

**SURVEY OF BIOLOGY TEACHERS' AWARENESS OF LABORATORY SAFETY  
GUIDES IN BOSSO LOCAL GOVERNMENT AREA, NIGER STATE**

**BY**

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**2017/3/69250BE**

**DEPARTMENT OF SCIENCE EDUCATION  
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION  
FEDERAL UNIVERSITY TECHNOLOGY MINNA**

**AUGUST, 2021**

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## **ABSTRACT**

The study survey Biology teachers' awareness of laboratory safety guides in Bosso Local Government Area, Niger State. The objective of the study was to determine whether biology teachers have awareness of laboratory safety guides, to determine whether gender influence awareness of laboratory Safety regulation and to determine whether teacher qualification influences biology teacher laboratory safety precautions. Three corresponding research questions were raised to guide the study. The study adopted a descriptive survey research design. The population of the study comprises of 64 Biology teachers' teaching in senior secondary schools in Bosso Local Government Area of Niger State. Mean and standard deviation were used in method of data analysis. The findings of the study revealed that there is high awareness on biology teachers awareness on laboratory safety guides, male biology teachers have influences on laboratory safety guides, B.Tech qualification biology teacher have influences laboratory safety guides. The study concluded that Biology teachers' awareness on laboratory safety guides in Bosso Local Government Area, Niger State is high and B.Tech qualification biology teachers have influence on laboratory safety guides. The study recommended that Biology teachers should increase their knowledge on the awareness of laboratory safety guides and the teachers should also ensure that the students are also aware of the safety guide.

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## CHAPTER ONE

### 1.0

### INTRODUCTION

#### 1.1 Background to the Study

Biology is one of the science subjects studied in secondary schools. Science Teacher's Association of Nigeria (STAN) (2012) stated that biology is a subject consisting of contents from microscopic organisms to the biosphere in general, encompassing the earth surface and all living things. It is the study of living things and their interaction with each other and their environment. No biology teacher can effectively carryout his/her task without being familiar with the laboratory management skills that will lead to the acquisition of desirable and useful skills. When equipped with such competencies, the biology teacher will be able to handle the students effectively in laboratory practical work thereby, developing desirable skills in the students (Nwagbo, 2016). According to Cardak (2017) science educators and teachers are of the view that laboratory or practical work is indispensable to the understanding of science. This being the case, the laboratory has to be properly organized and managed in such a way that it will always be utilized while teaching biology.

The biology laboratory is special room where students can practice biology practicals. The biology laboratory contains equipment which eases the teachers work and speed up the learning process for biology students. It is a powerful aid if properly used by a teacher who knows how to use it. The equipment could be wasted if the teacher does not possess the techniques of using them. Thus the biology teacher must be resourceful and undergo training in skills and competences for teaching because teaching is a skill demanding job. He must possess dexterity in manipulating objects, in managing resources and in solving problems as they appear. He has to be very rueful in carrying out his activities in the

laboratory because many laboratory operations involve presence of hazardous materials which may be chemical or biological.

Practical demonstrations help in enhancing concept acquisition in pupils and in the long run, help to reduce the degree of abstraction usually ascribe to the sciences (Achunine, 1998). The laboratory thus, become an important educational medium of achieving this goal. A laboratory is often seen as a place where experiments in science are carried out (Ali, 1998). The biology laboratory is a room or a building in a school, college etc set aside for scientific investigation and conduction of practical activities in biology. The central role of laboratory instructions as identified by Voss (1982) is to provide illustrations of some basic principles and to teach the students the application of the principles so acquired. A high quality biology laboratory programme enables students to develop good judgments self reliance, critical thinking, technical, analytical as well as manipulative skills through personal contact with apparatus and materials (Ajayi, 2004).

Clark and Neave (1992) reported that laboratories are potentially “dangerous” places and only constant vigilance and efficient working techniques by all those using them can ensure that accident do not occur. A laboratory needs to be well organized so that a climate for investigating scientific concepts will exists. Such a climate ensures that the laboratory is safe for those using it. Since laboratory environment is for man, accidents and injuries are bound to occur. Therefore the teacher and all that are concerned in any science laboratory are responsibly committed to teaching his/her students how to handle chemicals and materials, so as to bring about reactions and/or results in a safe manner. According to Bryd (1994) any curriculum established on the needs of the child must inevitably give attention to the field of safety or be guilty of neglecting learning experiences of the greatest

possible significant. The emphasis in safety practices should be upon practical ways of preserving life.

Most of the accidents, hazards, injuries that occurs in our secondary schools biology laboratory result from;

- Inadequate knowledge of safety rules.
- Insufficient skills where in persons attempt what is beyond their ability level.
- Improper attitude or carelessness.

The teacher should endeavour to inculcate safety knowledge and practices into their students, so that they can develop a philosophy of safety that emphasizes positive rather than negative habits (Bryd, 1994). Safety practices can be explained to mean the process of averting danger. (Hornby, 2003). It is obvious that anyone who is not safety conscious stands the greatest risk of turning a minor hazard into an accident which could be fatal.

On this note, Bryd (1994) outlined some safety practices which include

- Development of habits which will prevent accidents.
- Developing habits which will lead to happier healthier living.

A standard laboratory should have certain specified safety rules and regulations as well as safety facilities like fume cupboards, eye goggles, fire extinguisher, etc that ensure safety of the students before allowing them to work in the laboratory.

As appropriate safety practices can reduce tremendously the rate of accidents and hence guarantee the safety of lives. There is then the need to evaluate the extent to which these safety practices are being implemented in our biology laboratory; hence this study

## **1.2 Statement of the Problem**

The success of any teacher among other factors lies on his/her skills in managing and controlling the teaching and learning environment. The teaching-learning environment must be devoid of chaos and anarchy. It must be safe and secured for the working of men and machines. However, most graduate of the Nigerian education system are not sufficiently exposed to proper managerial skills. According to Allison (2014) they lack the skills in the state of the art procedures and practices required for modern science teaching. Achimugu (2012) also reported that science teachers cannot display correct understanding of the science process as they cannot organize and conduct practical classes.

Many research works on students' achievement in biology like Nwagbo (2000), Biology Chief Examiner's report (2015) and Ezeobi (2017) have reported poor achievement and performance in biology especially at West African Examination Council (WAEC) and National Examination Council (NECO) terminal examinations. A number of factors which have been found to be responsible to this situation include poor teaching method, poor attitude of students to studies, lack of laboratory equipment, inadequate laboratory activities and practical work. It is against this background that this study is set out to find out survey of biology teachers' awareness of laboratory safety guides in Bosso local government area, Niger state.

## **1.3 Aim and Objectives of the Study**

The aim of the study is to survey Biology teachers' awareness of laboratory safety guides in Bosso Local Government Area, Niger State. The objective of the study are:

1. To determine whether biology teachers have awareness of laboratory safety guides

2. To determine whether gender influence awareness of laboratory Safety guides
3. To determine whether teacher qualification influences awareness of biology teacher laboratory safety guides.
4. To determine whether school type influences awareness of biology teacher laboratory safety guides.

#### **1.4 Research Questions**

The following research question were raised to guide the study;

1. Do biology teachers have awareness of laboratory safety guides?
2. Does gender influence biology teacher awareness of laboratory safety guides?
3. Do teacher qualification influences awareness of biology teacher laboratory safety guides?
4. Do school type influences awareness of biology teacher laboratory safety guides?

#### **1.5 Significance of the Study**

The findings of this study will be beneficial to biology teachers, biology students, education administrators, policy makers, researchers, curriculum planners and textbook writers.

The result of the study could enable the biology teachers to see the need for effective and efficient utilization of available laboratory resources provided to schools. In the same way, students will appreciate the need to manage and improvise laboratory resources in secondary schools.

Biology students would realize the importance of group and individual laboratory work situations in the effort of learning biology concepts. It could also help the students to become knowledgeable in the following areas: communication, problem-solving, self-

confidence and critical thinking. These are knowledge they are expected to acquire from practical activities which could lead to students' improvement on their academic achievement.

To education administrators as the recommendations will enhance educational growth. It will also furnish them with the quantity and quality of laboratory resources that are available in secondary schools the extent to which they are utilized for effective and efficient dispensation of lessons. They will also appreciate the need to plan, direct, control, co-ordinate and supervise institutions of higher learning to actualize national educational objectives.

The findings of this study will help policy makers to work out effective means of providing and managing resources in biology laboratories in secondary schools. This could be achieved through the establishment of resource centres where laboratory resources could be purchased, observed and experimented with at subsidized rates.

Researchers on assessing this study would find it useful since it will provide them with documents and reference materials.

To the curriculum experts the findings of the study could form a basis for introducing laboratory innovations in teaching at all levels to promote practical based learning in schools. The textbook writers on assessing the findings of this study would upgrade the content of the textbooks to include more practicals and more theoretical work on all science and its related subjects.

