**THE EXTENT OF IMPLEMENTATION AND ADHERENCE TO SAFETY PRACTISES AMONG STAFF AND SENIOR SECONDARY SCHOOL STUDENTS IN ENUGU SOUTH LOCAL GOVERNMENT AREA OF ENUGU STATE**

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**TITLE PAGE**

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**A RESEARCH WORK SUBMITTED TO THE DEPARTMENT OF SCIENCE AND VOCATIONAL EDUCATION FACULTY OF EDUCATION GODFREY OKOYE UNIVERSITY UGWU- OMU NIKE ENUGU IN PARTIAL FULLFILLMENT OF THE REQUIRMENT FOR THE AWARD OF BACHELOR OF SCIENCE IN EDCATION. (B. SC.Ed)**

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**July 2018**

**CERTIFICATION PAGE**

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Maduka Adaobi Joycelyn Date

U16/EDU/BIO/027

**DEDICATION**

 This work is dedicated to the Blessed Virgin Mary who, through her intercession has guided my footsteps.

**ACKNOWLEDGEMENTS**

I wish to register my profound gratitude to God who has been my spiritual assistant. I am equally thankful to my beloved parent Late Mr. and Mrs. Obioma Maduka for their efforts to see me through my academic pursuit and my Benefactor: Dr. Godwin Maduka for his provision to my needs. I am thankful to my Supervisor Dr. Ezugwu for his humble efforts by way of constructive, criticism and proof reading of this project which has helped in making this work a successful one. I am also grateful to my humble HOD Prof. U. Agwagah for motherly care and great understanding towards me. To my lecturer. Prof. Nkadi Onyegegbu. for her moral instructions over my life. In the same vein I am grateful to my classmates and Friends for their assistance in my academic pursuits.

My prayer is that God should meet you all in your own time of needs.

**TABLE OF CONTENTS**

Title page i

Approval page ii

Certification: iii

Dedication: iv

Acknowledgement: v

Table of content: vi

Abstract: vii

**CHAPTER ONE: INTRODUCTION**

Background of the Study 1

Statement of the Problem 3

Purpose of the study 4

Objectives of the study 4

Research questions 5

Scope of the study 6

**CHAPTER TWO: REVIEW OF RELATED LITERATURE**

Conceptual Frame Work 7

Theoretical Frame Work 11

Review of Related Empirical Studies 17

Summary of Review of Related Literature 21

**CHAPTER THREE: RESEARCH METHODS/METHODOLOGY**

 Design of the study 22

Area of the Study 22

Population of the Study 23

Sample and Sampling Techniques 23

Instrument for Data Collection 23

Validation of the Instrument 24

Reliability of the Instrument 25

Method of Data Collection 25

Method of Data Analysis 26

**CHAPTER FOUR: ANALYSIS OF DATA AND RESULTS**

Research Questions /Result 27

**CHAPTER FIVE: DISCUSSIONS, CONCLUSIONS, IMPLICATIONS, RECOMMENDATIONS, LIMITATION, SUGESSIONS AND SUMMARY OF THE STUDY.**

Discussion of findings 33

Conclusions

Recommendations 36

Limitations 37

Suggestions for Further Research 37

Summary of the Study 38

References 39

Appendix 1 41

Appendix 2 42

Questionnaire 43

Appendix 3 44

***ABSTRACT***

*The topic of this study is the extent of implementation of safety practices among senior Secondary Schools in Enugu South Local Government Area of Enugu State. There has been a persistent decline in implementing safety practices to a large extent in the biology laboratories among senior secondary schools. This ugly trend has been of great concern to the government, educators and the society. The purpose of the study is to identify the extent of implementation and adherence to safety practices in biology laboratories. The design of the study was a descriptive survey research. The area of the study is Enugu South Local Government Area. The populations of the study consist of 14 Secondary Schools from which 5 schools were selected from the population. The researcher randomly selected 100 respondents. A sample size of 75 students and 25 teachers was used. The instrument used for data collection was questionnaire. The data collected was analyzed using simple mean which significantly guided the study. The researcher found out that safety practices is poor and is not encouraging during practical. The researcher recommended that the Government should increase their funds in assisting the school management for a suitable laboratory building and the school administration should send science teachers for training through seminar and workshop.*

 **CHAPTER ONE**

 **INTRODUCTION**

**Background of the study**

Biology is a science that is concerned with life processes. The study of biology is mainly accomplished through practical activities usually performed in well equipped biology laboratories. The biology laboratory is a room or a building in a school or college where the practical side of biology is taught. It is usually a place set aside for conducting practical activities in biology .The central role of biology laboratory as identified by Voss (2012) is to provide illustration of some basic principles and to teach the students the applications of the principles so acquired. A well equipped biology laboratory enables students to develop good judgments, self reliance, critical thinking, technical personal contact with apparatus and materials present in the laboratories under the direction\supervision of the teacher.

A biology laboratory needs to be well organized so that a climate for investigating scientific concepts will exist such a climate ensures that the laboratory is safe for those using it. Since laboratory environment is meant for man to handle, accidents and injuries are bound to occur. Therefore the teacher in biology laboratory is responsibly committed to teaching his students on how to handle chemicals and materials, so as to bring about good results in a safe manner of preserving life. In this regard, Byrd (2004) posited that most of the accidents and injuries that occur in secondary schools biology mainly result from inadequate knowledge of safety rules, insufficient skill by the laboratory workers and carelessness .

The students when using the laboratory have the obligation to help themselves and others; the teachers on their own part have to inculcate safety knowledge and practices into their student so they can develop a philosophy of safety that emphasizes positive rather than negative habits.

