	1	260	1	100	1	30	1	20	1	06
16.	Boiling tube	1	110	1	200	1	180	1	110	1	200	-	-	-	-
17.	Petri dish	1	150	1	300	1	140	1	120	1	120	1	20	1	02
18.	Evaporating dish	1	50	1	59	1	100	1	112	1	140	1	10	-	-
19.	Suffocating bottle	-	-	1	36	1	70	1	50	1	40	1	05	-	-

20.	Bunsen burner	1	120	1	76	1	60	1	80	1	60	1	03	1	03
21.	Tripod stand	1	200	1	89	1	200	1	150	1	100	1	03	-	-
22.	Gas jar	1	01	1	58	1	02	1	01	1	02	-	-	-	-
23.	Clinostat	-	-	1	49	1	02	1	01	1	02	-	-	1	04
24.	Crocodile clip	-	-	1	150	1	03	-	-	-	-	-	-	1	03
25.	Desicator	-	-	1	100	1	02	1	02	1	01	-	-	-	-
26.	Dissecting set	1	120	1	200	1	80	1	120	1	150	1	08	1	04
27.	Dissecting board	1	60	1	250	1	92	1	10	1	50	1	10	-	-
28.	Filter paper, 100mm diameter	1	20	1	300	1	16	1	15	1	20	-	-	1	02
29.	Filter paper, 185mm diameter	1	25	1	350	1	25	1	20	1	30	-	-	-	-
30.	Filter funnel, 90mm diameter	1	200	1	90	1	50	1	160	1	180	-	-	1	04
31.	Filter funnel, 140mm diameter	1	120	1	88	1	62	1	200	1	100	-	-	-	-
32.	Wire guaze with ceramic centre	1	200	1	89	1	83	1	150	1	250	1	15	-	-
33.	Magnifier hand lens	1	60	1	250	1	56	1	42	1	50	1	05	1	04
34.	Hygrometer	-	-	1	40	1	102	1	01	1	01	-	-	-	-
35.	Meter rule	1	50	1	56	1	300	1	03	1	02	-	-	-	-
36.	Measuring tape	1	01	1	69	1	03	1	02	1	02	-	-	1	05
37.	Quadrant	1	02	1	49	1	02	1	01	1	02	-	-	1	06
38.	Wind vane	-	--	1	03	1	01	1	01	1	01	-	-	1	02
39.	Photentiometer	-	-	1	10	1	03	-	-	-	--	-	-	-	-
40.	Thermometer	1	100	1	68	1	60	1	100	1	120	-	-	-	-
41.	Stop clock	1	30	1	100	1	84	1	30	1	25	-	-	-	-
42.	Anemometer	1	03	1	23	1	02	1	01	1	02	-	-	-	-
43.	Insect net	-	-	1	200	1	06	1	01	-	--	-	-	-	-

44.	Spring balance	1	30	1	100	1	91	1	20	1	25	-	-	-	-
45.	Test tube rack	1	200	1	250	1	72	1	210	1	250	-	-	-	-
46.	Test tube holder	1	120	1	200	1	250	1	120	1	100	1	10	1	01
47.	Retort stand	1	50	1	150	1	300	1	50	1	60	1	25	-	-
48.	T.S Monocotyledonous stem	1	01	1	52	1	05	1	01	1	02	1	10	-	-
49.	T.S Dicotyledonous stem	1	01	1	64	1	04	1	01	1	02	1	05	1	06
50.	T.S Monocotyledonous root	-	-	1	54	1	03	-	-	-	--	-	-	-	-
51.	T.S Dicotyledonous root	-	-	1	57	1	02	1	02	1	01	-	-	1	07
52.	T.S Leaf	1	02	1	06	1	01	1	01	1	02	-	-	-	-
53.	T.S Mammalian skin	1	05	1	10	1	01	1	01	1	03	-	--	1	03
54.	Male sperm	1	01	-	-	-	-	1	02	1	01	-	-	-	-
55.	Female ovum	1	03	-	-	-	-	1	03	1	02	-	-	-	-
56.	Stages of embryo development in flowering plants	1	03	-	-	-	-	-	-	1	02	-	-	-	-
57.	Conjugation of gamete	-	-	-	-	-	-	1	01	1	01	-	-	-	-
58.	Hydra	1	02	1	20	1	03	1	02	1	02	-	-	1	01
59.	Paramecium	1	01	1	30	1	04	1	03	1	02	-	-	-	-
60.	Euglena	1	01	1	40	1	01	-	-	1	02	-	-	-	-
61.	Amoeba	1	06	1	20	1	01	1	03	1	05	-	-	1	01
62.	Chlamydomanos	-	-	1	30	1	02	-	-	1	02	-	-	-	-
63.	Neurone cell	1	02	-	-	1	01	1	01	1	02	-	-	-	-
64.	Model of heart	1	05	1	50	1	02	1	02	1	03	1	02	1	04
65.	Model of skin	1	03	1	49	1	02	1	03	1	03	1	05	-	-
66.	Model of ear	1	02	1	30	1	03	-	-	1	02	1	03	1	02
67.	Model of eye	1	01	1	42	1	01	1	05	1	01	-	-	1	02
68.	Model of human skeleton	1	05	1	05	1	02	1	03	1	06	1	01	1	01
69.	Model of lungs	1	04	1	40	1	01	1	02	1	03	-	-	1	01

