PROBLEMS OF STUDENTS IN CONDUCTING EFFECTIVE PHYSICS PRACTICAL IN SENIOR SECONDARY SCHOOLS IN SOKOTO METROPOLIS

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APPROVAL PAGE

The research work has been carefully read and approved as meeting the requirement for the award of Bachelor of Science Education Degree in Physics Education, in the Department of Science and Vocational Education, Faculty of Education and Extension Services, Usmanu Danfodiyo University Sokoto, Sokoto State.

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DEDICATION

This work is dedicated to our parents who gave us the maximum support for our stay in the University both financially and advisably.

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All praise be to Allah, the Lord of the Universe, Allah alone we worship and Allah alone we ask for help. We praise and thank Him for making this project a successful one and Whose in His infinite mercy and kindness blessed our life from the very day we were born, and we also praise and thank Him for His guidance, protection, mercy and blessing on us, and for making it possible for us to witness this day and bring this project to a completion.

His salutation and benediction be upon to our noble prophet MUHAMMAD (S.AW), his families, companions and all those who follow his teaching till the day of judgment.

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ABSTRACT

This study is an in-depth research on the problems that are facing students in the conduct of physics practical. The research adopted a descriptive survey research design, the population of the study constitutes of about (1413) student, and (20) teachers, out of which only (306) students, and (15) teachers were randomly selected as the sample. During the course of the study, a lot of problems have been discovered, which were: problem in identifying physics apparatuses, setting the apparatuses, making observations, taking readings, plotting of graph, lack of standard physics laboratory, inadequate laboratory apparatuses, lack of supervision, and lack of appropriate time allocation to physics practical among others. The recommendations made after this study include provision of a standard physics laboratory, and provision of adequate laboratory equipments among others.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Today we are living in the age of science and technology. Scientific inventions and discoveries have revolutionalised our lives. Science is nothing but knowledge so obtained by observations, readings, experimentation and realization.

Science subjects constitute a major part of the subjects being offered in most post primary institutions in Nigeria today. These subjects are so important that the Federal government National Policy on Education (2004) in specific terms states that “the secondary school Education shall provide trained manpower in the applied sciences and technology’’.

The importance attached to science by the Federal government could be due to the general belief that science is capable of improving and changing skills, attitudes, and cognition by increasing pupil’s store of knowledge about themselves, their environment and their world. The development of any nation which depends on science and technology, hinges on science Education, science has been viewed as an instrument that can aid development in many countries. It plays important and dominant roles in spear heading technological advancements, promoting national wealth, improving health, and accelerating industrialization (Validya, 2003).

Physics as one of the science subjects is basic for understanding the complexities of modern technology and essential for technological advancement of a nation. This aspect of science is making significant contributions to many of the inventions that are shaping modern day, and has helped to explain many of the events being encountered in everyday life. Physics is one of the pre-requisite subjects for the study of engineering technological, medical and other applied science courses, in the University. Physics provide training for a vast range of carriers where it is either employed directly or where the skills developed can be applied in innovative ways in other fields. Despite its importance, physics remain the least favored science subject among students generally, only a few students choose to study physics at O. Level and subsequently at higher degree. Students performs poorly in physics, lack of practical work may be an important reason for students for poor content knowledge and understanding of physics at secondary school level in Nigeria (Millar, 2004).

There is a serious shortage of students and teachers of physics in Nigerian secondary schools, this is generating concern among science educators, and researchers are increasingly exploring why students avoid the subject, over the years student of physics in secondary school have found it extremely difficult to perform well in the subject (Nelkon & Ogbon, 1988).

Studies have been carried out to find out the cause of such poor performance. Poor performance of students in physics could be linked to students practical ability (Olabanji,

1997), supported by Akanbi (2003) that poor performance in physics may be due to inadequate laboratory equipment, and facilities which make the present study imperative.

Physics as a course of study is perceived to be experimental, the understanding of practical aspect may help students to learn physics concepts. The educational objectives of physics education cannot be fully realized if student's performance in both physics theory and practical are not balanced (Aina, 2011).

For the mere fact that physics has been severally labeled as the most conceptually difficult subject, particularly the practical aspect of the subject, it is important to explore the underlying difficulties that might impede quality learning in the subject, in the context of Nigerian school environment. The aim of this study is to identify problems associated with conducting effective physics practical in senior secondary schools in Sokoto metropolis.

1.2 Statement of the Problem

The purpose of this study is to make a critical appraisal of the problems hindering the conduct of physics practical and advance suggestion that will enhance the effectiveness, and efficiency of the conduct of physics practical in senior secondary schools within Sokoto metropolis.

A close look at the ways physics practical is handled in most of our secondary schools indicate that probably students were made to merely see physics as a collection of rules. However, it is assumed that proper conduct and involvement of students in physics

practical has became less valued, physics students are likely to be passive listeners even in the laboratory, as they watch teachers carry out the teaching theoretically or carry out demonstration or experiments (Anele, 2011).

Other assumed problems may include that students are not encouraged to consider practical work useful for the development of scientific skills and attitudes. Another problem confronting the learning and conduct of physics practical in schools is the lack of equipment and facilities and their inadequacy (in some case) which hinder the effectiveness of learning physics in schools (Jegede & Okebukola, 1995; Nwaokolo, 1998; Anikweze, 2000; Anele, 2001).

Allocation of time to physics practical in school lesson time table is insufficient, activities to be undertaken therefore suffer. This constitutes an enormous problem to the proper conduct of physics practical in school (Mistler, Dackson & Butler, 2000; Polman, 2000).

Physics teachers stress is another problem confronting the conduct of physics practical in schools. A stress results when the teacher's experience is unpleasant, given rise to tension, frustration, anger, anxiety, and depression, poor working conditions resulting from lack of practical equipments for conducting effective physics practical have been identified as the source of stress in some part of the world (Akpan, 2001). This is not a unique case in the Nigerian context. Physics teachers in Nigeria find these poor working condition stressful (Jegede & Okebukola, 1995).