## **1.6 Scope of the Study**

The scope of the study is to survey Biology teachers' awareness of laboratory safety guides in Bosso Local Government Area, Niger State. The study will investigate the extent on how biology teachers can effectively utilized laboratory safety guides in teaching biology practicals. The study will be limited to private and government secondary schools biology teachers in Bosso local Government area, Niger State.

## **1.7 Definition of Terms**

**Biology teachers:** typically referred to as science teachers, are highly skilled in the sciences, specifically biology teachers in Bosso local government area.

**Teachers:** is a person who helps students to acquire knowledge, competence or virtue in secondary schools

**Student:** Is a learner, or someone who attends an educational institution.

**Laboratory:** is a facility that provides controlled conditions in which scientific or technological research, experiments, and measurement may be performed.

**Practical:** an examination or lesson in which theories and procedures learned are applied to the actual making or doing of something.

## **CHAPTER TWO**

### **2.0 LITERATURE REVIEW**

#### **2.1 Concept of Science Laboratory**

So many researchers have defined laboratory in different ways but all the definitions come to give the same meaning. Ardo (2014), defines school laboratory as an instructional facility for helping pupils to learn what science is and how scientists work. Bello in Oguntona (2016) said that nature should be a laboratory and that learning of science should be through inquiry rather than dogma. This will help for logical, critical and independent thinking. Adeyemi (2016) sees science laboratories to be central to the teaching of science in the secondary schools. Akano and Nma (2013) defined laboratory as a place where people engage themselves in human enterprise to examine and explain natural phenomena. Laboratories have been found to be a primary vehicle for promoting formal reasoning, skills and students' understanding, thereby enhancing the desired learning outcomes in students. (Ogunleye, 2019). Proeter (2015) agreed to the view that laboratory is a room or building with specific equipment for doing scientific test of teaching science or a place where chemicals and medicines are produced.

According to Hornby (2015) laboratory is a room or building used for scientific research, experiment, testing. Laboratory is a place equipped for making tests or doing experimental work (Studdert and Gay, 2007). Laboratory is a place where scientific research and development is conducted and analysis performed (Britannica Concise Encyclopedia 1994–2010). Espindle (2014) sees laboratory as a room or building where scientific work or tests are carried on. According to Lewis (2013) a laboratory symbolizes a place to experiment



with ones inner feelings, beliefs and fears. Wikipedia defines a laboratory as a facility that provides condition in which scientific research, experiment and measurement may be performed. Omosewo (2010) defined laboratory as a place equipped for experimental study. She added that the world in the minds of most people is synonymous with scientific investigation, while Kamar (2009) sees laboratory as a place where the scientists do their work. He also added that it is a room that is well equipped for the purpose of carrying out practical work and allows students to have experiences that are consistent with the goal of scientific literacy. Mohanty (2013) opined that a laboratory is essential in the secondary schools to practice various experiments by the students and get convince about the fact, events, phenomena etc. Laboratories have been found to be scientists' workshops where practical activities are conducted to enhance a meaningful learning of science concepts and theories. (Olubor and Unyimadu, 2011). Laboratories have been found to be a primary vehicle for promoting formal reason skills and students understanding, thereby enhancing the desired outcome in students (Adeyemi,2016). From the above definitions, laboratory can be summarized as a place for students to practice various experiments so as to be convinced about scientific facts, events and phenomena. This place also enhances meaningful learning of science concepts and theories through hands on experiments.

## **2.2 Biology as a Branch of Science**

Science has been defined science as a way of investigating about events in nature. Science is also an objective, logical and repeatable attempt to understand the principle and forces operating in the natural universe. Science is from Latin word 'scientia', to know, Science is not dogmatic but should be viewed as an ongoing process of testing and evaluation. According to Adeyemi (2018), science subjects in secondary schools comprises of three

major branches which are physics, chemistry and biology that are core subjects in secondary school curriculum. One of the intended benefits of student taking a biology course is that they will become more familiar with the process of science. Nworgu (2015) has it that science has a dual nature, that is, it can be defined in terms of methods and processes as well as its product that make up the body of science. The study and understanding of science involves - Observation, hypothesis, experimenting, data analysis, inference, conclusions. All these make up the scientific method. Considering the dual nature of science, Nworgu (2015) defined science as an organized body of knowledge got through investigation and experimentation. To this effect, science is seen in terms of 'processes' and as well 'products'.

According to Okeke (2007), the nature of science is that it seeks for explanations utilizing investigative methods that are objective and can even be replicated. The entire process demands rigor, patience, perseverance, and honesty which cannot but yield credible result. Superstition is prevalent in our society. This is in conflict with science education where persons are encouraged to seek explanations that are based on logical, objective and testable scientific principles and theory. The fact is that explanations based on superstition and supernatural powers are rooted in cultural beliefs and make no intellectual demands on individuals to rationalize, making this option to enjoy greater patronage than the option of scientific explanations. This puts science in a disadvantaged position toward contributing to utilitarian values.

According to Ukoli (2013), the aspect of science which science education provides the individual with, should among other things do the following.

- Develop among increasing numbers a questioning intellectual temper towards traditional belief so that issues which were formerly accepted without questions are now subjected to systematic and critical thought.
- Free the minds of people from superstition.

These views of the intellectual advantages of science are the same as those of the national teachers association at the United States of America. One of the most important goals of science education is to develop scientifically literate person with the necessary intellectual resources, values, and attitude and inquiry skills to promote the development of a man as a rational human being.

Such is the tremendous advantage of science when taught properly. Talking about the nature of sciences, Osogbonye (2012) asserted that learning more and more of the scientific knowledge does not make one a scientist, rather, children should be taught the skill and attitudes of science which are used to search for the scientific knowledge. This will prepare the children to be able to solve problems that will confront them in future (Osobeonye, 2012).

However, science has its nature as tentative, dynamic and objective activity which has greater implications to the teaching and learning of science. It means a change from teaching students about science to educating them through science. This shift in teaching method has been identified and accepted by the Nigerian government (Nwosu, 2015). According to the Federal Republic of Nigeria (FRN, 2013) policy document “Science education should emphasize the teaching and learning of science process and principle. This type of teaching de-emphasizes rote memorization and regurgitation of facts, stresses development of skills and thereby making student to do science rather than learning

science. Abugu (2015) conceptualized science education as any systematic training and instruction that enables the learners upon completion to achieve among others the ability to manipulate scientific equipments, interpret and prepare maps, graphs, charts and table appropriate to problem. Along with the ability to demonstrate problem solving skills like observing, testing, inferring, defining problems, making hypothesis, carrying out investigation, outlining scientific procedures to test hypothesis, controlling and manipulating variables, formulating models, making valid conclusions, predicting, etc. All these according to Adey and Harlen (2011) lead to the advocating of process approach to teaching science as opposed to the use of content approach, illustrating the significance of science process skills.

### **2.3 Biology Teaching and Learning**

Biology occupies a unique position in the school curriculum. Biology is central to many science related courses such as medicine, pharmacy, agriculture, nursing, biochemistry and so on. It is obvious that no student intending to study these discipline can do without biology.

Longman Dictionary of contemporary English (2018) defined biology as the scientific study of living things. Biology is also a natural science concerned with the study of life and living organisms, including their structure, function, growth, origin, evolution, distribution and living organisms, including their structure, function, growth, origin, evolution, distribution and taxonomy. As has been noted before, Odigie (2011) explained that biology is the prerequisite subjects for many fields of learning that contribute immensely to the technological growth of the nation. This includes medicine, forestry, biotechnology etc.

Teaching is defined by Onwuka (2012) as the direction of the activities of learners towards worthwhile educational goals. Ngwoke (2010) defined learning in a broad sense as a process which causes a change in behavior of an individual. This change in behavior results from experience or interaction between the individual and his environment. He also noted that learning is an activity, something the learner does and not something the teacher does for the learner. Meaningful learning occurs if students can relate their learning with daily experiences. In spite of the importance and popularity of biology among Nigerian students, performance at senior secondary school level had been poor (Ahmed, 2018). The most general causes of the poor performance in science are poor quality science teachers, over-crowded classrooms, and lack of suitable and adequate science equipment, among others (Kareem, 2013). The teaching method is a significant factor in biology teaching and learning.

Ajaja (2015), in respect of this said that unfortunately, teaching is largely teacher-dominated and the laboratory neglected. This he noted in his investigation on “evaluation of science teaching in secondary school in Delta State”. All these factors and lots more contribute to ineffectiveness of biology teaching and learning. Emphasizing on the qualities of a good biology lesson Nworgu (2015) outlined the following.

- Biology lessons should have clearly stated set of instructional objectives.
- Involve the use of relevant activity oriented
- Facilitate the transfer of knowledge to the wider society.

To solidify this, objective of teaching and learning of biology can be seen in the biology curriculum. It was derived from the national policy on education (1977, 1981, 2013, 2013) these includes

- Adequate laboratory and field skills in biology.
- Meaningful and relevant knowledge in biology.
- Ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture.
- Reasonable and functional scientific attitudes.

It goes to say that for effective learning of biology to occur, it has to be student – oriented and accompanied by practical activities.