70.	Model of kidney	1	02	1	05	1	01	1	01	1	02	1	01	-	-
71.	Agar powder	1	02	-	-	1	02	1	02	1	03	-	-	-	-
72.	Ammonia solution	1	03	1	40	1	02	1	03	1	02	-	-	-	-
73.	Ammonium hydroxide	1	05	1	49	1	02	1	02	1	04	-	-	-	-
74.	Benedict's solution	1	02	1	50	1	03	1	01	1	05	-	-	-	-
75.	Calcium nitrate	1	06	1	49	1	02	1	01	1	06	-	-	-	-
76.	Calcium sulphate	1	04	1	50	1	04	1	02	1	03	-	-	-	-
77.	Calcium hydroxide	1	03	1	20	1	05	1	03	1	02	-	-	-	-
78.	Congo red	-	-	-	-	1	01	1	04	1	01	-	-	-	-
79.	Chloroform	1	05	-	-	1	02	1	06	1	04	1	01	-	-
80.	Diastase	1	02	-	-	1	01	-	-	1	02	-	-	-	-
81.	Copper sulphate	1	07	1	40	1	02	1	07	1	06	-	-	-	-
82.	Ethanol	1	04	1	20	1	01	1	08	1	03	-	-	-	-
83.	Fehling's solution A	1	01	1	30	1	02	1	03	1	02	-	-	-	-
84.	Fehling's solution B	1	01	1	45	1	01	1	02	1	01	-	-	-	-
85.	Formalin (methanol)	1	03	1	59	1	02	1	02	1	03	1	01	-	-
86.	Glycerine	-	-	1	10	1	03	1	04	1	01	-	-	-	-
87.	Hydrochloric acid	1	05	1	30	1	02	1	05	1	04	1	02	-	-
88.	Iodine solution	1	02	1	20	1	02	1	04	1	02	-	-	-	-
89.	Iron (III) chlorine	1	03	-	-	1	03	-	03	1	02	-	-	-	-
90.	Magnesium chloride	1	01	1	10	1	04	1	02	1	01	-	-	-	-
91.	Magnesium sulphate	1	02	1	15	1	03	1	03	1	03	-	-	-	-
92.	Methylated sprit	1	05	1	80	1	04	1	04	1	05	-	-	-	-
93.	Millions reagent	1	05	1	40	1	03	1	03	1	04	1	05	-	-
94.	Potassium chloride	-	-	1	30	1	06	1	05	1	02	-	-	-	-
95.	Potassium phosphate	1	03	1	25	1	03	1	03	1	03	-	-	-	-
96.	Pepsin	-	-	1	35	1	01	-	-	1	05	-	-	-	-
97.	Sodium carbonate	1	06	1	10	1	02	1	02	1	03	-	-	-	-

98.	Sodium hydroxide	1	06	1	20	1	02	1	01	1	04	-	-	-	-
99.	Sudan III	1	02	1	50	1	03	-	-	1	02	-	-	-	-
100.	Trypsin	-	-	1	92	1	01	1	01	1	01	-	-	-	-
101.	Universal indicator test paper	1	03	1	82	1	05	1	02	1	02	-	-	-	-
102.	Yeast powder	-	-	1	100	1	10	1	20	1	10	-	-	-	-
	TOTAL	**83**		**91**		**98**		**90**		**99**		**31**		**30**	