Other problems encountered by students in conducting physics practical in senior schools include:

- Lack of good practical supervision
- Lack of practical manuals.
- Inadequate qualified physics teachers in secondary schools.
- Lack of motivation
- Poor laboratory condition
- Poor physics practical apparatus
- Problems in setting apparatus
- Problem in relating physics practical with physics theory.

1.3 Objectives of the Study

The following are the objective of the study

1. To identify the problems facing students in conducting effective physics practical in senior secondary schools.
2. To find out the possible solutions to the problems facing students in conducting effective physics practical in senior secondary school.
3. To find out the relationships between insufficient physics practical equipments and the conduct of effective physics practical in senior secondary schools.

4. To find out the appropriate and sufficient time allocation for the conduct of effective physics practical in senior secondary schools.

1.4 Research Questions

In line with stated objectives, the following research questions were generated to guide the study.

1. What are the problems/challenges facing students in conducting physics practical?
2. What are the solutions to the problems facing students in the conduct of physics practical in senior secondary schools?
3. Does an insufficient practical material or equipments hinder effective conduct of physics practical in senior secondary schools?
4. Are the periods allocated to physics practical in senior secondary schools appropriate and sufficient?

1.5 Research Hypotheses

Since the researchers had relatively no idea regarding the outcome of the research, thus the following null hypotheses were designed.

1. There are no problems/challenges facing students in the conduct of physics practical.
2. There are no solutions to the problems facing students in the conduct of physics practical in senior secondary school.

3. There is no significant relationship between conducting effective physics practical and availability of laboratory equipments.

4. There are no appropriate and sufficient periods allocated to physics practical in senior secondary schools.

1.6 Significance of the Study

The outcome of this research may possibly help in enhancing successful teaching of physics subjects by teachers, students' involvement and performance of practical work in physics. Furthermore the findings may hence be used to increased student's interest in physics. It is likewise hope that the attitudes of students towards the conducting of physics practical will drastically change, with the view to encourage, and motivate students to learn physics. It is equally hope that teachers would find all possible means of making physics practical periods more interesting, rather than being boring. Finally the study will also provide the basis for further findings of research in the area.

1.7 Scope and Delimitation

This study will strictly be limited to the problems of conducting effective physics practical in senior secondary schools in Sokoto metropolis, Sokoto State of Nigeria, in order to obtain useful and relevant information about the findings, only senior secondary schools that offer

science subjects would be considered. Due to the time factor and financial problems, the research will only cover five selected senior secondary schools within the area, namely;

i. Government Girls College Secondary School, Sokoto.

ii. Sheikh Abubakar Gummi Memorial College, Sokoto.

iii. Nana Girls Secondary School, Sokoto

iv. Nana Asma'u Girls Islamic College, Sokoto.

v. University Model Secondary School, Sokoto.

1.8 Operational Definition of Terms

- National policy on education – means the national policy governing the business conduct educational matters.
- School – an institution designed for the teaching of students under the direction of the teachers.
- Physics – A natural science that involves the study of matter and its motion, through space and time, along with related concepts such as energy and force.
- Students – A learner or someone who attends an educational institution.
- Teaching – The act of imparting knowledge to learners.
- Practical work- Means the physics experiments or demonstration selected for the science students to do or observe at the laboratory in secondary schools.
- Practical class – Class for doing practical experiments.

❖ WAEC – West Africa Examination Council, is an examination board that conduct the West Africa senior certificate examination.

❖ Problem – A personal matter that causes difficulty and need to be dealt with.

1.9 Basic Assumptions

The research assumes the following.

i. There is inadequacy of laboratory equipment in senior secondary schools in Sokoto State.

ii. There is poor practical supervision in senior secondary schools in Sokoto state.

iii. Student with good physics practical knowledge perform better than those with poor practical knowledge in the theoretical aspects of physics.

iv. Allocation of appropriate and adequate time to physics practical affect the understanding of physics practical.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

The aims and objectives of education in Nigeria states that "education should aim at helping the child to acquire appropriate skills, ability and competences both mental and physical as equipments for the individual to live and contribute to the development of his society Federal Ministry of Education (FME, 2004).

To acquire appropriate skills needed for the development of our society, effective practical work and laboratory activity should be organized. But several research reports (Olanrewaju, 1986; Okoli, 2007, Nwagbo, 2001) converge to indicate that students achieve poorly in secondary school science subjects. Available statistics from the west African examination council (WAEC) on senior secondary school students performance in science (physics included) revealed that, there is a very poor performance of science subject (physics, chemistry, biology) at senior secondary schools certificate examination, especially in the practical examination where students exhibit very poor science skills acquisition (WAEC chief examiner report, 2004).

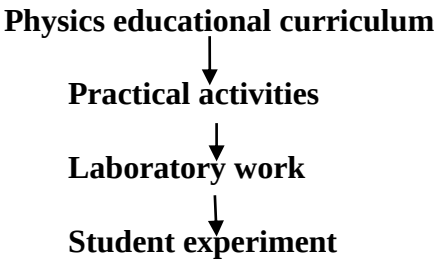
A number of factors have been identified as contributing to non-acquisition of skills by secondary school students, such factors includes, teachers method of teaching, effective practical work, and laboratory activity, Federal Ministry of Education (FME, 2004).

This chapter therefore, treats physics practical work under laboratory activity, field trip and project. Advantages of laboratory work, skills to be developed during the laboratory activity, were also discussed.