### **2.3.1 Biology practical and effective teaching**

According to UNESCO (2015), it is acknowledged that many teachers intuitively included the essential learning within their teaching and have long done so. They recognized the need of knowledge skills at a particular subject. Opportunities present by the particular or in the classroom are recognized and used. The research observed from the literature at hand that effective teaching of biology can be sub-divided such as qualification of teachers teaching method effective use of laboratory and mastery of the subjects. The science teachers conference reported on Udeh (2014) stated that ‘if Nigeria teachers can cope adequately with tasks of them they have to be well trained for their job. The national conference maintained that if our education is to achieve the national objective well qualified trained, efficient, satisfied and educated teachers are absolutely necessary. Opuh, Eze and Ezemagu (2018) conceived that it is not easy to think of effective teaching of biology without qualified teachers for the work force. Eze (2012) regretted that the lack of qualified teachers in the secondary schools especially in the area of practical. It is often said that teachers is the hub of any educational system for schools cannot be better than their teachers. This entail that highly qualified teachers will impact better knowledge or higher

standard education on the students, Orjika (2014) in Opuh (2018) noted that educationists had expressed that science teacher should possess a good professional training and biology teachers are not exceptional.

Many researchers are of the opinion that the teaching method employed during science classes contribute a lot to effective teaching of biology. Nnamonuh (2013) stated that laboratory method is the method used in effective teaching and learning of science subjects especially biology. It encompasses activities carried out by an individual or a group for the purpose of learning. Okoye (2014) had earlier opined that laboratory method of teaching should be investigated as an approach so that this activity can provide student the opportunity of acquiring process skills. Meregini (2015) reported that recent classroom observation studies have shown that teacher's instructional materials/methods were at variance with the method implied in science curriculum. Accordingly, Nnamonu (2013) stated that laboratory and field work are central to the teaching of science. Without laboratory method, teaching of science will be ineffective. Laboratory work should be seen as a mean of relating science concept, enquiry process, observation and interpretation of data.

Fafunwa in Ugwu (2015) observed that most teachers resort to the use of lecture method not minding the lecture modification, the concept of education while maintaining that the best learning is that which result from purposeful practical activity. Ugwu (2015) suggested that teachers should use as many techniques as possible to gain the attention and interest of the students. The teacher should apply any method of motivation, so as to heighten the spirit of the students. Laboratory method is inevitable in the teaching of biology. Nnamonu (2013) advocated that teachers should be using laboratory method mostly in teaching to

avoid making biology largely a memory work. He further observed that schools where the laboratory is effectively used significantly performed better in science than others. In his own contribution, Okri was quoted by Uche (2014), as follows: the techniques employed in imparting information to the students may have effect in creating favorable or unfavorable impression about biology in the mind of the students.

Another factor that affects effective teaching of biology is mastery of the subject matter. Ugwu (2015) stated that the teachers whose attitude shows a wealth of knowledge at their finger tips about what they are teaching will restore confidence on their students. Okoye (2015) stated that teachers' knowledge of the subject matter is another factor that contributes to effective teaching and learning. A teacher who knows his subject matter very well uses his own language to teach his students by using concrete examples to illustrate his points. Killdara (2007) advocated that for effective teaching to occur the teacher should be very knowledgeable with regards to their subject matter and this should be excellent use of specific terminologies throughout the lesson. Similarly, Opuh, Eze and Ezemagu (2018), asserted that the quality of a good teacher is good mastery of the subject matter. The teacher has to know everything concerning the subject. Eze (2015) noted that some unskilled teachers abuse the use of teaching methods. Keldare (2007) went further to stress that continuity from previous lessons and new information should be linked to previous learning. In light of the above, Ude (2014), recommended that the place in which biology is to be taught is the indispensable laboratory. It is essential for every teacher of biology to become acquainted with teaching method that will help his students achieve their learning objectives. In summary, teachers affect change in the society. These changes can be affected if teachers themselves are well educated, competent industrious and disciplined. It



is also when the desired and desirable changes in the students learning have been realized that the teaching of biology can be effective. Effective teaching and learning is dependent on the effectiveness on the quality of the teacher.

### **2.3.2 Biology practical and effective learning**

It has been earlier deduced that effective learning is dependent on effective teaching. It has also been noted in this work that biology practical occupy the central position of effective teaching of biology. Hence it is also logical to state that biology practical contributes to effective learning of biology. According to Kuren (2015), many students expressed their interest and enthusiasm in practical exercise. It is well known that students who enjoy science practical do well in science. Ude (2014) accepted that there is a positive link between biology practical and effective learning of biology. Supporting her idea, she quoted the ministry of education as saying that since biology is a science subject; effort should be made to maintain reasonable extensive science equipment coupled with suitable method of teaching. The researchers believed that students attitude and interest towards practical classes contributes immensely to the effective learning of biology. Karental (2015), have a similar view. They opined that improving students based course. Karase (2015), recommended that it's particularly important to address these issues (students' interest and attitude to practical work). They further opined that laboratory practical experience rank highly as contributing factor towards effective learning in science in general and biology in particular. Nnamonu (2013) declared that students attitude towards laboratory work helps for effective teaching and learning of science and improve academic performance of students. Consequently, Cosbourne, Simon and Collins (2013) agreed that if the laboratory and practical experience is accessible, it should play a major role in

influencing students' attitude and academic achievement. In fact, it can define students' performance in science. Hofstein and Lunette (2013) disclosed that a significant fact that continues to reduce learning in the laboratory is the recipe-book style that limits students' opportunity to experience ownership, creativity and development of effective learning.

Uzel cited in Eze (2013) and Orjika (2007) stated that, practical agriculture (similarly Biology) has positive effect on students motivation. He also maintained that practical enhance both skills acquisition and the quality of learning because the students can equally add their understanding by discussing about the work done. Somi and Henry (2013), demonstrated that providing a constructively laboratory experience resulted in higher mean grade and enhanced interest, enjoyment and learning awareness. Anichebe (2007) in his study emphasized that teachers must understand their students as individual knowing how they learn best and how they may best transmit their skills and knowledge in order that the students may be educated.

Finally, practical laboratory experiences are unique to biology in that it allows students to gain hands-on experience in the subject matter. It clearly provides students with the opportunity to become highly engaged in the process of learning and promote academic performance of students.

### **2.3.3 Biology practical and academic performance**

By providing students with practical laboratory lessons, that are academically stimulated, students are more likely to engage meaningfully with tasks and subsequently achieve higher assessment grades (Karen et al 2015). Nevertheless, it was earlier observed by WAEC Chief Examiner (2013) that academic performance of candidates in biology fell

below expectation. The chief examiner lamented that “there were many candidates who could not answer correctly a single question in biology practical, in most cases, they have wild guesses and guess unrelated answers that were sometimes unbiological. And also the candidates were faulty in experimental procedures”. Students that neglect practical work often encounter problems with questions that require some mathematical skills, deductive reasoning, proper observation and interpretation of data.

In addition, Sandbarey, Armstrong and Wischusen (2015), explained that enquiry based practical offers students a more realistic experience where the answer is not always predetermined and which requires students to come up with their own ideas from their own observation. Allan, Rob and Jonathan (2013) complained that students who avoid practical classes are always frightened by figures of graph during examinations and this made them not to understand the figures for correct interpretations. Eze and Ezemagu (2018) observed with Adeleye that schools which are involved in practical classes perform better in SSCE than those that neglect practical work. As disclosed by Sandberg (2015), educators were initially slow to change their methodologies in biology but with good result (improved academic performance) and support from national science and educational organizations, there is now progress (Myer and Burgess 2013). From the above, it can be stated categorically that biology practical have a positive effect on the academic performance of students in biology examinations.

#### **2.4 Availability of Functional Laboratory Facilities**

Laboratory facilities are the material resources that facilitate effective teaching and learning in school laboratories (Timilehin, 2016) posited that laboratory facilities are those things

which enable a skillful science teacher to achieve a level of instructional effectiveness that far exceed what is possible when they are not provided.

The problem of lack of adequate instructional facilities in Nigerian schools is dated back to the beginning of formal education in Nigeria and the provision of educational facilities was not given adequate and proper attention it deserved (Adesina, 2011). He further said the resultant effect was overcrowding of pupils in the schools leading to overstressing of available spaces and facilities. Oyetunde (2018) was of the view that the problem of lack of school facilities or inadequate school facilities is affecting all State Secondary Schools in the federation. Ahmed (2013) revealed that in most of the nation's Secondary Schools, teaching and learning take place under a most non conducive environment, lacking the basic materials and thus hindered the fulfillment of educational objectives. Lack of adequate facilities such as text books, workshops, ill equipped classrooms, laboratories and libraries are among the probable causes of student's poor performance in examination. Despite the fact that practical work is a unique source of teaching science, it is widely acknowledged that laboratory equipment are lacking in most schools (Omosewo, 2010). She also concluded from her studies that practical work was difficult to organize as a result of lack of apparatus. Onawola (2014) reported lack of qualified teachers in addition to lack of equipment for laboratory work and also reported lack of adequate equipment most especially in established schools. Some researchers have found shortage of laboratory facilities as the cause of students' failure in science skills because their teachers were unable to conduct practical as they would like to and this always has inevitable consequences for students' learning. The shortage of laboratory facilities could have serious implication on the quality of school output (Adeyemi 2016). Onah and Ugwu, (2010)

revealed that the constraint to quality science education in Nigeria is inadequate laboratory equipment/facilities in our schools.