APPENDIX V

DEPARTMENT OF SCIENCE AND VOCATIONAL EDUCATION FACULTY OF EDUCATION AND EXTENSION SERVICES USMANU DANFODIYO UNIVERSITY, SOKOTO

ASSESSMENT OBSERVATION FORM ON UTILIZATION OF INSTRUCTIONAL RESOURCES BY SCIENCE TEACHERS

Dear Sir/Madam

This assessment form is designed to collect information on the utilization of available instructional resources by science teachers for proper teaching and learning science in senior secondary schools in Sokoto State. All information would be treated as confidential and used exclusively for the purpose of this research only.

SECTION A: PHYSICS

S/N	Items	Adequate	Fairly Adequate	Inadequate
1	Retort stand with clamp			
2	Spring balance			
3	Thread			
4	Flat bottom plastic petri-dish			
5	Syringe (0 – 10cm^3)			
\6	Potentiometer ((0 – 100cm^3)			
7	Ammeter (0 – 3A) and (0 – 5A)			
8	Voltmeter (0 – 5v)			
9	Jockey			
10	Standard resistors (20hms, 50hms)			
11	Rheostart			
12	Dry cell			
13	Connecting wires			
14	Vernier calipers			
15	Vertical scale ruler (Plastic)			
16	Resistance box capable of reading (0 – 100ohms)			
17	Metre bridge			
18	Zero centred galvanometer			
19	Plug key			
20	Crocodile clip			

21	Wire gauze			
22	Bunsen burner			
23	Stop clock			
24	Pendulum bob			
25	Rectangular glass block			
26	Triangular glass prism			
27	Object pins			
28	Image pins			
29	Set of mass 50g			
30	Set of mass 10g			
31	Set of mass 100g			
32	Set of mass 150g			
33	Set of mass 200g			
34	Set of mass 250g			
35	Set of mass 500g			
36	Set of mass 1000g			
37	Set of mass 1500g			
38	Set of mass 2000g			
39	Beaker 100cm^3			
40	Beaker 250cm^3			
41	Beaker 400cm^3			
42	Beaker 500cm^3			
43	Beaker 1000cm^3			
44	Concave mirror			
45	Convex mirror			
46	Concave lens			
47	Convex lens			
48	Gas cylinder			
49	Wet cell			
50	Plasticine			
51	Iron fillings			
52	Locopodium prouder			
53	Lamp holder			
54	Lamp			
55	Screen			
56	Ray box			
57	Pin – hole camera			
58	Constantin wire			
59	Transformer			

60	Electric door bell			
61	G-Cramp			
62	Bench vise			
63	Spiral spring			
64	Pulleys			
65	Metre rule			
66	Thermometer			
67	Sonar			
68	Wind vane			
69	Barometer			
70	D.C Generator			
71	A.C Generator			
72	Cork			
73	Calorimeter			
74	Magnet			
75	Horse shoe magnet			
76	Switch			
77	Turning fork			
78	Razor blade			
79	Amplifier			

SECTION B: CHEMISTRY

S/N	Items	Adequate	Fairly Adequate	Inadequate
1	Spatula			
2	Filter paper			
3	Beakers			
4	Flasks (conical, flat, bottom			
5	Testubes			
6	Boiling tubes			
7	Ignition tubes			
8	Bunsen burner/stove			
9	Funnel (glass/rubber)			
10	Wash bottles			
11	Test tube racks			
12	Test tube holder			
13	Reagent bottles			
14	Retort stand			

15	Burrette			
16	Pipette			
17	Litmus paper			
18	Standard table			
19	Tripod stand			
20	Wire gauze			
21	Glass rod/stimmer			
22	Calculation/mathematical table			
23	Methyl indicator (Orange)			
24	Methyl indicator (Blue)			
25	Methyl indicator (Red)			
26	Phenolphthalene			
27	Aqueous Amonia			
28	Dilute Hydrochloric aid			
29	Dilute Sodium Hydroxide			
30	Dilute Barium Chloride			
31	Silver nitrate (v) solution			
32	Ammonium sulphate			
33	Iron (III) chloride			
34	Lead nitrate			
35	Lime water			
36	Potassium permanganate			
37	Potassium iodide			
38	Zinc carbonate			
39	Aluminium potassium sulphate Alk			
40	Calcium carbonate			
41	Ammonium chloride			
42	Sodium nitrate			
43	Sodium chloride			
44	Ammonia solution			
45	Tetraoxosulphate (vi) acid			
46	Methanol			
47	Ethanol			
48	Acetic acid			
49	Aluminum chloride			
50	Calcium carbide			
51	Calcium chloride			
52	Zinc chloride			
53	Sodium Hydrogen			