According to the advance learner dictionary, safety is freedom from danger or risk. The importance of safety measures in biology laboratories is very necessary for both students and teachers to reduce or eliminate the occurrence of laboratory hazards. In this regard, Osborne (2012) maintained that most laboratory hazards can be reduced to minimum occurrence by good value, careful manipulation of laboratory apparatus, adequate supervision and the knowledge of the safety practices and their applications. It is obvious that anyone who is not safety conscious stands the greatest risk of turning a minor hazard into an accident which may be fatal. Also, there is need for safety facilities like fume, eye goggles, fire extinguishers, sink, lab coat, waste containers and first aid boxes to be provided in the biology laboratory as their absence may create health hazard. Though it is not enough to provide these safety equipment, supervision of the students during laboratory activities is also necessary.

Appropriate safety practices in biology laboratories in secondary schools can reduce the rate of accidents and guarantee safety of the students in the laboratories. A standard biology laboratory should have certain specified rules and regulations as well as safety materials and equipment presented to the students before allowing them to work in the laboratory and their implementation should be ensured.

These safety rules are guidelines designed to help keep both the students and the instructors’ safe when experimenting. Some equipment and chemicals in a biology laboratory can cause serious harm. It is always wise to follow all laboratory safety rules which are a sample of the most basic rules that should be followed when in biology laboratory,

**STATEMENT OF THE PROBLEM**

Since the inclusion of laboratory experience in the teaching and learning of biology, the question of both staff and students during practical work have become crucial. Biology laboratories have been established in some Nigeria secondary schools without safety considerations in their designs and constructions (Abdullahi, 2000). Poor safety practices in biology laboratories have led to accidents such as glass breaking, skin contact with specimens and chemicals, injury, fire out breaks and even death.

In the light of the above, it is therefore necessary to investigate the extent of implementation on safety practices in biology laboratories in using randomly selected secondary schools in Enugu South of Enugu state, Nigeria.

**PURPOSE OF THE STUDY**

The purpose of this study is to identify the extent of implementation and adherence to safety practices among staff and senior secondary school student in biology laboratories in Enugu South Local Government Area.

**OBJECTIVES OF THE STUDY**

Specifically the study intends to find out:

* The general designs and fittings of biology laboratories relevant to safety.
* The availability of safety equipment and materials in biology laboratories
* The services of laboratory assistants that are employed to ensure safety.
* The extent of implementation of safety rules biology laboratory.

**SIGNIFICANCE OF THE STUDY**

This research work will be beneficial to the following groups: National science teachers association (NSTA), students, teachers and school administrators.

Student who have phobia for practical’s in science laboratories due to the occurrences of hazards and accident in the science laboratory will find this work reliable in order to develop good attitudes, safe and conscientious laboratory habits in any practical field of study.

The teachers and other laboratory staff should also see the need of keeping the rules, developing slogans about them, writing some of them on the cardboard sheets hung on the laboratory. With these, practical work will be conducive through safety measures in the science laboratories.

The school administrators will find this work relevant by providing an adequate facility such as good modern and reliable building with necessary equipment where laboratory investigation can be conducted with ease.

The national science teachers association will find the best means to administer the groups of objectives that may be achieved through the use of laboratory in science classes such as attitude, understanding the nature of science, cognitive abilities, acquisition of knowledge concept and skills.

**RESEARCH QUESTIONS**

The following research questions have been formulated to guide the study.

1. How does the type of design and fitting in the biology laboratory appropriate to ensure safety?
2. To what extent is safety equipment available in the biology laboratory?
3. How often do services of laboratory assistants employed, ensures safety during laboratory instructions.
4. To which measures does the secondary school biology student apply safety practices during practical sessions?

**THE SCOPE OF THE STUDY**

The study looks at the extent to which safety practices are implemented by staff and adherence to safety rules among students in biology laboratories in senior secondary schools in Enugu south local government area of Enugu state.

 **CHAPTER TWO**

**LITERATURE REVIEW**

The literature of this study has been carried out and organized under the following sub-headings:

Conceptual framework

Theoretical framework

Empirical review

Summary of literature review

**Conceptual framework**

1. Concepts of biology

2. Concepts of biology laboratory

3. Concept of safety practices

 **Concepts of biology**

Biology, also referred to as the biological sciences, is the study of living organisms utilizing the scientific method (Howell and Elizabeth 2014) Biology examines the structure, function, growth, origin, evolution, and distribution of living things. It classifies and describes organisms, their functions, how species come into existence and the interactions they have with each other and with the natural environment. Four unifying principles form the foundation of modern biology: cell theory, evolution, genetics and homeostasis. Biology as a separate science was developed in the nineteenth century, as scientists discovered that organisms shared fundamental characteristics. Biology is now a standard subject of instruction at schools and universities around the world, and over a million papers are published annually in a wide array of biology and medical journals. Most biological sciences are specialized disciplines.

Traditionally, they are grouped by the type of organism being studied: botany, the study of plants; zoology, the study of animals; and microbiology, the study of microorganisms

**The fields of biology based on scale**

The fields within biology are further divided based on the scale at which organisms are studied and the methods used to study them: biochemistry examines the fundamental chemistry of life; molecular biology studies the complex interactions of systems of biological molecules; cellular biology examines the basic building block of all life, the cell; physiology examines the physical and chemical functions of the tissues and organ systems of an organism; and ecology examines how various organisms interact with the environment . Applied fields of biology such as medicine and genetic research involve many specialized sub-disciplines (Benson David 2008).

A central organizing concept in biology is that life changes and develops through evolution and that all life forms known have a common origin.