According to Aderounmu, (2017) the strict adherence to the school time table with little or no provision for adequate qualified staff, tools, equipments, workshops and laboratories perhaps could lead to poor performance in Science, Technology and Mathematics Education, (STME). In addition, they said that most teaching in STME classes which are supposed to be done with charts and real life objects are mostly done in abstract, ignoring the fact that 'seeing is believing'. Biology is an activity – based and students centered course and cannot be effectively taught without equipment (Nwagbo, 2018). She further said lack of equipment/materials have provided excuses for Biology teachers who now neglect the practical aspect which has greater potential for developing critical thinking and objective reasoning ability in students. They resort instead to expository method of teaching which is known for promoting rote learning and hindering transfer of learning. In order to ensure better performance from schools, there is need to provide necessary facilities (Suleiman, 2013).

Ihuarulam (2018) argued that the absolute neglect in the provision of effective teachers, enough materials and fund has worsened the quality of education as was reflected in public examination. The inadequacy of academically competent professionally sound and enduring committed school personnel, inadequacy of well equipped laboratory/workshop are factors hindering meaningful curriculum development in science. Ogunleye, (2013) said that one of the objectives of teaching science in schools is to communicate the spirit of science and to ensure that students acquire the process skills of science. This cannot be effectively achieved unless students are exposed sufficiently to

practical work and laboratory experimentation. He further said that many of our secondary schools that were established over the years still remain without science laboratories; others have laboratories that are not sufficiently equipped. Even with the establishment of the science equipment manufacturing centre at the Product Development Institute, Enugu (PRODA) as well as the Science equipment centre at Ijanikin – Lagos and Minna in Niger state, the situation has not improved. The end result is that students learn Science without laboratories and equipment which is not in the spirit of Science.

According to Mohanty (2017) only 19.35% of his sampled schools had Science laboratory, 80.65% of the schools used to go without laboratory. He also said that there was no Science laboratory in any of the Junior Secondary Schools except in one private Secondary school.

Audu and Oghogho (2017) said that one of the major aspects of Science Education that has been of great concern is the area of availability and effectiveness of usage of specialized Science equipment, facilities and teaching aids. They quoted Abimbola (2017) who said that in Nigeria, one of the most striking problems of Science Education is that of inadequate Science teaching materials. In addition, they said that the National Policy on Education that introduces Science into the curriculum introduces it as activity – based subject that require a lot of teaching and learning materials and aids. Oboh (2018) opined that teaching of Biology in most Nigerian schools is more theoretical than practical. The usual reason given is the unavailability of materials and equipment. This is supported by Danmole and Abdullahi (2018) who emphasized the importance of improving instructional strategies through the use of teaching aids.

Laboratory facilities are material resources that facilitate effective teaching and learning and also promote students performance. The inadequacy of these facilities has been noted

many years back and still persists particularly with the overcrowding classes (Abimbola, 2017). It was also observed that where the facilities are available, they are not usually used due to unqualified teachers and their incompetency to use the facilities. Therefore, there is the need for this study to find out the relationship between laboratory facilities and class size factor on students performance in Biology in the Senior Secondary Schools.

Facility management is an integral part of overall management of school. The actualization of goals and objective of education require the provision, utilization and appropriate management of the facilities. Asiabaka (2010) observed that the advance in Science and Technology necessitate that the school managers should adopt modern methods of facilities management. She was of the view that modern management of facilities will improve the quality of teaching and learning of science. Based on her work, she concluded that there is a direct relationship between the quality of school facilities provided and the quality of the products of the school. Danmole and Abdullahi (2018) observed that the maintenance of the little available equipment is not taken care of as many schools have no laboratory technologists/attendants worse still, the basic laboratory essentials of water, gas, and electricity are just not there in many school laboratories. Asiabaka (2010) in her work on the need for effective facility management in schools in Nigeria observed that the most fundamental problem in facility management is lack of policy guidelines for infrastructural development in schools. She added that in some schools, there are inadequate classrooms, staff offices, laboratories, workshops, libraries and study areas while in some schools, these facilities are adequately provided. She further said that this situation arises because the Federal, State and Local Government have failed to establish policy directives on minimum standard in relation to school facilities.

According to Oyelere (2013) the problems associated with Science and Science teaching is poor management of laboratory equipment and materials, supply of sub- standard equipments etc. Hassan (2017) opined that mismanagement of funds and available apparatus or equipment is also a problem to Biology teaching. She further said that where funds are available, they are often mismanaged, in the sense that fake and non-durable equipments are often bought. The available equipments are not usually managed well and taken care of adequately thereby reducing the durability of the equipment and the desired results. In this era of unskilled or lack of laboratory assistants to run the laboratories, the Biology teachers face the problem of doing virtually everything, ranging from preparation of reagents and solutions to detecting and effecting minor repairs of faulty equipments and organizing the students and materials/materials for practical work (Nwagbo, 2013).

The management of laboratory facilities according to the findings above showed that no laboratory assistants in most schools, sub-standard equipments are bought, no policy guideline by any of the three tiers of Nigerian Government in relation to laboratory facilities.

## **2.5 Academic Performance of Students in Biology**

Isa (2017) quoted West African Examination Council (WAEC) chief examiner's report 2013 which shows that despite the fact that there are improvements in the subject; students' performance in Biology is poor due to their inadequate exposure to practical work and their non-acquisition of relevant skills. Research works have shown that Biology enjoys much better patronage by the students than Chemistry and Physics. However, the trends in the Senior Secondary School Certificate Examinations (SSCE) show that the failure rate is highest in Biology when compared to Chemistry and Physics. Oyedokun



(2012) opined that poor result in Biology might be due to the fact that almost every students with or without ability is enrolled for the subject. It has been observed that poor performance in sciences is caused by poor quality of Science teachers, overcrowded classrooms and lack of suitable and adequate science equipment (Yusuf and Afolabi, 2010). According to them, students perform poorly in Biology because Biology classes are usually too large and heterogeneous in terms of ability level. In addition to that, the laboratories are ill equipped and the syllabus is overloaded (Ahmed, 2018). On the other hand, lack of adequate facilities such as textbooks, ill-equipped classrooms, laboratories, workshops and libraries are among the probable causes of students' poor performance in examination (Olubor, 2018). According to Fabayo and Oyebola (2014) low level students' academic performance is related to the decline in the availability of teaching resources in our schools. Ugbaja (2015) observed that over the years the performance of the students has not been impressive as evidenced from the School Certificate Examination results of the West African Examination Council (WAEC) and National Examination Council (NECO). Ihuarulam (2016) was of the opinion that the poor performances in the Chemistry and in other Science subjects have been attributed to quality of teachers and available learning resources. Oyebola (2014) observed that certain factors that influence academic performances are poor physical environment, shortage of personnel, learning facilities and poor quality of teaching. She identified other factors that influenced poor academic performance of students as overcrowded classrooms, lack of laboratories, inadequate instructional materials and poor library facilities. Ugbaja (2015) confirms that there is a sharp fall in students' performance in Biology. The reason he advanced for this sharp fall was that student's performance in Biology is due to poor qualities of some laboratories or teachers avoidance of teaching certain topics in the syllabus.

Ihejirika (2010) opined that some studies have demonstrated that students' academic performance in Senior Secondary School Certificate Biology and other Science subject examination since eighties have remained poor. She quoted Ukaegbu (2016) who reported that only 34%, 32%, and 35% of the entire candidates who participated in the West African School Certificate Examination (WASCE) in 2001, 2002 and 2003 respectively obtained five credits and above. Among the reasons she listed for the poor performance are poor use of Biology terminology, poor diagrams, careless drawing and labeling, incompetence and laziness on the part of the teachers. Ihejirika (2010) reported that candidates' performance was worst in Biology with 49.1% passes, compared with 55.4% passes in Chemistry and 62.5% passes in Physics. While Hills (2009) in Ihejirika (2010) attributed poor academic performance of students in Biology to poor state in which science is being taught in schools. "Chalk and talk" method has been the most widely used science teaching due to poor quality laboratory, large class size and much work load on the teachers. Etuk (2012) studied many Secondary Schools in Uyo and Ebonyi States where he found out that most students have never witnessed the laboratory preparation of 'hydrogen' nor have seen 'spirogyra' under microscope by the time they are considered ready to take final examination.

Ihejirika, (2010) identified the following factors for the poor performance of students in Biology as-

1. Almost every students with or without ability is enrolled for the subject. Poor quality of Science teachers.
2. Overcrowded classroom.
3. Lack of suitable and adequate Science equipments.