2.2 Concept of Physics Practical

Practical knowledge according to James (2000) refers to that knowledge that is connected with reality rather than ideas and theories. In the word of Mankilik, (2011) practical approach means any teaching and learning activity which involves at some points the students in observing or manipulating real objects and materials. The term practical is used in preference to laboratory work, because location is not a salient feature in characterizing this kind of activity. This means that the observation and manipulation of objects could take place in a school laboratory or in an out of school settings, such as learners home (boiling and freezing of water, switching on/off light, A.C, T.V, Radio, using mirrors, etc)

According to Meester&Kirscher, (1995) laboratory work contrives learning experience in which students interact with materials to check and observe phenomena in a laboratory classroom. They further said that the interrelationship between experiments, laboratory work and practical activities is that, student experiment is a subset of laboratory work; laboratory work in turn is a subset of practical activities, which in turn is a subset of the physics education curriculum. These relationships are shown below.



2.3 Importance of Practical Work in Physics

Physics should be taught primarily as a practical subject, so that students can have a firsthand understanding of physics concepts. When treated as a largely theoretical subject as it is done by many teachers in senior secondary schools, students suffer in two ways:

Firstly, manipulating skills in understanding and relating the subject to everyday life. Secondly, the students may not understand the general value of practical work in physics. Both losses are to be regretted but the second may be serious. (Maduabum,1984) said that "practical work may be described as any learning experience which demand activities rather than reception with characteristics of the study of physics".

(Tyler, 1977) posited that course in practical physics is designed to give students the opportunity of acquiring the necessary skills and techniques in the manipulation of apparatus, and the use and understanding of the instruments employed.

(Aina- Jacob, 2011) identified some importance of physics practical as follows:

Physics practical encourages learners to develop the spirit of discovery, as a way of acquiring knowledge of physics. Most science concepts are learned by students through

discovery method. The teacher taught them by conventional method (teacher centered), but practical physics will eliminate or minimize this bad way of learning by allowing students to learn physics concept through practical. It familiarizes learners with the limitation of data analysis and encourages learners to take cautions in drawing conclusions from experimental work.

It encourages students to think clearly and independently and use their own ingenuity and initiative in carrying through an investigation to successful conclusion and then preparing a report for their findings.

It helps student to use their own ability and initiative to carry out and independent investigation to a logical conclusion and write their own reports unaided.

It enhances the understanding of physics theory and phenomenon, when practical is done it is a way of understanding theory very well. Most equations, theorems, laws, and formulae in physics will not be well understood without the knowledge of practical. Most formulas are used by students without knowing the relationship between the variables, but when practical is done student will know the relationship that exist between the variables. For example, ohm's law in electricity: V=IR. Student will not know the relationship between current (I), potential difference (V), and resistance (R) unless law is investigated through practical.

Practical work also helps retention of knowledge gained for a longer time than theory. Students do forget easily the things they have learned by hearing only, but when learning is

done through hearing, seeing and manipulation of physical materials as done in practical activities, retention of knowledge is almost permanent.

Practical work stimulates the interest of the learner in areas of discoveries and scientific conclusions. Students are more interested in physics when they know that on their own they can make discoveries in physics and arrived at scientific conclusion based on their discoveries.

The concept of practical work may be extended to include the need of experience and even a student exercise involving pencil, paper, and calculations based on real examples. Practical work may be performed in the laboratory, but clearly practical activities are confined to the laboratory alone. In view of this, therefore we shall treat physics practical work under;

i. Laboratory activities, experiment and demonstration

ii. Field trip

iii. Project.

2.4 Laboratory Activities, Experiment and Demonstration.

A laboratory activity is a situation where by individuals or group of students are provided with specimens or work guide, including some laboratory equipments for studying a particular phenomenon.

(Maduagbum, 1984) listed a number of reasons which he considers as advantage of laboratory method in science teaching as:

i. Learning through laboratory method extend and re-enforces theoretical learning through reality

ii. Laboratory method offers students to develop scientific thinking carefully and open mindedly.

iii. Because the method implies learning by doing students tend to be more interested due to their active involvement.

iv. Students become familiar with how scientific recordings, observations, and results, summarizing data and drawing conclusion are made.

v. Through laboratory method students learn to handle apparatuses, and other instruments thereby developing manipulative skills.

vi. Laboratory methods promote problem solving and self reliance and happiness.

Similar view were held by Abdullahi, (1982) whom in addition, describes the laboratory method as an activity carried out by an individual or group, for the purpose of making personal observations about processes, products or events.

Skills which could be developed in the laboratory during the laboratory activities can be listed as follows;

i. Manipulative skills

ii. Observational skills

iii. Critical thinking

iv. Generalization

He also said that these skills may show themselves in the cognitive behavior of students.

(Okoli, 2007) said that "investigative laboratory approach de-emphasizes rote memorization of scientific concepts and principles while emphasizing knowledge and skills acquisition through hand-on-minds-on the scientific activities under the guidance of science teachers''.

2.4.1 Laboratory Experiments in Physics

Laboratory experiment is a method of investigating particular type of research question or solving particular type of problem. Physics and natural science in general is a reasonable enterprise based on valid experimental evidence, criticism and rational discussions. Experiment plays many role in physics, one of its important role is to test theories and to provide the basis for scientific knowledge, it can also call for a new theory , either by showing that an accepted theory is incorrect, or by exhibiting a new phenomenon, that is in need of explanation. Experiments can provide hints toward the structure or mathematical form of a theory in physics, and it can provide evidence for the existence of the entities involved in our theories. An experiment is the most important educational and motivational tool in physics education. Physics teachers are often interested in creation of school experiments but they usually do not think about the concrete implementation of the

experiment in teaching and learning physics. Laboratory experience in physics is a method of verifying already known field or investigating less known field, solving practical problems, providing theoretical assumptions, which can take place either in the laboratory or outside the laboratory (Okoli, 2007).

How Laboratory Experiment Differs from other Methods

Laboratory experiment differs from other method of scientific enquiries in many ways;

i. Laboratory experiment is carried out mostly in the laboratory or within school environment, while other methods were mostly done outside the laboratory, like project method and field trip.

ii. In laboratory experiment we usually verify scientific laws, and sometimes investigate less known fields, while in other methods such as field trip we observe things for educational purposes.