Charles Darwin established evolution as a viable theory by articulating its driving force, natural selection (Alfred Russell Wallace is recognized as the co-discoverer of this concept in 1835).

Darwin theorized that species and breeds developed through the processes of natural selection as well as by artificial selection or selective breeding.

Genetic drift was embraced as an additional mechanism of evolutionary development in the modern synthesis of the theory.

Biological form and function is created from and is passed on to the next generation by genes, which are the primary units of inheritance.

Despite the complexity of the science, there are certain unifying concepts that consolidate it into a single, coherent field. Biology recognizes the [cell](https://en.wikipedia.org/wiki/Cell_%28biology%29) as the basic unit of life, [genes](https://en.wikipedia.org/wiki/Genes) as the basic unit of [heredity](https://en.wikipedia.org/wiki/Heredity), and [evolution](https://en.wikipedia.org/wiki/Evolution) as the engine that propels the [creation](https://en.wikipedia.org/wiki/Speciation) and [extinction](https://en.wikipedia.org/wiki/Extinction) of [species](https://en.wikipedia.org/wiki/Species). [Living organisms](https://en.wikipedia.org/wiki/Organism) are [open systems](https://en.wikipedia.org/wiki/Thermodynamic_system) that survive by transforming [energy](https://en.wikipedia.org/wiki/Energy) and decreasing their local [entropy](https://en.wikipedia.org/wiki/Entropy) to maintain a stable and vital condition defined as [homeostasis](https://en.wikipedia.org/wiki/Homeostasis).

Sub-disciplines of biology are defined by the research methods employed and the kind of system studied: [theoretical biology](https://en.wikipedia.org/wiki/Mathematical_and_theoretical_biology) uses mathematical methods to formulate quantitative models while [experimental biology](https://en.wikipedia.org/wiki/Experimental_biology) performs empirical experiments to test the validity of proposed theories and understand the mechanisms underlying life and how it [appeared](https://en.wikipedia.org/wiki/Abiogenesis) and evolved from non-living matter about 4 billion years ago through a gradual increase in the complexity of the system.

**The concept of a biology laboratory**

A biology laboratory is a work place for conducting scientific research. In the school, it is an instructional facility used by the teacher to help students learn about science and how scientists investigate the world around them. It provides learners with the opportunity to design and execute investigation, engage in scientific reasoning, manipulate equipment, generate, record and analyze data and then discuss results. In the biology laboratory learners are brought into direct contact with materials, object apparatus, devices, tools they manipulate through procedures that reflect scientific thinking. The procedures entail mimicking and learning how scientist works. Laboratory activities enable them to acquire and apply science process skills which include observation, experimentation, hypothesizing etc. All these leads to acquisition of first hand scientific knowledge and development of scientific habits, skills and attitude .The laboratory provides learners the opportunity to develop the personal qualities of scientist, which include honesty, openness, accuracy fairness, patience, perseverance and objectivity (Ezugwu2017).

**Concept of safety practices**

 Safety is the state of being safe and the condition of being protected from harm or the non-desirable outcomes. Safety can also refer to the control of recognized hazards in order to achieve an acceptable level of risk (Charles G. Oakes 2012).

Safety practices are generally written methods outline on how to perform a task with minimum risk to people, equipment, materials, environment and processes. Safety practices are developed as a result of completing a hazard assessment and laboratory or sector of construction. Some safety practices require specific procedures which clearly set out in a chronological order to each step in a process.

**Theoretical Framework**

The study considered psychological learning theories such as the Brunner’s theory of instruction, it also considered theories of Educational Administration and management such as the system theory and scientific management theory as being pertinent and are presented as follows

Brunner’s theory of instruction

Brunner, a cognitive and developmental psychologist viewed human being as information processors, thinkers and creators of ideas (Brunner cited in Eze, 2006). Brunner’s major concerned was to determine how individuals actively select, retain and transform information which is the main essence of learning. The theorist pointed out that acquisition of knowledge in whatever form is active process because by nature man actively interacts with his environment adjusting is to suit his purpose. Brunner also believed that a person actively constructs knowledge by relating incoming information to previously acquired psychological frame of reference. The theorist stressed that an individual is not a passive or reactive organism but one who actively select information in order to achieve valued goals (Brunner cited in Ezenwa, 2011)

Bruner’s ideas about learning can be related to the extent of implementation and adherence of safety practices in Biology Laboratories since both require active participation of the learner. Also the theorist pointed out that a learner actively constructs his knowledge by relating new content being learnt to previously acquired information as well as uses his information in future circumstances. This can equally be applied to extent of implementation and adherence of safety practices in Biology Laboratories since students relate their previous knowledge with the learnt safety practices before implementing and adhering to it.

The Systems Theory

In this theory an organization is seen as a social system which can be further sub-divided into subsystems each having a supra system which constitute its environment. There is a believe that the only meaningful way to study an organization is to study it as a system. That is why ( Nwankwo 1982) in (Okpala Oka 2009) defined a system as a unit with series of inter-related and inter-dependent parts such that the interplay of any part affects the whole. A system can therefore be regarded as a structure with inter-dependent parts. For example, with the educational system, there is other sub system as Primary, Secondary and Tertiary sub-systems. It is based on the concept of system that the system theory was developed.

Consequently looking at Biology Laboratory system, the system theory is relevant to the implementation and adherence of safety practices in biology laboratories because, the entire Biology Laboratory set up is a system, where the concept of interaction and interdependence of parts with others is applicable. According to ( Edem 2006) , in any social system, all the subsystems work towards the maintenance of the life of the social system as a whole, the survival of which depends on its capacity to maintain consistency in the processes and relationship within and outside the system. To survive, the system and its subsystem must be open, that is, they must have the capacity to relate to and exchange matter with their environments, unlike a closed system which cannot do so. Hence the extent of implementation and adherence of safety practices in Biology Laboratories depends on the whole Biology Laboratory system.