54	Sodium carbonate			
55	Cupper sulphate			
56	Methylated spirit			
57	Zinc nitrate			
58	Distilled water			
\59	Masking tape/marker			

SECTION C: BIOLOGY

S/N	Items	Adequate	Fairly Adequate	Inadequate
1	Light microscope			
2	Aspirator			
3	Spatula			
4	Triple beam balance with supplementary mass			
5	Double beam balance with supplementary mass			
6	Water bath			
7	Beaker, 100 cm^3			
8	Beaker, 250 cm^3			
9	Beaker, 400cm^3			
10	Conical flask 250cm^3			
11	Vacuum flask 100cm^3			
12	Measuring cylinder 10cm^3			
13	Measuring cylinder 100cm^3			
14	Measuring cylinder 1000cm^3			
15	Test tube			
16	Boiling tube			
17	Petri dish			
18	Evaporating dish			
19	Suffocating bottle			
20	Bunsen burner			
21	Tripod stand			
22	Gas jar			
23	Clinostat			
24	Crocodile clip			
25	Desicator			
26	Dissecting set			
27	Dissecting board			
28	Filter paper, 100mm diameter			

29	Filter paper, 185mm diameter			
30	Filter funnel, 90mm diameter			
31	Filter funnel, 140mm diameter			
32	Wire guaze with ceramic centre			
33	Magnifier hand lens			
34	Hygrometer			
35	Meter rule			
36	Measuring tape			
37	Quadrant			
38	Wind vane			
39	Photentiometer			
40	Thermometer			
41	Stop clock			
42	Anemometer			
43	Insect net			
44	Spring balance			
45	Test tube rack			
46	Test tube holder			
47	Retort stand			
48	T.S Monocotyledonous stem			
49	T.S Dicotyledonous stem			
50	T.S Monocotyledonous root			
51	T.S Dicotyledonous root			
52	T.S Leaf			
53	T.S Mammalian skin			
54	Male sperm			
55	Female ovum			
56	Stages of embryo development in flowering plants			
57	Conjugation of gamete			
58	Hydra			
59	Paramecium			
60	Euglena			
61	Amoeba			
62	Chlamydomanos			
63	Neurone cell			
64	Model of heart			
65	Model of skin			
66	Model of ear			

67	Model of eye			
68	Model of human skeleton			
69	Model of lungs			
70	Model of kidney			
71	Agar powder			
72	Ammonia solution			
73	Ammonium hydroxide			
74	Benedict’s solution			
75	Calcium nitrate			
76	Calcium sulphate			
77	Calcium hydroxide			
78	Congo red			
79	Chloroform			
80	Diastase			
81	Copper sulphate			
82	Ethanol			
83	Fehling’s solution A			
84	Fehling’s solution B			
85	Formalin (methanol)			
86	Glycerine			
87	Hydrochloric acid			
88	Iodine solution			
89	Iron (III) chlorine			
90	Magnesium chloride			
91	Magnesium sulphate			
92	Methylated sprit			
93	Millions reagent			
94	Potassium chloride			
95	Potassium phosphate			
96	Pepsin			
97	Sodium carbonate			
98	Sodium hydroxide			
99	Sudan III			
100	Trypsin			
101	Universal indicator test paper			
102	Yeast powder			

APPENDIX VI

DEPARTMENT OF SCIENCE AND VOCATIONAL EDUCATION
USMANU DANFODIYO UNIVERSITY, SOKOTO

STUDENTS SCIENCE PERFORMANCE TEST

The test is designed to enable the researcher obtain information on the effect of the availability and utilization of instructional resources on secondary school students performance in science.

Instruction: This performance test has three sections. Section A Physics, Section B, Chemistry and Section C, Biology, all the sections contained ten questions each. You are to answer all by filling the blank space provided in each questions.