Use of laboratory experiment method in physics helps one to acquire the science process skills. Studies by Okebukola and Ogunniyi (1984), and Okoli (2007), assert that when one acquires the science process skills of observing, measuring questions, designing experiments, interpreting data, etc. such a person becomes specifically equipped with the tools required for scientific inquiry or problem solving as well as ability to use these skills in the laboratory for a variety of investigations. From this we can see that experimental method is very crucial in physics teaching, because it motivates students towards physics.

2.4.2 Demonstration in Physics Practical

Demonstration is defined as a display by the teacher for the students to watch, for the purpose of introducing, raising questions, providing visualization of concepts, explaining proper and safe ways of using science apparatuses. Physics more than any other science subjects can be demonstrated principle after principle by direct and simple experiments. Demonstration can clarify a physical principle or show some interesting application of a principle, e.g a teacher demonstrating how to find the value of the acceleration due to gravity (g) using simple pendulum.

Abdullahi, (1982) emphasized the fact that through demonstration, a lesson could be brought to climax and to an end after introduction.

Okerie, (1979) noted that demonstration if used by a skillful teacher are conducive to the development and maintenance of students interest.

Demonstration can clarify a physical principle or show some interesting application of a principle. When conducting demonstration teacher should make sure that student in the back row, as well as front row can see and hear what is going on.

Advantages of Demonstration

1. Demonstration is safe as it is only the teacher that is going to conduct it.
2. Demonstration is used when there is limited apparatuses

3. It can be used as part of a revision session or when you want to draw quick comparison e.g. Looking at the behavior of water waves and comparing that with light wave, or sound waves.

4. It allows students to practice, as being scientist: discussing, developing hypothesis, designing experiment, predicting outcome and returning to fresh hypothesis and more experiment.

5. Students develop their power of observation, thinking and problem solving. Active learning follows the adage “hear and forget, see and remember, do and understand”.

Disadvantages of Demonstration

1. It becomes boring when the teacher does not organize it well.

2. Students at the back row may possibly not see the full detail of the demonstration and therefore will not understand.

2.5 Other Related Methods

Apart from laboratory demonstration and experiments that can be done in the classroom laboratory for teaching physics, there are still some other useful methods involving students and teachers in meaningful scientific investigation, which can be done even outside the classroom or laboratory, this include field trip and project;

2.5.1 Field Trip

A field trip is a journey by a group of people to a place away from their normal environment. The purpose of the field trip is usually observation for education, or non-experimental research and provides students with experience outside their everyday activities. In Nigerian culture people first come across this method during school years when classes are taken on excursion to visit a geological or geographical feature of the landscape for example.

Abdullahi, (1982) and Maduabum, (1984) hold the view that field trip is an important part of any effective science teaching (physics included).

Field trip can:

1. Motivate pupils by stimulating interest and enjoyment.
2. Enhance the learning of scientific knowledge.
3. Give insight scientific method and develop expertise in using it.
4. Develop scientific attitude, such as open mindedness and objectivity.

The journey is risky and expensive. The number of students should not be too much or not be out of control of the teacher, most school systems now have formalized field trip procedure that consider the entire trip from estimation, approval, and scheduling through planning the actual trip and post trip activities.

A well planned field trip offers students the opportunity to develop skills such as observing, recording, collecting data, classifying, studying relationship and manipulating

objects. In this case field trip play the same role as laboratory experiment and demonstration, because through the process students gain more experience and are motivated to read more about what they observed so as to harmonize the actual field experience with information gathered from text books. Examples of areas that can be visited as part of field trip in physics include. A visit to radio and television stations, and manufacturing industries where students can see the direct application of what they have learned as theory in the classroom.

2.5.2. Project Method in Physics

This method is derived from the educational ideas of one of the great educators, John Dewey, an American. Dewey argued that education should not prepare a child for the future that is unknown, but rather it should fit him rightly into the society.

It is a method of enquiry/instruction where by a student or group of students, study a real life situation or situations, or a phenomenon under the expert guidance of a teacher.

Many educators have defined project in their own words, Kilpatrick (1925) defined project as a heartily purposeful act and also says a project is a whole hearted purposeful activity that proceed in social environment (Klipatrick, 1935, p. 162)

According to Cremin and Knoll (1961, 1993) the Klipatrick based project concept is rooted in Dewey's theory experience, the students were getting experience and knowledge by solving practical problems in social situations, it should be noted that Klipatrick was heavily

influenced by Edward L. Thorndike psychology of learning, even more than by Dewey's theory of experience (Kilparick 1918).

The role of project method is to facilitate advice, guide and monitor the students. The role of the student is to be an active learner who contributes to learning process. The classroom is a dynamic learning environment in which role constantly change, the teacher becomes a student, and a student becomes a teacher. During presentation of student's project work, for example the teachers do not instruct but listens, and learn about student science process and product. Students on the other hand assume the role of the teacher during this part of the project. In this method lesson planning focus on area of study, identifying the learning environment and process, selecting resources, and time required, identifying possible learning challenges and selecting the appropriate formative and summative methods, and assessing learning outcomes.

At the end of the project the students should gain more and new knowledge about the topic and develop more skills.

Advantages

1. Children learn to plan and co-operate better with one another when working together as a team than when working individually and at different tasks.
2. Students come into contact with real-life situation and problems through the project work than they would have in the classrooms alone.
3. It is a child centered approach.

Limitations

1. Some subjects on the curriculum will be neglected and this suffers as a result of over concentration of a particular subject.
2. It is not a method that a teacher could use frequently in countries like Nigeria, where examination features prominently in our educational system.
3. The real needs of the individual child may be neglected by the emphasis on the social group and its activities.
4. There is no certainty that all the students will be equally interested in the topic and so take on active part in carrying out the research.