In Biology Laboratory System, three main levels can be identified first, the technical function which are the actual processes of teaching second, the managerial system or administration whose functions are to mediate between the school and outside world as well as to administer the schools internal affairs and third, the community system, a wider social system, which prescribes conditions for the control of the activities of the school so that it can reach its goals and be acceptable to public.

The scientific management theory.

The scientific management being one of the earliest administrative theories emphasized productivity at the expense of the human worker. All actions are intended to increase the productivity of the worker. For example, encouraging overtime work and pressurizing people seen only as a work harder. A worker is seen only as a worker who has no independent decisions about their work. The manager had the overall authority and control over him.

According to Nwankwo (1988) in Okpala Oka (2009)
it is believed that man can be so managed that he can work as fast and efficient as a machine. A proponent to this school of thought is Frederick W. Taylor. He is regarded as the father of scientific management’ because of his pioneer works in this area. Taylor’s main concern was the achievement of efficiency of workers by maximizing their outputs through the application of what he called principles of scientific management. He believed that best way to run organizations is for the administrator to know what to expect from the workers, and ensure that the workers achieve those things in the cheapest way possible. Accordingly, Taylor proposed six management principles which were summarized and highlighted by (Ukejie; Akabogu and Ndu 1992:28-29) In (Okpalaoka 2009) as seen in the subsequent paragraphs.

* **Time Study Principle**

This principle is that any work to be done must be accurately measured by time and standard time should be established for all works. This means that any given work must be finished within a stipulated period of time.

**Piece Rate Principle**

It holds that the amount of money to be earned by a worker should be determined by the amount of work done. This payment should be by result.

* **Scientific Method Of Work Principle**

It holds that, the management is expected to identify the best way to perform any organization’s Jobs and train workers accordingly.

* **Managerial Control Principle.**

It is expected that management should be knowledgeable in scientific management principle through training and should be able to apply them accordingly.

Notwithstanding, scientific management theory evoked public disapproval being criticized as an attempt to reduce human beings to machine, Foster the attainment of organization goals and objectives and make provision for the selection and training of staff remains indisputably important. (Edem 2006) stressing further, Taylor’s idea of efficiency demands that an organization

Must attain its objective and that these responsible for its administration must aim at a result to achieve. It also advocates the award on benefits, merit and stresses the need to keep on working until the result is achieved.

However, we must note that some of Taylor’s ideas is not applicable in school. For example the standardization of work thus, there are as many methods to use when working in biology laboratory. Therefore the ability to apply the right concepts of system theory and scientific management theory at the appropriate situation affect the extent of implementation and adherence of safety practices in biology laboratories among senior secondary schools.

**Empirical review**

According to the advance learners English dictionary, to organize means to coordinate and prepare for an activity while to manage means to organize or to deal with something that one has or controls (Osborne 2008). He stated that laboratory organization begins by providing the necessary facilities, services and materials while the stage where the provided facilities, services and materials have to be looked after adequately and made available for use is seen as laboratory management. Furthermore, ( Iwang 2010) pointed out that laboratory management consists of controlling the use of laboratory materials and facilities in order to make the laboratory a safe place for all the people making use of it. He also pointed out that making the school laboratory a safe place for teachers and students to work is a very essential aspect of laboratory management .( Mbanugo 1999), suggested that the science teachers 'activities during practical classes should include handling of chemicals ,labeling of containers ,transferring of liquids, water mixing and cleaning of glass wares. In his own view, he maintained that poisonous and highly toxic substances must be labeled and kept in a locked cupboard or store while apparatus and laboratory materials should be used only for purposes sanctioned by the teacher. Students must not be allowed to perform unauthorized experiments. He further explained that waste solid must be put in trash bins provided and not in sinks; liquid substance should not be tasted without definite instruction from the teacher. Again the working environment in the laboratory should be conducive so as to ensure safety.

(Ogbodo 2010) He discovered that the type of personnel employed as laboratory attendants do not help matters in terms of maintaining safe and good working environment. He identified the lack of qualified laboratory technicians as the cause of the unsafe practices and problems which exist in the biology laboratories. He reported that another factor that hinders good laboratory environment and instruction is unqualified science teachers. The qualified science teachers employ laboratory management skills and knowledge to a large extent than the lowly experienced science teachers.

 **Teacher's Role in Maintaining Safety Practices in Biology laboratory**

(Ogbodo 2010) pointed out that all items that clearly pose danger to student should be removed or controlled by the laboratory assistant. A very good way of avoiding accidents during laboratory activities is to prompt them to students before they occur, highlight all possible dangers if any before the beginning of each laboratory activities The teacher should be observant by going round the laboratory while students are carrying out laboratory activities and fully equipped first aid boxes should be kept in the vicinity of everybody in case of any accident.

**Location, Shape and Design of biology Laboratory**

The biology laboratory can be on its own or part of a building .It can be a part of bungalow or a storey building .If part of a storey building , it can be upstairs or downstairs .It should be on its own, a separate building bungalow or a storey building preferably, located towards the east end of the school compound. It should be separated and a little distance away from other buildings in the school compound for some reasons, such as

1. In future it can be expanded when the need for that arises and requirements are available.

2. To protect other school facilities and their users from radiation, smells, fire, explosion and other hazards that might come from the laboratory.