4. Over-loaded syllabus.
5. Poor and careless diagrams.
6. Poor labeling and poor use of biological terminology.
7. Management of Biology Laboratory Facilities.

### **2.5.1 laboratory facilities and students performance in biology**

Hofstein and Lunetta (2014) defined laboratory as an appropriate learning environment for promoting meaningful learning, enhancing students understanding of both scientific knowledge and the nature of science, where students interact with material, and/or with models to observe and understand the natural world. Nworgu (2015) also defined laboratory as a room or building used for scientific research and experiment. She went on to say that the laboratory is the focal point of science activities. She went further to state that for biology teaching to be meaningful, it has to be accompanied by laboratory activities. Akpan (2012) summarized the place of laboratory activities as “in the laboratory, people carry out measurement, verify situations, obtain basic information, manipulate instruments, get to know the equipment and materials by name and are exposed to the activities of scientist, and are trailed in experimental procedures.

In the laboratory, people get to appreciate the information presented in the textbook or in lecture classes by getting to know the basic principles and abstractions that are involved in the process. The goal of every teaching is the learner. The importance of laboratory is not authentic if students are not engaged in the laboratory activities. Unfortunately, most laboratory assessments are accomplished with objective items, paper-and-pencil instruments rather than hands-on mode (Hofstein and Lunetta, 2014).

Tobin (2011), suggested that meaningful learning is possible in the laboratory if the students are given opportunities to manipulate equipment and materials in an environment suitable for them to construct their knowledge of phenomena and related scientific concepts. As has been noted earlier in this work, several schools don't make full use of the laboratory in teaching biology. They only organize practical for students when the one short-end of course examination (SSCE) commences; hence teachers and parents begins to expect the students to do some magic and pass in flying colours the Senior Secondary School Examinations. In support of this Ahmed (2018), has noted that some of the observed poor achievement of biology students in SSCE is due to ill-equipped biology laboratory. This is not meant to be so, the laboratory need to be equipped, and students regularly visit it for experiment in order to acquire necessary skills. According to Lunetta (2014), science laboratories have very important role in the educational system for science students. He noted again that these laboratories have made this world very advanced and scientific in its purpose.

Osogbonye (2012), reported that modern science curriculum reforms seems to hold that the major functions of the laboratory are to convey the method and spirit of science inquiry, to provide students with opportunities to investigate to inquiry and to find out things by themselves. Osogbonye (2012) is of the opinion that the laboratory is the right place where students learn to do what scientists did, i.e. where they use the skills and attitudes of science to go through the scientific process to seek knowledge. It is in the laboratory that they put into practice these scientific skills and attitudes developed in them to make them self-reliant in the future. Hence Osogbonye (2012) stated that the goal for laboratory instruction in modern science courses “focuses upon the inquiry/discovery process or

methodological phase of science and upon its intellectual components” besides, laboratories are essential for the teaching of science related courses, is so much dependent on the laboratory provisions made for it. Osogbonye (2012) maintains that students rely on the laboratory as a place where they can both watch the teachers demonstrates as well as carry out practical works themselves. Biology as a science subject is to a large extent experimental.

Osogbonye (2012) sees higher quality laboratory programs as capable of eliciting thinking skills, and students’ motivation necessary to produce a well prepared group of scientist, engineers, biologists and citizens to meet the scientific and environmental challenges of today and the future. Based on the foregoing, Dienye and Gbananje (2011), reported that the functions/merits of the laboratory are grouped into five main categories which represented important goals in biology education and also demonstrate how teaching of biology in the laboratory is appropriate with advancement in science and technology.

### **Merits of Teaching with the Laboratory**

- i. The learner in this method learns about the nature of science and technology in order to foster the knowledge of human enterprises of science and thus enhance the aesthetic and intellectual understanding of the child.
- ii. Acquisition of problem skills: The basic goal of science Teaching is to help students learn skills that can be applied to other life situation in future.
- iii. The student learns to appreciate and emulate the role of the Scientists through acquisition of manipulative skills.

- iv. Develop interests, attitudes and values: When the students are accorded the chance for personal experience by handling the real things, their interest in science increases as they yearn to investigate and explore more about their environment.
- v. They also learn the major scientific concepts, models, principles and theories and understand their tentative natures. The laboratory experience affords students opportunities to gain exposure to facts in scientific phenomena.

### **Demerit of Teaching with the Laboratory**

The two major setbacks encountered in the use of laboratory are as follows;

- i. It is time consuming in terms of planning and preparations.
- ii. It is expensive due to the materials and equipment that will be used.

### **2.6 Biology Practical Activities**

As defined by Opuh, Eze and Ezemagu (2018), biology practical activities is the scientific study of the life and structure of plants and animals and their relative environment in real or experimental setup rather than dwelling on theory and ideas. UNESCO (2015) stated that in making observations, designing and carrying out their own experiments, students are most likely to learn about the nature of science. Similarly, Onah (2013) believed that if the progress of experimental science has demonstrated anything, it is that there is nothing better than genuine knowledge and fruitful understanding. This is the lesson of laboratory and the lesson all educators have to learn. A Chinese proverb was cited by Emmanuel and Eze (2007) as follows: “we hear we forget; what we see, we remember but that which we take part in we understand”. Explaining further they noted that in biology lesson, students have to take part in doing and on the course of doing (practical) students learns.

Lunette (2018) explained that laboratory has been given a central distinct role in science education, and science educators have suggested that there are rich benefits in learning using the laboratory activities. UNESCO (2015), reported that conducting set experiment, building models for understanding other practical tasks provides opportunities for developing many of the essential learning which includes understanding and appreciating the need to change on the basis of new audience, discovering new knowledge from the work present which can be applied in building new scenarios, transferring knowledge and understanding new situation, contributing to the creation of a culture of learning in a community, working effectively as a member of a team to achieve individual and shared goals, etc.. From the foregoing, practical lessons have been acclaimed to be mostly essential in effective teaching and learning of biology. The Nigeria council on science education annual report on secondary schools science instruction, as cited in Emmanuel and Eze (2007) noted that many schools teach the science subject including biology without any laboratory work.

Udeh (2014) concluded in her research that one of the problems militating against the effective teaching of biology with practical activities in secondary schools in Enugu East L.G.A. of Enugu state is that laboratory equipment are lacking and there is insufficient time for biology practical. Eze and Ezemagu (2018) similarly agreed with the fact that science particularly biology cannot be adequately learnt from a book but by carrying out experiments using tools in the laboratory. Emmanuel and Eze (2007), emphasized that because of its very empirical nature, biology must be studied with the aid of the laboratory classes. Okoye (2014) opined that laboratory activities should be investigative in approach so that they can provide the students the opportunity of acquiring process skills. He

strongly believe that laboratory work through making careful study or enquiry, helps the students to acquire basic skills in handling laboratory activities. In a sharp contrast, Lunette (2018) deviated by saying that at this time however, some educators have started questioning the effectiveness and role of laboratory work and the case for laboratory teaching is not self evident as it is once seemed.

Nevertheless, Nnamonu (2013) and other proponents of biology practical activities have suggested that effective use of biology laboratory properly maintained is most beneficial in effective teaching of biology. From the foregoing, it is clear that practical biology is highly indispensable in biology education. In fact, the benefit of practical classes in biology can never be overemphasized because laboratory (practical) activities is the life-wire of biology and without which biology loses its scientific nature.

## **2.7 Problems Associated with Conduct of Biology Practical**

**Inadequate Laboratory Facilities** :- the absence of adequate laboratory facilities in secondary schools has been a problem in teaching and learning of biology activities. Ani and Eze (2007), established that students understand better when they have practical experience, when the students perform experiments themselves during practical for obtaining the correct result, they cannot only remember the procedure involved but also feel proud of themselves for obtaining correct result. It is therefore essential that laboratory is properly equipped for the study of biology activities, and the students should very much be allowed to use in the laboratory since it is an established fact that they perform better when they partake in the activities. Lunette (2018) noted that the laboratory helps students in making accurate observation, devising hypotheses, finding the reasons for the results, planning control and withholding judgment.



**Time Management :-** this affects the students in such a way that many candidates out of nervousness and fear develop examination fever and this affect them badly. Some students spend a lot of time in reading and thinking out answers to a particular question at the expense of others. Students in their attempt to impress their examiner become verbose thereby giving unnecessary details to some answers and end up rushing through other questions. Tan (2018) reported that students should note that practical biology questions usually require or call for precise and direct answers.

**Comparing and Contrasting Specimen :-** comparing and contrasting the features of one specimen with another are vital problem of biology methods in science study. Students usually perform poorly in these tasks due to lack of the skills or lack of technical know-how. The simplest and the most reliable method of comparison is by use of tabulation. Comparing or contrasting features of specimen with those of another specimen means identifying and stating the similarities and differences between on specimen and the other.