2.6 Summary

In practical work and laboratory experiments, students are guided to find out the truth of ideas, facts or assumption for ultimate confirmation or rejection. The rationale for using this approach in physics teaching lies in the fact that if students are fully involved in activities and challenged to come out with results, they are more likely to learn than if they were simply told or presented with out-come of experiments. Students are also provided with opportunity to interact with materials within the environment through observing, classifying, measuring, questioning, hypothesizing, collecting and interpreting data, accurate reporting, and predicting and inferring laboratory experiment for acquisition of scientific knowledge and skills that enable one to live successfully in this modern age of science and technology.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter is going to discuss the methodology applied in this research as well as the procedure for data collection. The study is an in-depth research on the problems of students in conducting effective physics practical in senior secondary schools in Sokoto metropolis.

However, this chapter describes the research design, the population of the study, sample and sampling technique, instrument for data collection, validity of the instrument, reliability of the instrument, administration of instrument as well as techniques for data analysis.

3.2 Research Design

The design used in this research was a descriptive survey research design where by data were collected, analyzed, and interpreted based on the prevailing circumstances.

3.3 Population of the Study

The population of the study includes all the entire science senior secondary schools in Sokoto metropolis out of which only five were selected to represent the whole schools in Sokoto metropolis. These selected five secondary schools are shown in the table below.

Table 3.3.1: Population of the Study

S/N	School	Number of Physics teachers	Total Number of Students
1	Government Girls College secondary school Sokoto	4	303
2	Sheikh Abubakar Gummi Memorial College Sokoto	3	310
3	Nana Girls Secondary School Sokoto	3	355
4	Nana Asma'u Girls Islamic College Sokoto	4	250
5	University Model Secondary School Sokoto	4	195
	Total	19	1413

Principal's office

3.4 Sample and Sampling Technique

The sampling procedure was based on random sample of different teachers and students among the five selected secondary schools in Sokoto metropolis.

Sixty (60) physics students and three (3) physics teachers were selected from different science classes of each school. This means that a total of (306) students and fifteen (15) teachers were selected to represent the entire physics students and teachers in the Sokoto metropolis.

The schools and the number of students and teachers selected per each school are shown in the table below:

Table 3.4.1: Sample and Sampling Technique

S/N	School	Number of Teachers selected per school	Total number of students selected per school
1	Government Girls College Secondary School Sokoto.	3	60
2	Sheikh Abubakar Gummi Memorial College Sokoto	3	60

3	Nana Girls Secondary School Sokoto	4	64
4	Nana Asma'u Girls Islamic College Sokoto	2	61
5	University Model Secondary School Sokoto	3	61
	Total	15	306

Source: Field Survey, (2015)

3.5 Instrumentation

The instrument used for the data collection in this research study was a two set of structured questionnaire for senior secondary school teachers and students.

The questionnaire consists of (25) questions, (10) questions for students and fifteen questions for teachers. The students questionnaire ask questions on students problems in conducting physics practical which include their observed areas of difficulty in conducting and presentation of physics practical experiment i.e. identifying physics apparatus setting apparatus, making observation, taking readings, preparing table of values, and plotting graph among others.

The teacher's questionnaire ask question based on the adequacy of laboratory equipment, laboratory condition, time allocated to physics practical class, and their suggestion on the possible solution to the problems in their schools.

3.5.1 Validity of the Instrument

The validity of the measurement tool is considered to be the degree to which the tool measures what it claims to measure. Also validity refers to whether a study is able to scientifically answer the questions it is intended to answer. It also tells how accurate and how useful the inferences are about the assessment.

To ensured validity of the instrument, the questionnaires was given to the supervisor for moderation, as such items that are required are fully used and those that are not required are removed and approved as good enough to solicit information needed for the study.

3.5.2 Pilot Study

This is a preliminary studies conducted on a small scale portion of the population in order to test whether the instrument designed for the conduct of a research will be valid and reliable. With regard to this, questionnaires were administered in two secondary schools which are in the population of these studies but not in the sample and the reliability index was found to be 0.83.

3.5.2 Reliability of the Instrument

Reliability can be defined as the consistency of the measurement of a research instrument. The data collection technique and rules for this research are relevant and correct, thus, the instrument used produced required information because people who are experienced in the area of the study were selected. The reliability index after pilot study was found to be 0.83.

3.6 Procedure for Data Collection

Compilation of data was done through the administration of questionnaires to the selected senior secondary schools. In order to make the study quicker, and easier, the researchers visited the area of the study and administered the questionnaires themselves.

3.7 Procedure for Data Analysis

The statistical techniques used in analyzing and quantifying the data are:

i. frequency distribution

ii. percentage

These techniques were employed for easy computation of results collected from respondents.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter is going to present the data or information collected from the questionnaire issued to the respondents.

The data were presented and analyzed through the frequency tables and simple percentages. The chapter also discussed the findings of the results.

4.2 Data Presentation and Analysis

Presentation and analysis of data was presented in two parts. Part A: the simple frequency table and simple percentages for the responses to the questionnaire of students; Part B: the simple frequency tables and simple percentages for the responses to the questionnaire of teachers.

PART A (STUDENT'S QUESTIONNAIRE ANALYSIS)

Table 4.2.1: Practical Text Book and Practical Manual:

Response	**Frequency**	**Percentage**
Yes	32	10.5%
No	274	89.5%
Total	306	100%

Source: Field Survey, (2015)

Table 4.2.1 Reveals that 89.5% responded yes while 10.5% responded No. This shows that there is lack of sufficient practical text books and practical manuals to guide the students. This may be due to inadequate materials.

Table 4.2.2: Identifying Physics Apparatuses

Response	**Frequency**	**Percentage**
Yes	94	30.7%
No	212	69.3%
Total	306	100%

Source: Field Survey, (2015)

Table 4.2.2 reveals that 69.3% responded No while 3.7% responded yes. This shows that there is problem in identifying physics apparatuses. Which may be due to lack of pre-requisite knowledge and vision impairment.