Section A. Physics

1. The unit of potential different (p.d) and electromotive force (e.m.f) is ___________________________
2. A simple cell has certain disadvantages. True / False __________________
3. The energy of a Daniel cell cannot be restored by recharging but only by the addition of trash ______________________
4. A voltmeter connected across the battery will show weather a car battery is well charged or in need of charging, true of false _______________________
5. Potential different between two points in an electric circuit is the __________ in moving a unit charge across the two point
6. Electrical resistance in an electric circuit is the ________________ to the flow of electric charges.
7. _______________ is the resistance offered by the electrolyte to the motion of the current
8. ____________ is used when work is done
9. The unit of both energy and work are __________________

10. The energy of the current in an electrical circuit can be converted to sound energy in ________________ and _____________

Section B: Chemistry

1. The volume of burette used in quantitative analysis is _______________cm^3
2. In quantitative analysis between strong acid and strong alkali using methyl orange indicator the colour observed at the end point is _____________
3. Presence of methyl orange indicator in acid medium gives _________ colour
4. In preparing a standard solution, the appropriate instrument used is ______
5. In quantitative analysis involving strong acid and strong alkali, using phenolphthalein as indicator, the colour observed at end point is __________
6. The type of reaction involved in quantitative analysis is ________________
7. The types of pipette used in the quantitative analysis are $20cm^3$ and __________ cm^3
8. The function of indicators in quantitative analysis is due to their sensitivity in __________ change
9. The difference between the alkali and base is their solubility in __________
10. The gas released in the quantitative analysis rekindled glowing splint, the gas is ______________

Section C: Biology

1. The pelvic girdle is found in _____________________________ region.
2. Name the bone responsible for neck pivoting ____________________
3. How many ribs are there in human skeleton________________________

4. What type of skeleton does the human have ______________________

5. What are the constituents of an axial skeleton __________,___________, ____________ and ________________

6. What are the constituents of appendicular skeleton ________________, _________________ and _______________________

7. Four type of vertebrates are __________________,________________, ____________________ and ________________________

8. Which bone is the longest bone in human skeleton _______________

9. The type of joint at the elbow is known as _______________________

10. The Lumbar vertebra when compared with a thoracic vertebra has a ______________________________

APPENDIX VII

S.S.P.T. ANSWERS

Physics

1. Volt
2. False
3. Diluted Sulphuric acid
4. True
5. Work done
6. Opposition/Opposite
7. Internal resistance
8. Energy
9. Joules
10. Electric door bell and loud speaker

Chemistry

1. $50cm^3$
2. Yellow/Orange
3. Red colour
4. Volumetric Flask
5. Colourless
6. Neutralization
7. $25cm^3$
8. Colour (PH)
9. Water
10. Carbon(1v)oxide (CO_2)

Biology

1. Lower Abdominal
2. Atlas vertebrae
3. 24 (12 in each side)
4. Endo Skeleton
5. Skull, Vertebral column, Ribs and Sternum
6. Limbs, Scapular and Pelvic girdle
7. Cervical, Thoracic, Lumber and Sacral
8. Femur
9. Hinge joint
10. Longer neural spine

APPENDIX VIII

```
GET
  FILE='C:\Users\Baba\Documents\sirajo.sav'.
DATASET NAME DataSet1 WINDOW=FRONT.
T-TEST GROUPS=inadq(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=adq
  /CRITERIA=CI(.95).
```

T-Test

Group Statistics

		N	Mean	Std. Deviation	Std. Error Mean
	adqt	274	17.1241	5.42474	.32772
	inadqt	39	15.2821	4.81745	.77141

Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	.771	.381	2.010	311	.045	1.84204	.91635	.03901	3.64507
Equal variances not assumed			2.198	52.716	.032	1.84204	.83814	.16074	3.52334

```
T-TEST GROUPS=privet(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=public
  /CRITERIA=CI(.95).
```

Group Statistics

	privet	N	Mean	Std. Deviation	Std. Error Mean
	Publi c	274	17.1241	5.42474	.32772
	Privet	39	15.2821	4.81745	.77141

Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	.771	.381	2.010	311	.045	1.84204	.91635	.03901	3.64507
Equal variances not assumed			2.198	52.716	.032	1.84204	.83814	.16074	3.52334

```
T-TEST GROUPS=female(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=male
  /CRITERIA=CI(.95).
```

Group Statistics

		N	Mean	Std. Deviation	Std. Error Mean
	Male	237	17.2194	5.51369	.35815
	Female	48	15.6875	4.80760	.69392

Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	1.794	.182	1.791	283	.074	1.53191	.85516	-.15138	3.21519
Equal variances not assumed			1.962	74.326	.054	1.53191	.78089	-.02394	3.08776

APPENDIX IX

Table 1. Showing scores obtained from SSPT

Respondents	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17
1	3	4	4	2	3	4	4	4	3	4	4	4	1	2	3	4	3
2	2	1	4	2	4	3	4	3	2	3	4	4	2	2	4	3	2
3	3	3	1	2	4	3	3	4	2	2	4	3	1	3	2	2	4
4	3	4	4	2	3	2	3	3	2	2	4	3	1	2	3	1	1
5	1	3	4	2	3	2	2	1	2	3	2	4	2	2	2	1	3
6	1	1	3	1	3	3	3	3	2	2	2	2	1	2	1	3	2
7	2	2	3	3	3	3	2	3	3	3	3	3	2	3	3	3	2
8	3	4	4	3	3	3	4	1	1	4	4	3	4	4	2	2	4
9	3	4	3	2	3	3	2	1	2	4	4	4	2	1	2	2	3
10	2	3	4	3	4	4	3	3	1	4	4	4	4	2	2	2	2
11	3	4	2	3	3	3	1	3	3	2	2	2	2	1	2	2	4
12	3	4	1	3	4	4	4	4	1	1	4	4	3	3	3	2	1
13	2	3	3	3	3	2	3	4	2	3	3	3	3	3	4	2	3
14	6	4	3	7	8	8	4	3	3	4	4	6	2	1	5	3	4

Table II showing how SSPT data has been split into two halves

Respondents	Q1	Q3	Q5	Q7	Q9	Q11	Q13	Q15	Q16	Total Odd	Q2	Q4	Q6	Q8	Q10	Q12	Q14	Q16	Total even
1	3	4	3	4	3	4	1	3	4	28	4	2	4	4	4	4	2	4	28
2	2	4	4	4	2	4	2	4	3	28	1	2	3	3	3	4	2	3	21
3	3	1	4	3	2	4	1	2	2	25	3	2	3	4	2	3	3	2	23
4	3	4	3	3	2	4	1	3	1	25	4	2	2	3	2	3	2	1	19
5	1	4	3	2	2	2	2	2	1	22	3	2	2	1	3	4	2	1	17
6	1	3	3	3	2	2	1	1	3	18	1	1	3	3	2	2	2	3	19
7	2	3	3	2	3	3	2	3	3	23	2	3	3	3	3	3	3	3	23
8	3	4	3	4	1	4	4	2	2	29	4	3	3	1	4	3	4	2	24
9	3	3	3	2	2	4	2	2	2	26	4	2	3	1	4	4	1	2	21
10	2	4	4	3	1	4	4	2	2	23	3	3	4	3	4	4	2	2	24
11	3	2	3	1	3	2	2	2	2	20	4	3	3	3	2	2	1	2	22
12	3	1	4	4	1	4	3	3	2	23	4	3	4	4	1	4	3	2	22
13	2	3	3	3	2	3	3	4	2	26	3	3	2	4	3	3	3	2	23
14	6	3	8	4	3	4	2	5	3	39	4	7	8	3	4	6	1	3	30

By using person product moment correlation coefficient to calculate half reliability

Respondents	X(odds)	Y(evens)	XY	X^2	Y^2
1	28	28	784	784	784
2	28	21	488	784	441
3	25	23	575	625	529
4	25	19	475	625	361
5	22	17	375	484	289
6	18	19	342	324	361
7	23	23	529	529	529
8	29	24	686	841	576
9	26	21	546	676	441
10	23	24	552	529	576
11	20	22	440	400	484
12	23	22	506	529	484
13	26	23	598	676	529
14	39	30	1170	1521	900
Total	355	316	8175	1327	7284

$$r = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{\left(\sum x^2 - \frac{(\sum x)^2}{n}\right)\left(\sum y^2 - \frac{(\sum y)^2}{n}\right)}}$$