**Drawing and Labeling :-** biologists attach a lot of importance to making of diagrams with correct labeling of the specimen under study in practical classes. Tan (2018), reported that biology diagrams are different from those of fine art in which artists are expected to make colorful artistic diagrams. In drawing and labeling of biology specimen, the following are considered: size, proportionality, title and view or perspective.

**Observation :-** observation is a vital aspect of practical biology. The importance of close observation of specimen in a practical biology examination can never be overemphasized. Candidates are expected to observe the specimen given to them very carefully and critically without which, proper specimen's identification, full representation in drawing and realistic comparative analysis cannot be done.

Different reasons have been given to the problems relating to laboratory work (Tan 2018). According to Benze and Hodan (2015), problems in laboratory work arise when students blindly follow the instructions of the teachers. Some researchers on the other hand claim that the laboratory instead of being a place for science practical and experiments has become a place where tasks set by the teachers are carried out. No attention is given to the method or purpose during laboratory work, only the set tasks are carried out (Hurtegal 2012). Jimenz Alexander (2014), Wikinson and Wand (2007) have connected the problem with laboratory work to a poor evaluation of the purpose of the tasks undertaken in the laboratory.

The multiple purpose of the laboratory work has been subject of discussion worldwide for many years. Multiple list of these purpose have been prepared for different levels of education. Many of these list focus on carrying out experiments through scientific methods and technical skills while some strongly emphasize effective objectives others have dwelled on other purpose (Johnstone and Al-Shuali 2011; Reid and Shah 2007). When university biology laboratory are considered the general purpose of laboratory work may be:

- Supporting or strengthening theoretical knowledge
- Experiencing the pleasure of discovering and developing of the psychomotor skills
- Teaching how scientific knowledge may be used in daily life.
- Increasing creative thinking skills
- Gains in scientific working methods and high thinking skills
- Developing communication skills
- Developing manual dexterity by using tools and equipment
- Allowing students to apply skills instead of memorizing (Bayraktar 2014).

## **2.8 Theoretical Framework**

This research employed the General System Theory (GST) as the theoretical framework for the study. Higgs and Smith (2018) defined system theory as general science of organization and wholeness. It can also be regarded as a philosophy that claims that life is a system of which we are parts. The key assumptions in system theory are: everything including human beings is a system of some sort (Higgs and Smith 2018) and all systems are purposeful and goal directed. In order to achieve goals of the system, all part of a system must work in harmony with one another and their environment. The General System Theory (GST) was first developed by a biologist Von Bertalanffy in (2018) his assumptions pertained primarily to the living organisms, machines, galaxies and organizations. He postulated that part of a system do not work in isolation, they work within a system. His postulation countered a popular scientific view that a system a system could be understood first by breaking it down into its components so that each component could be studied and analyzed as an independent entity. And that the components could be added in a linear fashion to describe the totality of a system. Bertalanffy (2018) defined a system as set of elements standing in interrelation. System can either be closed or opened. The school is an example of open system in which two or more persons work together in a coordinated manner to attain common goals (Norlin 2015).

All schools are open system though the degree of interaction with their environment may vary. The school is a system with the following components, environment inputs transformation process, output and feedback. The open system is that type of system that receives input from the environment and releases the output to the environments. Any change in the environment can profoundly impact on the open system. Parts of the system

interact together for the school system to succeed or help locate the source of the problem and as a result find the solution. This theory has been adopted for this study because the school is an example of the social open system with goals to achieve excellence in all the subjects. One of the major goals of biology teaching and learning in secondary schools is to equip students with the necessary skills and attitudes of scientists that will propel to undertake professional courses such as Medicine, Dentistry, Pharmacy, Nursing among others in universities (Abugu 2015). However, this cannot be achieved unless the parts/aspects of biology (theory and practical) work together as expected to achieve the desired goal. With regards to this study, all aspect of biology teaching and learning could affect the degree of performance of the students in examination. If one aspect of the system is lacking, the effect will be negative but if all the aspects of the system work together, meaningful learning will be achieved with increase in the academic performance of the students.

### **2.8.1 Piaget's Theory**

Piaget's theory of cognitive development is a comprehensive theory about the nature and development of human intelligence. It was first created by the Swiss developmental psychologist Jean Piaget (1896–1980). The theory deals with the nature of knowledge itself and how humans gradually come to acquire, construct, and use it. Piaget's theory is mainly known as a developmental stage theory. Piaget "was intrigued by the fact that children of different ages made different kinds of mistakes while solving problems". He also believed that children are not like "little adults" who may know less; children just think and say words in a different way. By Piaget thinking that children have great cognitive abilities, he came up with four different cognitive development stages, which he put out into testing.

Within those four stages he managed to group them with different ages. Each stage he realized how children managed to develop their cognitive skills. For example, he believed that children experience the world through actions, representing things with words, thinking logically, and using reasoning.

To Piaget, cognitive development was a progressive reorganization of mental processes resulting from biological maturation and environmental experience. He believed that children construct an understanding of the world around them, experience discrepancies between what they already know and what they discover in their environment, then adjust their ideas accordingly. Moreover, Piaget claimed that cognitive development is at the center of the human organism, and language is contingent on knowledge and understanding acquired through cognitive development. Piaget's earlier work received the greatest attention.

Child-centered classrooms and "open education" are direct applications of Piaget's views. Despite its huge success, Piaget's theory has some limitations that Piaget recognized himself: for example, the theory supports sharp stages rather than continuous development.

## **2.9 Review of Related Empirical Studies**

Henry (2018) carried out a study on effect of biology practical on student academic performance in biology in Enugu State secondary schools (a case study of Nsukka Local Government Area). This study concerned itself with practical work conducted in biology in secondary schools. It examined whether the way practical experience were presented to the students and students' engagement in them enhanced the attainment of goals of practical work. The procedures of conducting practical work in biology were of great concern and

more especially the skills emphasized during practical work in biology lessons. The study also examined the teachers and students attitude towards practical work in biology. All these are done with view of identifying the problems and giving recommendations that could guide practice and effective teaching and learning of practical work in biology in particular and biology in general. The study adopted a descriptive survey research design. The population of the study comprised of all the 47 public secondary schools in the local government from which 9 sample schools were selected using a combination of stratified, purposive and systematic sampling procedures. It involved 29 biology teachers and 309 from biology students comprising 170 boys and 139 girls respectively. The main finding of the study indicated that science laboratory in secondary schools in Nsukka local government area were fairly equipped with better apparatus, chemicals and materials and students were indeed involved in a variety of practical activities in biology. However, basic scientific skills such as experimental design and formulation of hypotheses were found wanting in the area of students. The study recommended that that NECO should assess students in as many skills in NECO biology examination including simple aspects of experimental design.

Also research work done by Nwagbo, Chukelu and Uzomaka (2015) investigated the effect of biology practical activities on secondary school students process skill acquisition in Abuja municipal Area council. The design of the study was quasi experimental, specifically the pretest, posttest non-equivalent control group design. Samples of one hundred and eleven senior secondary one (SS1) biology students randomly drawn from two co-educational schools were used for the study. An instrument known as science process skill acquisition test (SPSAT) was used for data collection. The data collected were analyzed

using mean, standard deviation and Analyses of Covariance (ANCOVA) at 0.05 level of significance. The result revealed that practical activity method was more effective in fostering students' acquisition of science process skills than the lecture method of instruction. There was no interaction between method and gender on student process skill acquisition.

## **2.10 Summary of Review of Literature**

In this study science was defined as a way of investigating about events in nature. Good science is not dogmatic but should be viewed as an ongoing process of testing and evaluation. On the other hand, biology was seen as the scientific study of living things. Biology is also a natural science concerned with the study of life and living organisms, including their structure, function, growth, origin, evolution, distribution and living organisms, including their structure, function, growth, origin, evolution, distribution and taxonomy. As it has been noted before, laboratory has been given a central distinct role in science education, and science educators have suggested that there are rich benefits in learning using the laboratory activities. Theoretical framework was base on the General System Theory developed by Von Bertalanffy in 2018. The theory maintained that everything including human beings is a system of some sort and all systems are purposeful and goal directed. In other to achieve goals of the system, all part of a system must work in harmony with one another and their environment.

## **CHAPTER THREE**

### **3.0 RESEARCH METHODOLOGY**

#### **3.1 Research Design**

The descriptive survey research methodology was adopted for the study. The design is considered suitable for the study because it is a status-study in nature. It focuses on selective dimension of phenomenon, information in a systematic, sequential and precise manner, (Eboh, 2009). Descriptive survey is also primarily concerned in investigating present events or trends that exist and often considers past and future events that tend to affect the present trends (Olagbewo, 2012).

Furthermore, Nwakachiku (2012) opined that descriptive survey is a method that involves gathering of information about a representative group or targeted population empirically from a sample and generalizing the findings obtained from the analysis of the sample of the entire population.

#### **3.2 Population of the Study**

The population of the study comprises of 64 Biology teachers' teaching in senior secondary schools in Bosso Local Government Area of Niger State. The population is further classified into two (2): 32 public schools and 32 private schools of biology teachers in Bosso Local government Area Niger State.