Table 4.2.3: Problem in Setting the Apparatuses

Response	**Frequency**	**Percentage**
Yes	262	85.6%
No	44	14.4%
Total	306	100%

Source: Field Survey, (2015)

Table 4.2.3 Indicates that 85.6% responded yes while 14.4% responded No. This shows that majority of the students have problems in setting the physics apparatuses. Which may be due to lack of proper supervision and truancy of students.

Table 4.2.4: **Problem in Making Observations**

Response	**Frequency**	**Percentage**
Yes	264	86.3%
No	42	13.7%
Total	306	100%

Source: Field Survey, (2015)

The table above indicates that 86.3% responded yes while 13.7% responded No. This shows that the students have problems in making observations during experiment which may be due to lack of proper supervision, vision impairment, and inadequate lightning in the laboratory.

Table 4.2.5 :Taking Readings and Preparing table of Values.

Response	**Frequency**	**Percentage**
Yes	97	31.7%
No	209	68.3%
Total	306	100%

Source: Field Survey, (2015)

Table 4.2.5 indicates that 31.7% responded yes while 68.3% responded No. This illustrated that taking readings and preparing table of values is another problem confronting students in conducting physics practical. This may be due lack of adequate knowledge of approximation in mathematics.

Table 4.2.6 : Plotting of a Graph

Response	**Frequency**	**Percentage**
Yes	37	12.1%
No	269	87.9%
Total	306	100%

Source: Field Survey, (2015)

The table indicates that 12.1% responded Yes, while 87.9% responded No. Plotting graph which is very important in physics practical is another problem facing student in the conduct of physics practical which may be due to inability to select appropriate scales and locating appropriate points in the graph.

Table 4.2.7: Problem in Calculation Related to Practical

Response	**Frequency**	**Percentage**
Calculation of slope	58	19%
Question and calculation related to practical	61	19.9%

Relating physics equation to graph for calculation	187	61.1%
Total	306	100%

Source: Field Survey, (2015)

Table 4.2.7 indicates that relating physics equation to graph for calculation is another problem, which has 61.1%, calculation of slope has 19%, question and calculations related to practical has 19.9%. This may be due to lack of adequate knowledge in mathematics, inadequate supervision and lack of interest.

Table 4.2.8: Problem in Writing Conclusion and Practical Reports

Response	**Frequency**	**Percentage**
Yes	192	62.7%
No	114	37.3%
Total	306	100%

Source: Field Survey, (2015)

From the table above the result shows that 62.7% of the students are having problem in writing conclusion and a good practical report based on the experiment they have carried out in physics practical. This may be due language problem.

PART B (TEACHER'S QUESTIONNAIRE ANALYSIS)

Table 4.2.9: Teacher's Qualification

Response	**Frequency**	**Percentage**
NCE	7	46.7%
Diploma	2	13.3%
B.Sc. Ed.	3	20%
B.Sc.	3	20%
Total	15	100%

Source: Field Survey, (2015)

Table 4.2.9 indicates that 46.7% are NCE holders, 13.3% are Diploma holders, 20% are B.Sc.Ed holders and 20% are B.sc. holders. This gives them the required qualification to answer the questionnaire.

Table 4.2.10: Adequacy of Laboratory Equipment

Response	**Frequency**	**Percentage**
Yes	2	13.3%
No	13	86.7%
Total	15	100%

Source: Field Survey, (2015)

Table 4.2.10 shows that 86.7% of the teachers responded No while 13.3% responded yes. This shows that there is inadequate physics laboratory equipments in the schools, which makes the conduct of practical more difficult if not impossible.

Table 4.2.11: Periods allocated to physics practical per week

Response	**Frequency**	**Percentage**
Once	11	73.4%
Twice	2	13.3%
Thrice	2	13.3%
Total	15	100%

Source: Field Survey, (2015)

Table 4.2.11 reveals that 13.3% responded that they are conducting physics practical thrice in a week, 13.3% were also conducting physics practical twice in a week, and 73.4% responded that they were conducting physics practical once in a week. This shows that there is inadequate time allocation to students for the proper conduct of physics practical.

Table 4.2.12 : Time Allocated to Physics Practical Class

Response	**Frequency**	**Percentage**
30 minutes	9	60%
45 minutes	4	26.7%
1 hr	2	13.3%
Total	15	100%

Source: Field Survey, (2015)

The table above shows that 13.3% responded that the time allocated to practical class is 30 minutes, 26.7% responded that the time allocated to practical class is 45 minutes and 60% responded that the time allocated to practical class in their school is 30 minutes. This information shows that there is inadequate period allocation to student in conducting physics practical.

Table 4.2.13: Suitable and Appropriate time for Conducting Physics Practical

Response	**Frequency**	**Percentage**
Morning	13	86.7%
Afternoon	2	13.3%
Total	15	100%

Source: Field Survey, (2015)

Table 4.2.13 indicated that 86.7% responded morning while 13.3% responded afternoon as the suitable time for conducting physics practical. This is because in the morning the body and brain of the students is fresh while, in the afternoon they are likely to be tired due to the sunlight and activities before the period.

Table 4.2.14: Lack of Motivation and Interest

Response	**Frequency**	**Percentage**
Yes	12	80%
No	3	20%
Total	15	100%

Source: Field Survey, (2015)

Table 4.2.14 Reveals that 80% responded Yes while 20% responded No. This may be due to their inability to comprehend, and lack of reinforcement.

Table 4.2.15: Adequate Maintenance of Equipments

Response	**Frequency**	**Percentage**
Yes	4	26.7%
No	11	73.3%
Total	15	100%

Source: Field Survey, (2015)

Table 4.2.15 indicates that 26.7% responded Yes, 73.3% responded No. The result shows that there is inadequate maintenance of laboratory equipment due to poor management by the school authority.