3. To reduce noise and other forms of distraction that might come from the classroom, offices, workshops, hostels, playgrounds etc to interfere with instructions and activities in the biology laboratory.

4. To avoid damages, injury or losses that could be caused by stay game and sports equipment from playing ground if located close to the laboratory.

5. To enhance safety of the laboratory and its equipment from thieves, fire out break from other facilities. It is better to burglar- proof and guide it better when it is separated from other facilities. (Ezugwu2017)

Good modern reliable building materials are used to construct the walls and floor of the laboratory while Asbestos or aluminum are used for the roof and the ceiling The floors of a biology laboratory should be even and smooth .The laboratory hall proper can be square, rectangular , U- or semi- circle or T - shaped .

In the biology laboratory the largest space is the hall, where the learners interact with the science curriculum, instructional materials and the teacher. It is the actual learning environment. The hall is equipped with tables, cupboard, racks shelves, tools as well as real conventional science laboratory materials, tools, equipment, apparatus and gadgets which the learners and teacher work with.

Ideally, the laboratory hall is designed to have large double doors at opposite ends to enhance free movement into and out of the laboratory hall. The windows are large, low and oppositely located.

According to (Maria Harris 2018) a biology laboratory is an expensive investment and is expected to last for many years. A well designed laboratory will impact generations of students, teachers and technicians.

According to ( Omiko 2007) he sees the biology laboratory as the heart of a good scientific program which allows students to have experiences which are consistent with the goals of scientific literacy. This implies that science teaching and learning cannot be completely done in a secondary school where there is no well designed and equipped laboratory.

**Summary of literature review**

Words that form the framework of the research topic were explained under the conceptual frame work

The safety practices upon which this research topic is predicted was comprehensively discussed under the theoretical framework

Related research works were reviewed under the empirical studies.

 **CHAPTER THREE**

 **RESEARCH METHOD**

The chapter is discussed under the following headings : Design of the study, Area of the study, Population of the study, Sample and sampling techniques, instrument for data collection, validation of the instrument ,reliability of the instrument ,method of data collection, method of data analysis and decision rule.

 **Design of the study**

The research design of this study is a descriptive survey which according to Nworgu (2006) ,is a design that collects data on a given population , and describes the data in a systematic manner pointing out the characteristic features or facts about that population. It was designated in such a way that their needed result will be accomplished to achieve a higher level of confidence.

  **Area of the study**

This research is to be carried out in all the secondary schools in Enugu South Local Government Area of Enugu State.

 **Population of the study**

The population of the study is all the secondary schools teachers and students in Enugu South Local Government Area of Enugu State. There are fifteen (14) secondary schools with 29 biology teachers and 13,424 senior students (post primary schools management board) in Enugu South Local Government Area of Enugu State.

 **Sample and Sampling Techniques**

A simple random sampling procedure was employed to sample. Five (5) schools out of 14 out of 14 secondary schools Five (5) teachers and (15) students in each of the five secondary schools were sampled from each of the schools making a total of (20) respondents from each of the five secondary schools giving a total of 100 respondents.

 **Instrument for Data Collection**

The instrument used for the data collection is questionnaire. It was used for biology teachers and students in the sampled senior secondary schools. The questionnaire is made up of two sections A and B, section A contains the biographical data of the respondent while section B contains items relating to the research study.

The response format;

Strongly Agree (SA)

Agree (A)

Disagree (D)

Strongly Disagree (SD)

The respondents are expected to express the degree of their agreements or disagreements with each of the interest statement by a tick (√) in the appropriate column. The range of the scoring skewed for positively interested statements is (4-1) for (SA-SD) while the negative skewed statement is (1-4) for (SA-SD)

**Validation of the instrument**

The following procedures were adopted to establish the validity of the instrument, which refers to the extent to which an instrument measured that which it is designed to measure (Nworgu, 2006).

This questionnaire was subjected to two forms of validation, face and content validation. Face and content validation was carried out by three people, a measurement and evaluation expert and two biology teachers in one of the senior secondary schools. The validators examined the instruments based on clarity of questions, appropriateness of the questions to the student’s level of understanding and experience as well as agreement in addressing the purpose of the study.

The valuators' made corrections and the suggestions were incorporated into the final draft before producing it.

 **Reliability of the Instrument**

The coefficient of correlation was used to determine the internal consistency of the instrument The data obtained were analyzed finding the relationship of each item in the instrument using person’s product moment formula and result obtained was 0.83 indicating that the instrument is reliable for the study.

 **Method of Data Collection**

The instrument used in data collection was personally administered by the researcher to the teachers and students. After discussing with them the purpose of her coming and of the study, the researcher proceeded to distribute the questionnaire to the teachers and the students. The teachers and the student were requested to complete the instrument and submit on the appointed date on which the researcher collected them.

**Method of Data Analysis**

The data were analyzed using mean scale. The mean values are obtained by summing up the product of the nominal values assigned to the scaling items and dividing by the number of the sample size. Thus, mean above$\overbar{ x}- \frac{∑fx}{∑f}$.

The mean score of 2.50 was regarded as the acceptable mean. Any item with a mean of 2.50 and above was regarded as accepted (as providing a positive answer) while any item with a mean below 2.50 was regarded as providing negative answer and hence rejected.

Therefore, 2.50 are regarded as the decision point for the items in the table research questions.

**CHAPTER FOUR**

 **RESULTS**

 **Research Questions**

This chapter presents the analysis of the data collection and the tables that contain the details of the data.