#### **3.3 Sample and Sampling Techniques**

Due to population of the study is minimal, therefore there will not be any sampling technique. Because the population of biology teachers in the study is very small, the



researcher considered the use of all the teachers significant and appropriate. Therefore, all the 64 number of teachers and their opinions collected for the purpose of making the result generalizable

### **3.4 Instrument for Data Collection**

The instrument that was used by the researchers for data collection is a questionnaire. The questionnaire is titled “ Survey of Biology teachers’ awareness of laboratory safety guides in Bosso Local Government Area, Niger state ” . Section A contains bio-data information of the respondents, Section B – which contains twenty two (22) items. The responses in Section B is weighed on a modified Likert 5-point rating scale, having Extremely Aware = (EA), Moderately Aware = (MA), Somewhat Aware = (SWA), Slightly Aware = (SA), Not at all Aware = (NA). The scale provides flexibility and sensitivity for the respondents to make decision based on the items of the study.

### **3.5 Validity of the Research Instrument**

To ensure face and content validity of the questionnaire, the instrument was validated by two (2) experts in Department of Science Education. All the items use for the study was reviewed by subject experts, to ascertain the content validity and the appropriateness of the instruments for the study. Suggestions, inputs, observation and comment that will be made to ensure that all the relevant aspect and concepts in the study will be measured.

### **3.6 Reliability of the Research Instrument**

In order to ensure the consistency of the instruments, Cronbach Alpha reliability was computed from the data collected for determination of reliability coefficient.

### **3.7 Method of Data Collection**

The researcher sought for a research permit from the department of Science Education in Federal University of Technology, Minna before going to the field. The researcher will proceed to visit the sampled schools for the study to establish rapport and seek permission from the schools administration to carry out the study. To avoid failure due to logistical issues, there will be a prior arrangement with the school administrators for appropriate time to visit the schools for actual data collection from the respondents of the study. Research assistants will be employed to aid the process of administering and retrieving copies of the questionnaire. The researcher will distribute sixty four (64) copies of the questionnaires to the respondent for the study in the various schools.

### **3.8 Method of Data Analysis**

Descriptive statistics mean and standard deviation will be use to answer the research questions. All statistical analyses will be conducted with the aid of Statistical Package for Social Science (SPSS) version 23.0

## CHAPTER FOUR

### 4.0 RESULTS AND DISCUSSION

#### Analysis of Research Questions

**4.1 Research Question One:** Do biology teachers have an awareness of laboratory safety guides?

**Table 4.1: Mean of the respondent on biology teachers awareness on laboratory safety guides**

S/N	ITEMS	N	$\bar{X}$	SD	Remarks
1	Do biology teachers have the awareness that students must wear lab coats in the laboratory	64	4.00	1.01	Aware
2	Do biology teachers have the awareness that long hair should be tied up in a band	64	3.60	1.20	Aware
3	biology teachers are aware that bags, purses, and coats should be placed on the door shelves.	64	3.82	0.92	Aware
4	Is biology teachers aware that no food is allowed in the laboratory	64	3.34	1.13	Aware
5	Make sure you read the labels on waste containers and notify the laboratory technologist it is filled up.	64	3.69	1.43	Aware
6	Excess chemicals should never be returned to the reagent containers.	64	3.54	1.25	Aware
7	Dispose of broken glass in the blue and white cardboard boxes provided in the laboratory.	64	1.86	0.76	Not Aware
8	Do not place broken glass into the trash can.	64	3.61	1.23	Aware
9	Do not use your fingers to pick up the glass.	64	3.06	1.20	Aware
10	Know the location and the use of the first aid kit.	64	3.47	1.29	Aware
11	Know the location and the use of the fire extinguishers	64	4.09	1.16	Aware
12	Keep the benchtop clean and dry at all times.	64	3.46	1.26	Aware
13	Do not look down into angle test tubes because it generates heat a lot.	64	3.95	1.04	Aware
14	Do not inhale when attempting to detect chemical odours	64	3.67	1.17	Aware
15	Do not pick up hot objects. Let items cool or use oven mitts/tongs to move hot items.	64	3.94	0.72	Aware
16	Always pour concentrated acids into water carefully; any concentrated reagent should be handled with care.	64	3.94	0.72	Aware

17	If any chemical is splashed on you, wash it off with plenty of water. Then report to the instructor if further treatment is needed.	64	3.39	1.08	Aware
18	Always wash your hands before leaving the lab	64	3.85	1.30	Aware
19	Do not perform unauthorized experiments	64	3.54	1.27	Aware
20	Dispose of all biological specimens in the proper disposal area as designated by your teacher.	64	3.64	1.23	Aware
21	Carefully dispose of sharps in the designated container for sharps objects.	64	3.09	1.19	Aware
22	Teachers should avoid the use of mercury vapours because they are poisonous	64	3.37	1.26	Aware
<b>Grand Average</b>			<b>3.54</b>	<b>1.12</b>	<b>Aware</b>

**Decision= Mean ( $\bar{X}$ ): 3.00**

Table 4.1 above revealed the results on Biology Teachers awareness on Laboratory Safety Guide which is 3.54. This meant that, Biology Teachers have awareness of Laboratory Safety Guide in Bosso Local Government of Niger State.

**4.2 Research Question Two:** Does gender influences biology teacher laboratory safety guides?

**Table 4.2: Mean of the respondent on gender influences on biology teacher awareness of laboratory safety guides**

S/N	Gender	N	Mean $\bar{X}$	Standard Deviation S. D	Mean difference
1	Male	31	42.31	3.55	0.26
2	Female	33	42.05	2.77	

Table 4.2 above revealed that the male had a mean ( $\bar{X}$ ) value of 42.31 while the female had a mean ( $\bar{X}$ ) value of 42.05. This meant that male biology teachers are more influenced on laboratory safety guides.

**4.3 Research Question Three:** Do biology teacher qualification influences biology teacher awareness of laboratory safety guides?

**Table 4.3: Mean of the respondent on teacher qualification influences biology teacher awareness of laboratory safety guides.**

S/N	Qualifications	N	Mean (X)	Standard Deviation S.D
1	NCE	8	21.42	5.3
2	B.Tech	12	25.37	4.6
3	B. Sc(Ed)	11	24.68	5.1
4	B. Ed	4	16.43	3.4
5	B.Sc	7	20.68	4.3
6	HND	3	15.33	3.1
7	PGDE	6	19.76	3.6
8	M.Ed	1	0.64	1.2
9	MTech	4	16.43	3.4
10	MSc	7	20.68	4.3
11	PhD	1	0.64	1.2

Table 4.3 above revealed that teacher qualification influences biology teacher laboratory safety guides. The result showed that B.Tech qualification has the highest score of 25.37, while P.hD M.Ed qualification has the lowest score (0.64) on teacher qualification influences biology teacher laboratory safety guides.

**4.4 Research Question Four:** Do school type influences awareness of biology teacher laboratory safety guides?

**Table 4.4: Mean of the respondent on how school type influences biology teacher laboratory safety guides.**

School Type	N	Mean (X)	Standard Deviation SD	Mean difference
Private	32	44.56	2.89	10.80
Public	32	33.76	2.13	

Table 4.4 above revealed that the private score is 44.56 and the public score is 33.76. This showed that the private schools' biology teachers have influences on laboratory safety guides.

#### **4.5 Summary of Major Findings**

The result in question one shows that there is high awareness on biology teachers awareness on laboratory safety guides

The result in question two shows that Male biology teachers have influences on laboratory safety guides

The result in question three shows that B.Tech qualification biology teachers have influences on laboratory safety guides.

The result in question four shows that Private schools biology teachers have influences on laboratory safety guides.

#### **4.6 Discussion of Results**

The result revealed that there is high awareness of biology teachers awareness of laboratory safety guides. The study's findings agreed with Audu and Oghogho (2017) said that one of the major aspects of Science Education that have been of great concern in the area of availability and effectiveness of usage of specialized Science equipment, facilities and teaching aids. They quoted Abimbola (2017), who said that in Nigeria, one of the most striking problems of Science Education is inadequate Science teaching materials. In addition, they said that the National Policy on Education that introduces Science into the curriculum presents it as an activity-based subject that require a lot of teaching and learning materials and aids. Oboh (2018) opined that teaching Biology in most Nigerian schools is

more theoretical than practical. The usual reason given is the unavailability of materials and equipment. This is supported by Danmole and Abdullahi (2018), who emphasized the importance of improving instructional strategies through teaching aids.