Table 4.2.16: Reducing Student's Negative Attitude toward Physics Practical

Response	Frequency	Percentage
Motivating students even when they are not doing fine in practical	8	53.3%
Proper supervision of students during the conduct of physics practical	7	46.7%
Total	15	100%

Source: Field Survey (2015)

Table 4.2.16 reveals that 53.3% of the teachers responded that motivation is significant in solving the problems facing students in the conduct of physics practical, while 46.7% reported that proper supervision by teachers could be a solution to the problems. This is because students may tend to hate the subject more if corporal punishment is applied by the teacher.

Table 4.2.17: Provision of a Standard Physics Laboratory

Response	Frequency	Percentage
Yes	15	100%
No	0	0%
Total	15	100%

Source: Field Survey, (2015)

This table shows that 100% of the teachers responded yes, which indicates that provision of a standard physics laboratory could be a solution to the problems in conducting physics practical.

Table 4.2.18: Other Solutions to the Problems

Response	**Frequency**	**Percentage**
Allocation of adequate time to practical class	9	60%
Provision of practical text books and manuals	6	40%
Total	15	100%

Source: Field Survey, (2015)

Table 4.2.18 indicates that 60% of the teachers responded that allocation of adequate time to practical is a solution to the problem in conducting physics practical, while 40% responded that provision of laboratory text books and manuals could be the solution. This is because students may have more time to deliberate on the process.

Table 4.2.19: Adequate Time Allocation to Physics Practical

Response	Frequency	Percentage
1 hr	12	80%
45 Minute	3	20%
30 Minute	0	0%
Total	15	100%

Source: Field Survey, (2015)

Table 4.2.19 shows that 80% responded 1 hour, 20% responded 45 minutes, while 0% responded 30 minutes. This implies that provision of adequate time to physics practical could be a solution to the problems of student in conducting physics practical.

4.3 Discussion of the Result

From the above analysis it was observed that students had difficulty in having good physics practical text books. Text book is very important to students learning. Physics practical books are scarce and the few available ones were costly for the students. Students need good text books to read in preparation for practical work. These books serve as aid when used together with practical manual. These books assist the students to understand the theory of physical laws and concepts when read and later come to laboratory for practical.

Motivation is very important to learning. Physics students must be properly motivated in their various courses especially in practical course. Practical require time and commitments.

Therefore, if students are not well motivated by the teachers they may not be putting in their best in learning. According to Ormrod, (2010) teachers can do many things to motivate students to learn and behave in ways that promote their long term success and productivity.

Supervision of practical is essential in guiding students when they are in the laboratory for physics practical. Even with the laboratory manual students still need laboratory instructor or technologist to guide them, where this is not properly done students find it very difficult to perform well.

Laboratory condition is essential to good performance in physics practical, that is why Aina,(2010) stressed that physics laboratory must be built following an acceptable standard. When physics laboratory is not built properly with correct facilities, learning practical in such laboratory will be hindered and it will be reflected in student's performance. There are facilities that physics laboratory must contained and should not be compromised under any condition (Aina, 2010).

Laboratory apparatuses are central and very important to physics practical, where such apparatuses are not adequately provided student's performance is affected. The analysis above agrees with the submission of Ajileye,(2006) that insufficient laboratory equipment affect student's performance in science.

There is no way we can separate physics theory from practical, because principles, laws and concepts, learned in theory are applied in practical. Aina,(2011) argued in his paper on the relation between student's academic performance in theory and practical physics, that

knowledge gained in theory assists in practical. Students must relate the two together for good performance in physics.

Graph is very important in physics because it is the easiest and shortest way of communicating findings in physics to the world. Students in physics should be able to plot good graph and correctly interpret graphical information. Essentially physics students should be able to draw and label axes of the graph, plot points accurately, choose good scale, identify and join best points, and be able to interpret any information on the graph. Calculation is an integral part of physics and therefore physics students must be very good in calculation. Meltzer, (2002) is of the opinion that there is a positive correlation between student's mathematical skills and their exams grade in physics.

Allocation of appropriate and adequate time to physics practical is very significant and also care should be taken in choosing the suitable time of the day for the conduct of physics practical.

Every experiment must have conclusion and report, that is why students should be able to infer correctly from all the experimental activities carried out in physics laboratory. There should be good inference showing that students under stood the title of the experiment he/she performed. Physics students should know how to write practical report.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

The aim of this chapter is to summarize the findings, draw some conclusion as well as to make some recommendations that may be helpful in minimizing the problems that are facing students in the conduct of physics practical in senior secondary schools in Sokoto metropolis.

5.2 Summary

As mentioned earlier on, the aim of this research is to make a critical appraisal of the seriousness of the problems of students in conducting effective physics practical in senior secondary schools in the Sokoto metropolis, in the course of the study a lot of problems were identified and analyzed to be responsible for the ineffective conducts of physics practical, these problems ranges from the problem in identifying physics apparatuses, problem in setting the apparatuses, problem in making observations, problem in preparing table of values, problem in plotting graph, insufficient laboratories and laboratory equipments, lack of motivation, lack of laboratory text books and manuals and inadequate time allocation to physics practical class among others.

However practical work is used in order to clarify and extend student's experience of the natural phenomenon and illustrate laws which make this phenomenon predictable. In essence for many students of science to understand and appreciate scientific skills, practical work is inevitable. Bearing all this in mind science teachers had a great role to play in making their decisions, and ready to modify and find solutions to already discussed problems in the light of experience.

5.3 Conclusions

This study has revealed that there are problems militating against effective conducts of physics practical in senior secondary schools in Sokoto metropolis. Having collected and critically analyzed the information gathered, the researchers here by draw the following conclusions.