**Research Question 1**

**How does the type of design and fitting in the biology laboratory ensure safety?**

Mean responses on the designs and fittings in the biology laboratories to ensure safety**.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S/N** | **Item Description** | **N** | **SA** | **A** | **D** | **SD** | **Total** | **X Mean** | **Dec** |
| 1 | The biology laboratory is separated a little distance away from other buildings in the school compound | 100 | 520 | 1236 | 50100 | 3333 | 100189 | 1.89 | R |
| 2 | The biology laboratory size is large and it accommodates learners for practical work  |  | 50200 | 3090 | 1020 | 1010 | 100320 | 3.2 | A |
| 3 | The Biology is equipped with different types of furniture such as tables, stools, cupboards, racks, shelves and chairs. |  | 1040 | 2060 | 50100 | 2020 | 100220 | 2.2 | R |
| 4 | The Biology Laboratory is designed with large double doors at opposite ends |  | 50200 | 40120 | 520 | 55 | 100345 | 3.4 | A |
| 5 | There are low and large windows facing one another as well as high windows. |  | 40160 | 60120 | 00 | 00 | 100280 | 2.8 | A |
|  | Total mean |  |  |  |  |  |  | 2.70 |  |

Table 1 shows the respondents responses (teachers response) on the type of designs and fittings in the biology laboratory appropriate to ensure safety . It shows the mean scores of 1.89, 3.2, 2.2, 3.4 and 2.8 therefore total mean for table 1 is 2.70 which is above the acceptable mean this means that the type of design and fitting in the biology laboratory do not ensure safety.

**Research Question II**

**To what extent is safety equipments available in the biology laboratory?**

Table II: Mean responses on the availability of safety equipment in biology laboratory

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| S/N | Item Description | N | SA | A | D | SD | Total  | X Mean | Dec |
| 6 | There are first aid kits in the biology laboratory |  | 30120 | 1030 | 50100 | 1010 | 100260 | 2.6 | A |
| 7 | The safety rules and slogan are hung on the wall. |  | 40160 | 1030 | 4386 | 77 | 100283 | 2.8 | A |
| 8 | The student wash their hands after practical |  | 50200 | 3090 | 1020 | 1010 | 200320 | 3.2 | A |
| 9 | Trash bins are present in the biology laboratory for all types refuse |  | 1040 | 39 | 70140 | 1717 | 100206 | 2.0 | R |
| 10 | Hand gloves and goggles are available in the biology laboratory |  | 2392 | 1545 | 50100 | 1212 | 100249 | 2.49 | R |
| 11 | Bucket of dry sand are available in the biology laboratory |  | 50200 | 3296 | 714 | 1111 | 100321 | 3.21 | A |
| 12 | Fire extinguishers are available in the biology laboratory |  | 50200 | 2060 | 2040 | 1010 | 100310 | 3.1 | A |
|  | Total mean |  |  |  |  |  |  | 2.7 |  |

Table 2 shows respondent responses on the availability of safety equipment in biology laboratory. It shows the mean scores of 2.6, 2.8, 3.2, 2.0, 2,49, 3.21 and 3.1. Therefore the total mean for table 2 is 2.7 which is above the acceptable mean, this means that there is availability of safety equipment in biology laboratory.

**Research Question III**

**How often do services of laboratory assistants employed ensures safety during laboratory instructions**

Table III: Mean responses on the services of laboratory assistants and personnel ensuring safety in biology laboratory.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S/N** | **Item Description** | **N** | **SA** | **A** | **D** | **SD** | $$\overbar{M}$$ | **X** | **Dec** |
| 13 | The laboratory assistants supervise the learners during practical activities in the biology laboratory  | 200 | 80230 | 1442 | 612 | 00 | 100284 | 2.8 | A |
| 14 | The laboratory assistant gives out detailed instructions to the student before and during practical work |  | 80320 | 1030 | 510 | 55 | 100365 | 3.65 | A |
| 15 | Labelled reagents are used during practical |  | 1144 | 927 | 50100 | 3030 | 100201 | 2.01 | R |
|  | Total mean |  |  |  |  |  |  | 2.8 |  |

Table 3 shows respondent responses (students responses) on the services of laboratory assistant and personnel ensuring safety in biology laboratory. It shows the mean scores of 2.8, 3.65 and 2.01, therefore the total mean for table 3 is 2.8 which is above the acceptable mean this means that the services of laboratory assistants and personnel ensures safety in biology laboratory.

**Research Question IV**

**To which measures do the secondary school biology students apply safety practices during practical sessions.**

Table IV: Mean responses on the extent to which the following safety practices is applied during practical section in biology laboratory.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S/N** | **Item Description** | **N** | **SA** | **A** | **D** | **SD** | $$\overbar{M}$$ | **X** | **Dec** |
| 16 | The students adhere strictly to the instructions given to them before and during practical work  | 100 | 55 | 1545 | 50100 | 3030 | 100180 | 1.8 | R |
| 17 | The students wear their laboratory coat before entering the laboratory. |  | 2392 | 1030 | 3060 | 3737 | 100219 | 2.19 | R |
| 18 | The students wear flat shoes to the laboratory |  | 40160 | 2060 | 1020 | 3030 | 100270 | 2.7 | A |
|  | Total mean |  |  |  |  |  |  | 2.23 |  |

Table 4 shows respondent responses (teachers responses) on the extent to which the following safety practices is applied during practical section in the biology laboratory. It shoes the mean scores of 1.8, 2.19 and 2.7. Therefore the total mean for table 4 is 2.23 which is below the acceptable mean, this means that safety practices is not applied by the student during practical section in biology laboratory.

**CHAPTER FIVE**

**CONCLUSION, IMPLICATION, RECOMENDATION, LIMITATION, SUGESSION AND SUMMARY OF THE STUDY.**

**Discussions of findings**

The four research questions that guided this study were the themes around which the major findings of the study were organized and discussed.