Data

$\sum x = 355$

$\sum y = 316$

$\sum xy = 8175$

$\sum x^2 = 9327$

$\sum y^2 = 7284$

N = 4

$$r = \frac{8175 - \frac{355\,(316)}{14}}{\sqrt{\left(9327 - \left(\frac{355}{14}\right)^2\right)\left(7284 - \left(\frac{316}{14}\right)^2\right)}}$$

$$r = \frac{8175 - 8013}{\sqrt{(9327 - 9002)\,(7284 - 7133)}}$$

$$r = \frac{162}{\sqrt{325\,(151)}}$$

$$r = \frac{162}{\sqrt{49075}}$$

$$r = \frac{162}{221.6}$$

$$r = 0.73$$

Therefore, in order to obtain full length reliability Spearman Brown formular was used

Let

Rh = half reliability

RF = full reliability

Therefore,

$$Rf = \frac{2Rh}{1 + Rh}$$

$$= \frac{2\ x\ 0.73}{1 + 0.73}$$

$$= \frac{1.46}{1.73}$$

$$= 0.84$$

This indicted that there is high positive relationship

APPENDIX **X**

DEPARTMENT OF SCIENCE AND VOCATIONAL EDUCATION
USMANU DANFODIYO UNIVERSITY, SOKOTO

WAEC (SSCE) RESULT SUMMARY

FROM 2009 – 2003

The WAEC result summary is designed to enable the researcher obtain information on the performance of students in Physics, Chemistry and biology from 2009 – 2013 in the following sampled schools. All information would be treated as confidential and used exclusively for the purpose of this research.

GOVERNMENT GIRLS COLLEGE, SOKOTO

Year	**PHYSICS**			**CHEMISTRY**			**BIOLOGY**		
	No. of Credit	No. of Passes	No of Fail	No. of Credit	No. of Passes	No of Fail	No. of Credit	No. of Passes	No of Fail
2009	Nil	15	39	Nil	Nil	68	Nil	01	71
2010	04	44	02	01	02	72	46	33	Nil
2011	Nil	11	35	Nil	04	139	07	82	72
2012	0	08	44	Nil	27	77	Nil	25	78
2013	01	Nil	88	Nil	18	27	06	63	06

NAGARTA COLLEGE, SOKOTO

Year	**PHYSICS**			**CHEMISTRY**			**BIOLOGY**		
	No. of Credit	No. of Passes	No of Fail	No. of Credit	No. of Passes	No of Fail	No. of Credit	No. of Passes	No of Fail
2009	02	48	145	03	62	130	08	79	108
2010	12	97	11	06	25	89	15	32	73
2011	Nil	71	29	05	43	52	51	37	13
2012	04	Nil	102	Nil	62	40	09	09	84
2013	05	45	40	01	53	36	15	49	36

AHMAD ADAMU MU’AZU MODEL SCIENCE SECONDARY SCHOOL, GORONYO

Year	**PHYSICS**			**CHEMISTRY**			**BIOLOGY**		
	No. of Credit	No. of Passes	No of Fail	No. of Credit	No. of Passes	No of Fail	No. of Credit	No. of Passes	No of Fail
2009	NIL	57	33	NIL	24	66	03	52	35
2010	05	48	48	02	75	24	04	80	17
2011	08	82	42	06	65	67	NIL	36	102
2012	09	129	64	NIL	78	124	03	19	180
2013	10	40	145	05	60	130	17	70	108

GOVERNMENT SCIENCE SECONDARY SCHOOL, GWADABAWA

Year	PHYSICS			CHEMISTRY			BIOLOGY		
	No. of Credit	No. of Passes	No of Fail	No. of Credit	No. of Passes	No of Fail	No. of Credit	No. of Passes	No of Fail
2009	12	103	105	16	87	117	29	56	135
2010	Nil	90	60	09	Nil	141	13	20	117
2011	20	80	Nil	08	40	52	50	41	10
2012	10	42	38	07	53	30	24	40	36
2013	Nil	92	68	17	73	70	38	69	53

GOVERNMENT SCEINCE SECONDARY SCHOOL, YABO

Year	PHYSICS			CHEMISTRY			BIOLOGY		
	No. of Credit	No. of Passes	No of Fail	No. of Credit	No. of Passes	No of Fail	No. of Credit	No. of Passes	No of Fail
2009	05	41	94	NIL	64	76	11	83	46
2010	NIL	24	66	05	48	37	28	52	10
2011	07	48	96	09	70	72	37	80	24
2012	08	82	42	13	65	60	Nil	102	36
2013	05	45	40	01	53	36	15	49	36