There are problems facing students in the conduct of physics practical in senior secondary schools in Sokoto metropolis. Hence hypothesis (1) which says that: there are no problems facing students in the conduct of physics practical is rejected.

There are solutions to the problems facing students in the conduct of physics practical. Therefore hypothesis (2) which says that there are no solutions to the problems facing students in the conduct of physics practical is also rejected.

Lack of laboratories and laboratory equipments is militating against a successful practical lesson as indicated by some teachers. Hence hypothesis (3) which says that: there is

no significant relationship between the availability of laboratory equipment and the effective conduct of physics practical is also rejected.

There is no adequate and appropriate time allocation to physics practical as indicated by some teachers. Hence hypothesis (4) which says that: there is no appropriate and sufficient time allocation to physics practical is accepted.

5.4 **Recommendations**

In the light of the above conclusions the following recommendations are here by suggested:

1. Government should ensure that good practical text books are provided in school libraries.
2. Emphasis should be on good grade in sciences related subject before admitting any students into physics class.
3. The course contents of science subjects should be made to be very rigorous so as to encourage those who will eventually study.
4. All schools should have a standard physics laboratory that is well equipped with modern physics equipments.
5. All obsolete physics apparatuses should be done away with in senior secondary schools and put new ones in place.
6. Physics teachers should make sure that all physics students are well taught in the area of graph

7. Students should be well motivated even when they are not doing fine in practical.

5. 5 Contributions to Knowledge

This research has contributed immensely to the development of knowledge by highlighting he important relationship that exists between physics theory and practical, it also illustrated the importance of experiment in physics and science in general. It also revealed the major problems in the conduct of experiments for stakeholders to take action. It stressed the importance of morning period for the conduct of experiments which is crucial but neglected.

5.6 Suggestions for Further Studies

Practical work is very significant in physics Education, despite its importance there is less research work in the area in Nigeria. Hence, the in-coming researchers are hereby urged to take off from the following:

* Effect of practical knowledge on the academic performance of students in physics.
* Attitudes of students toward physics practical
* The role of practical work in physics.

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APPENDIX I

Student's Questionnaire

Research topic: Problem of students in conducing effective physics practical in senior secondary school in Sokoto metropolis.

The researchers are final year student of Usmanu Danfodiyo University, Sokoto conducting a research on the problems of students in conducting effective physics practical in senior secondary school in Sokoto Metropolis. The research is in partial fulfillment of the requirement for the award of Bachelor Degree of science Education Physics. Please, Kindly answer the question below, make a tick.

Your assistance in completing this questionnaire would be highly appreciated in order to make the study successful. Your response will be treated logically, systematically and confidentially.

Section A (Bio Data)

School:

Sex:

Age:

Class:

Date:

Section B

1. Do you have problem in conducting physics practical

(a) Yes (b) No

2. Do you have practical text book and laboratory manual?

(a) Yes (b) No

3. Can you identify physics apparatuses?

(a) Yes (b) No

4. Do you have problem in setting the apparatuses?

(a) Yes (b) No

5. How do you find physics practical class?

(a) Interesting (b) Not Interesting

6. Do you have problem in making observations?

(a) Yes (b) No

7. Can you precisely take readings and prepare table of values?

(a) Yes (b) No

8. Do you know how to plot a graph appropriately?

(a) Yes (b) No

9. In calculation related to practical where do you have problems?

(a) Calculation of slope (b) questions and calculations related to practical (c) relating physics equation with graph for calculation.

10. Do you have problem in writing conclusions and practical report?

(a) Yes (b) No

APPENDIX II

Teacher's questionnaire

Research topic: Problem of students in conducing effective physics practical in senior secondary school in sokoto metropolis.

The researchers are final year student of Usmanu Danfodiyo University, Sokoto conducting a research on the problems of students in conducting effective physics practical in senior secondary school in Sokoto Metropolis. The research is in partial fulfillment of the requirement for the award of Bachelor Degree of science Education Physics. Pleaser, Kindly answer the question below, make a tick.

Your assistance in completing this questionnaire would be highly appreciated in order to make the study successful. Your response will be treated logically, systematically and confidentially.

Section A (Bio Data)

School…….

Qualification……

Date:……

Section B

1. Are you conducting physics practical in your school?

   (a) Yes (b) No

2. Does the laboratory in your school contain adequate physics laboratory equipments?

(a) Yes (b) No

3. If yes, are the equipments in a good condition and well functioning?

   (a) Yes (b) No

4. Is there adequate maintenance of physics laboratory equipments in your school?

   (a) Yes (b) No

5. Does insufficient practical equipment hinders effective conduct of physics practical in senior secondary school?

   (a) Yes (b) No

6. How many periods allocated to physics practical in your school per week?

   (a) Twice (b) Once (c) Thrice (d) None

7. What is the duration allocated to physics practical class in your school?

   (a) 30 minutes (b) 45 minutes (c) 1 hr.

8. In what time of the day do you conduct physics practical?

   (a) Morning (b) Afternoon

9. What is the suitable and appropriate time of the day for conducting physics practical?

   (a) Morning (b) Afternoon

10. Do you think that lack of motivation and interest hinders good performance of students in physics practical?

    (a) Yes (b) No

11. Do you think that provision of standard physics laboratory can solve the students problems in conducting physics practical?

    (a) Yes (b) No

12. How can the students negative attitude toward physics practical be solved

    (a) Motivating students even when they are not doing fine in practical.

    (b) Proper supervision of student when conducting physics practical

13. Can the provision of adequate laboratory equipment be solution to the problem in conducting physics practical?

    (a) Yes (b) No

14. What else do you think can help kin solving the problems of students in conducting effective physics practical?

    (a) Allocation of adequate time to physics class

    (b) Provision of practical text books and practical manuals.

15. What is the adequate and appropriate time allocation to physics practical class?

    (a) 30 minutes (b) 45 minutes (c) 1 hr