**Designs and fittings in the biology laboratory appropriate to ensure safety.**

In table I: it reveals that the respondent agree that item 2, 4 and 5 ,the designs and fittings in the laboratory ensures safety while item 1 and 3 disagree that the designs and fittings in the laboratory ensures safety This result is based on the laboratory assistant and biology teachers response.

With this, it means that more effort should be applied through using good, modern and reliable materials on the designs and fittings in the biology laboratory to ensure safety.

**The use and availability of safety equipment in the biology laboratory**

 In table 2: it was observed that item 6, 7, 8, 11and 12 do agree on the use and availability of safety equipment in the biology laboratory while item 9 and 10 disagree on the use and availability of safety equipment in the biology laboratory. This result is based on the senior student response.

With these there is availability of safety equipment in the biology laboratory.

**The services of laboratory assistant employed to ensure safety**

 In table 3 :it was observed that item 13 and 14 do agree on the laboratory assistant and personal ensures safety in biology laboratory while item 15 disagree on the laboratory assistant and personal ensures safety in biology laboratory. This result is based on the senior student response. With these the school authorities need to send the biology teachers and technicians on yearly educator training on how to manage materials and guide inquiry-based learning during laboratory experiment.

**The measures applied by the senior secondary school student to ensure safety during practical sessions.**

In table 4: it was observed that item 18 do agree on the application of safety practices in the biology laboratory while item 16 and17 disagree on the application of safety practices in the biology laboratory. This result is based on the teachers response.

Student need to be enrolled with orientation on how to use the equipment in the Biology laboratory

**Conclusion**

From the result obtained from the data analysis, the researcher has concluded that there is need to apply more effort on safety practices during practical session in biology laboratory.

Properly designed laboratory investigations should have a definite purpose that is communicated clearly to students, focus on the process of science as a way to convey content and there should be incorporate ongoing student reflection and discussion to enable students to develop safe and conscientious laboratory habits and procedures.

The teacher should not be faced with a Hobson's choice in teaching in an unsafe environment which can lead to harm, injury and loss of lives, in the result of accident which tends to make learners lose interest in biology science, particularly laboratory activities. The student develop fear instead of love and interest in biology and science subjects.

**Implication of the study**

The educational implications from the findings are in the part of the teachers, they should implement safety practices with good attitude to an extent in order for student to adhere to safety practices without being careless during the laboratory activities in Enugu South Local Government Area of Enugu State. This study implies that safety practices should be employed from the teacher and adhered by the students in order to improve safety practices in the Biology laboratory.

On the part of the students who have phobia for practical in science laboratories due to the occurrence of the hazards and accidents in the science laboratory will find this work reliable in order to develop good attitudes, safe conscientious laboratory habits in any practical field.

The teachers and the laboratory staff should also see the need of keeping the rules, develop slogans about them, writing some of them on the cardboard sheets hung on the laboratory. With these, Practical work will be conducive through the safety measures in the science laboratories.

The school administrators will find this work relevant by providing an adequate facility such good modern and reliable building with necessary equipment where laboratory investigations can be conducted with ease. The national science teachers association will find the best means to administer the groups of objectives that may be achieved through the use of laboratory in science classes such as attitude, understanding the nature of science, cognitive abilities, acquisition of knowledge concept and skills.

**Recommendation**

1. The school authority should send some personal for seminar and workshop in order to implement good attitude and safe practice to other students
2. Student should observe the rules and regulation guiding the biology laboratory which leads to safety practices.
3. The government should provide funds to equip scanty laboratories building for practical’s that can accommodates both student and their teacher to make teaching easier and leaning faster
4. The laboratory building should be set aside at the school environment in order to avoid distractions.

**Limitation**

The researcher in her minimum financially capacity managed to cope with transportation from Enugu east to Enugu south local government area during the distribution and collection of the questionnaire and getting information from the post primary school management board (PPSMB) on the number of teachers and student in Enugu south local government area for her research work in order to meet up with the supervisor. During the course of typesetting she had trouble with her lap top system which affected her work which lead in the delay of typing, editing and printing of the research work.

**Suggestions for further studies**

A further investigation need to be carried out to find out

1. The problems relating to lack of qualified laboratory personnel

2. The need to investigate on the size and location of a science laboratory.

3. The challenges effecting student in phobia for science courses

**Summary**

Practical activities are fragile, if is not properly organized it can lead to frustration, harm, injury and lose of life, that is why it is important to enroll science teachers on training and seminar yearly for them to impact what they have learnt to their student according to Brunner's theory of instruction, it holds that management should be knowledgeable in scientific management principles through training and should be able to apply them accordingly through which they can produce future scientist. In this view, the researcher embarked on this study in order to highlight the extent of implementation and adherence to safety practices in biology laboratory among staffs and senior secondary school student in Enugu South Local Government Area of Enugu State.

 To address this issue the researcher formulated four specific purpose of the study which seeks to: 1.The general designs and fittings of biology laboratory relevant to safety. 2 The availability of safety equipment and materials in biology laboratories. 3 The services of laboratory assistant that are employed to ensure safety. 4 The extent of implementing safety rules in biology laboratory. The study used descriptive survey research design questionnaire was used as an instrument to collect data. Four research questions and eighteen questionnaire item was used to gather information from 20 respondent made up of 5 teachers and 15 students from the 5 schools sampled which gives a total of 100 respondent drawn from the study area. The questionnaire was validated by three validators and its reliability was established using coefficient of correlation Pearson's product moment formula and the result obtained was 0.83 which shows that the study is reliable.

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 APPENDIX 1

 Godfrey Okoye University,

 Ugwu-Omu Nike,

 Enugu State.

Dear Respondents,

 This questionnaire is design to enable the researcher who is a student of the above institution to collect information on the "Extent of implementation adherence to safety among staff and senior secondary school student in Enugu South Local Government Area of Enugu State. You are requested to complete the items on the instrument as demanded by it. Be assured that all information supplies will be treated confidentially.

 Thanks for your cooperation.

 Yours faithfully

**Maduka Adaobi J.**

U16/EDU/BIO/027

 **APPENDIX II**

QUESTIONNAIRE ON THE EXTENT OF IMPLEMENTATION AND ADHERENCE TO SAFETY PRACTISES AMONG TEACHERS AND STUDENT IN ENUGU SOUTH LOCAL GOVERNMENT AREA OF ENUGU STATE

SECTION A

PERSONNAL DATA

Please fill or tick the spaces provided below.

* Status ( in relation to this study)

Teacher

Student

Tick (√) one

**SECTION B**

 Please tick (√) only one column in this section as applicable .The response column contains

Strongly agreed (SA)

Agreed (A)

Disagreed (DS)

Strongly disagreed (SD)

 **QUESTIONNAIRE**

**Instructions:** Kindly tick (√) in SA for strongly agreed, A for agreed, D for disagreed, SD for strongly disagreed.

**Research Question 1**

**How does the type of design and fitting in the biology laboratory ensure safety?**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S/N** | **Item Description** | **N** | **SA** | **A** | **D** | **SD** |
| 1 | The biology laboratory is separated a little distance away from other buildings in the school compound |  |  |  |  |  |
| 2 | The biology laboratory size is large and it accommodates learners for practical work  |  |  |  |  |  |
| 3 | The Biology is equipped with different types of furniture such as tables, stools, cupboards, racks, shelves and chairs. |  |  |  |  |  |
| 4 | The Biology Laboratory is designed with large double doors at opposite ends |  |  |  |  |  |
| 5 | There are low and large windows facing one another as well as high windows. |  |  |  |  |  |
|  | Total mean |  |  |  |  |  |

**Research Question II**

**To what extent is safety equipments available in the biology laboratory?**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| S/N | Item Description | SA | A | D | SD |
| 6 | There are first aid kits in the biology laboratory |  |  |  |  |
| 7 | The safety rules and slogan are hung on the wall. |  |  |  |  |
| 8 | The student wash their hands after practical |  |  |  |  |
| 9 | Trash bins are present in the biology laboratory for all types refuse |  |  |  |  |
| 10 | Hand gloves and goggles are available in the biology laboratory |  |  |  |  |
| 11 | Bucket of dry sand are available in the biology laboratory |  |  |  |  |
| 12 | Fire extinguishers are available in the biology laboratory |  |  |  |  |
|  | Total mean |  |  |  |  |

**Research Question III**

**How often services of laboratory assistants employed do ensures safety during laboratory instructions**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S/N** | **Item Description** | **SA** | **A** | **D** | **SD** |
| 13 | The laboratory assistants supervise the learners during practical activities in the biology laboratory  |  |  |  |  |
| 14 | The laboratory assistant gives out detailed instructions to the student before and during practical work |  |  |  |  |
| 15 | Labelled reagents are used during practical |  |  |  |  |
|  | Total mean |  |  |  |  |

**Research Question IV**

**To which measures do the secondary school biology students apply safety practices during practical sessions?**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S/N** | **Item Description** | **SA** | **A** | **D** | **SD** |
| 16 | The students adhere strictly to the instructions given to them before and during practical work  |  |  |  |  |
| 17 | The students wear their laboratory coat before entering the laboratory. |  |  |  |  |
| 18 | The students wear flat shoes to the laboratory |  |  |  |  |
|  | Total mean |  |  |  |  |

**APPENDIX III**

**RELIABILITY OF INSTRUMENT**

**COEFFICIENT OF CORRELATION USING PEARSON’S FORMULAR**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| S/N  | X | Y | X2 | Y2 | XY  |
| 1 | 3.20 | 2.49 | 10.24 | 6.20 | 7.96 |
| 2 | 2.20 | 3.21 | 4.84 | 10.30 | 7.06 |
| 3 | 3.40 | 3.10 | 11.56 | 9.61 | 10.55 |
| 4 | 2.80 | 2.80 | 7.84 | 7.84 | 7.84 |
| 5 | 10.89 | 3.65 | 3.57 | 13.32 | 6.89 |
| 6 | 2.60 | 2.10 | 2.76 | 4,41 | 5.46 |
| 7 | 2.80 | 1.80 | 7.84 | 3.24 | 5.50 |
| 8 | 3.20 | 2.19 | 10.24 | 4.79 | 7.80 |
| 9 | 2.10 | 2.70 | 4.00 | 7.29 | 5.67 |
| Total  | ∑x=24.19 | ∑y=24.04 | ∑x2=62.89 | ∑y2=67 | ∑x y =64.73 |

N∑XY-∑X∑Y

√ (N (∑X2)-(∑X)2 ] [N (∑Y2)-(∑Y2)

Where N=9

∑X =24.19

∑y =24.04

∑x y =64.73

∑x2 =62.89

∑y2 =67

= 9(64.73)-(24.19)(24.04)

√9(62.89)-(24.19)2][5(67)-(24.0.4)2

=582.57-581.5276

√566.01-585:1561)(603-577.9216)

0.0424

(19.1461)(25.0784)

0.0424

√480.1535542

= 0.830508413