The result also revealed that male biology teachers have influences on laboratory safety guides. The findings also support Henry (2018) carried out a study on the the effect of biology practical on student academic performance in biology in Enugu State secondary schools (a case study of Nsukka Local Government Area). This study concerned itself with practical work conducted in biology in secondary schools. It examined whether the way practical experiences were presented to the students and students' engagement in them enhanced the attainment of goals of experimental work. The procedures of conducting practical work in biology were of great concern and, more especially, the skills emphasized during practical work in biology lessons. The study also examined the teachers and students attitudes towards practical work in biology. All these are done to identify the problems and give recommendations that could guide practice and effective teaching and learning of practical work in biology in particular and biology in general. The study adopted a descriptive survey research design. The population of the study comprised of all the 47 public secondary schools in the local government, from which 9 sample schools were selected using a combination of stratified, purposive and systematic sampling procedures. It involved 29 biology teachers and 309 biology students comprising 170 boys and 139 girls, respectively. The study's main finding indicated that science laboratories in secondary schools in Nsukka local government area was moderately equipped with better apparatus, chemicals and materials and students were indeed involved in a variety of practical activities in biology. However, basic scientific skills such as experimental design and

formulation of hypotheses were found wanting in the area of students. The study recommended that NECO assess students in as many skills in NECO biology examination, including simple aspects of experimental design.

The result revealed that B.Tech qualification has the highest score of 25.37, while P.hD M.Ed qualification has the lowest score (0.64) on teacher qualification influences biology teacher laboratory safety guides. The findings of the result agreed with Nwagbo, Chukelu and Uzomaka (2015) investigated the effect of biology practical activities on secondary school students process skill acquisition in Abuja Municipal Area council. The design of the study was quasi-experimental, specifically the pretest, posttest, non-equivalent control group design. Samples of one hundred and eleven senior secondary one (SS1) biology students randomly drawn from two co-educational schools were used for the study. An instrument known as the science process skill acquisition test (SPSAT) was used for data collection. The data collected were analyzed using mean, standard deviation and Analyses of Covariance (ANCOVA) at a 0.05 level of significance. The result revealed that the practical activity method was more effective in fostering students' acquisition of science process skills than the lecture method of instruction. There was no interaction between strategy and gender on student process skill acquisition.

The result revealed that the private schools' biology teachers have influences on laboratory safety guides. The findings of the study are in line with Udeh (2014) concluded in her research that one of the problems militating against the effective teaching of biology with practical activities in secondary schools in Enugu East L.G.A. of Enugu state is that laboratory equipment is lacking, and there is insufficient time for biology practical. Eze and Ezemagu (2018) similarly agreed that science, particularly biology, cannot be adequately



learnt from a book but by carrying out experiments using tools in the laboratory. Emmanuel and Eze (2007) emphasized that because of its very practical nature, biology must be studied with the aid of laboratory classes. Okoye (2014) opined that laboratory activities should be investigative in approach to provide the students the opportunity to acquire process skills. He strongly believes that laboratory work through careful study or inquiry helps the students develop basic skills in handling laboratory activities. In sharp contrast, Lunette (2018) deviated by saying that at this time, however, some educators have started questioning the effectiveness and role of laboratory work. The case for laboratory teaching is not self-evident as it once seemed.

## CHAPTER FIVE

### 5.0 CONCLUSION AND RECOMMENDATION

#### 5.1 Summary

The study survey Biology teachers' awareness of laboratory safety guides in Bosso Local Government Area, Niger State. The study's specific objectives are to determine whether biology teachers have awareness of laboratory safety guides, to determine whether gender influence awareness of laboratory Safety guides, whether teacher qualification influences awareness of biology teacher laboratory safety guides, and whether school type influences biology teacher laboratory safety guides. Four related research questions were raised to guide the study. The target population of the study consist of 64 teachers in both private and public school.

The result in question one shows that there is high awareness on biology teachers awareness on laboratory safety guides

The result in question two shows that Male biology teachers have influences on laboratory safety guides

The result in question three shows that B.Tech qualification biology teachers have influences on laboratory safety guides.

The result in question four shows that Private schools biology teachers have influences on laboratory safety guides.

## **5.2 Conclusion**

The study concluded that Biology teachers' have the awareness of laboratory safety guides in Bosso Local Government Area, Niger State is high and B.Tech qualification biology teachers influence laboratory safety guides.

## **5.3 Recommendations**

The study recommended that;

1. Biology teachers should increase their Knowledge on the awareness of laboratory safety guides
2. The teachers should also ensure that the students are also aware of the safety guide
3. The practice of laboratory safety guide should be imbibed by both teachers and students

## **5.4 Contributions to Knowledge**

The study contributes to the practice and awareness of laboratory safety guides in Bosso Local Government Area.

## **5.5 Suggestions for Further Studies**

Assessment of Biology teachers on the usage of laboratory management in senior secondary schools in South-East Zone, Nigeria

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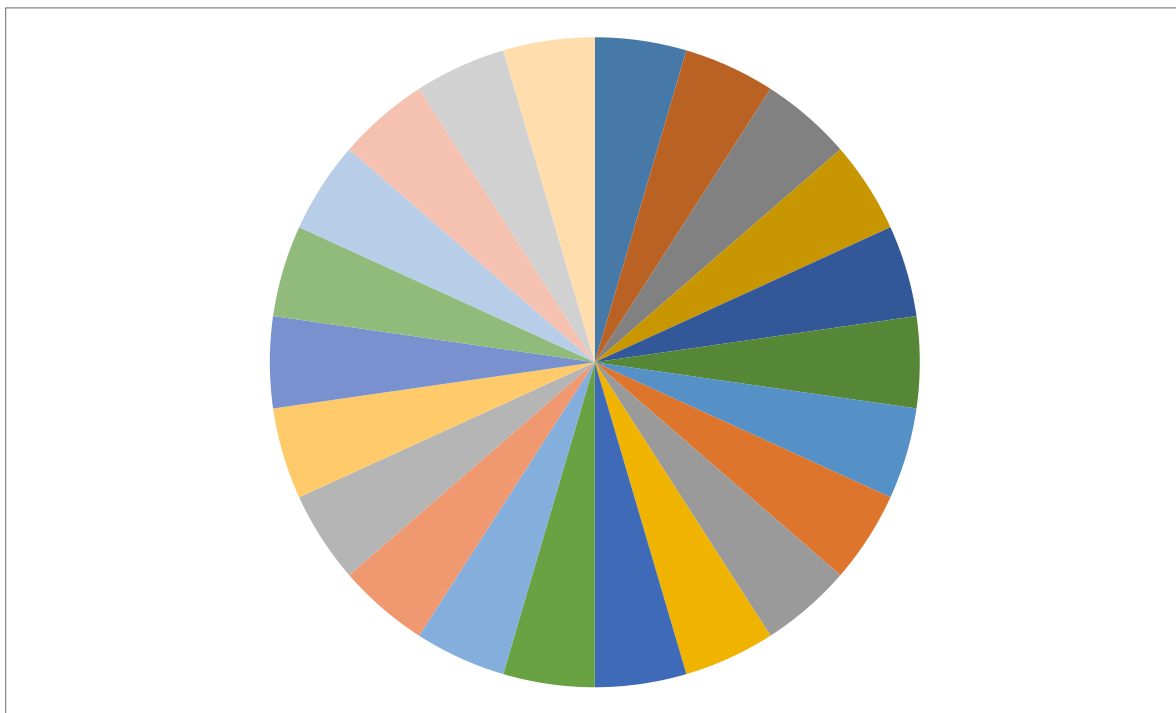
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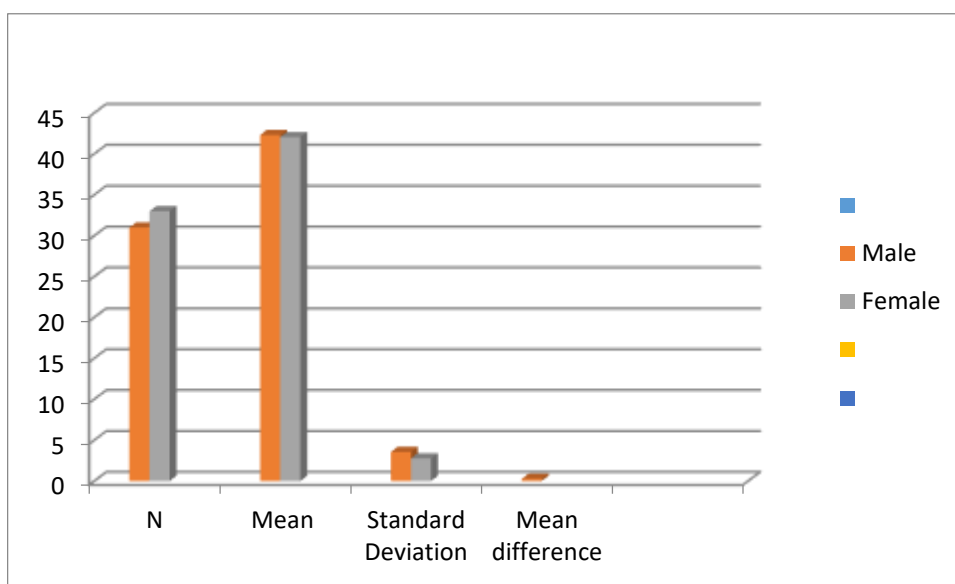
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## APPENDIX

Mean of the respondent on biology teachers awareness on laboratory safety guides



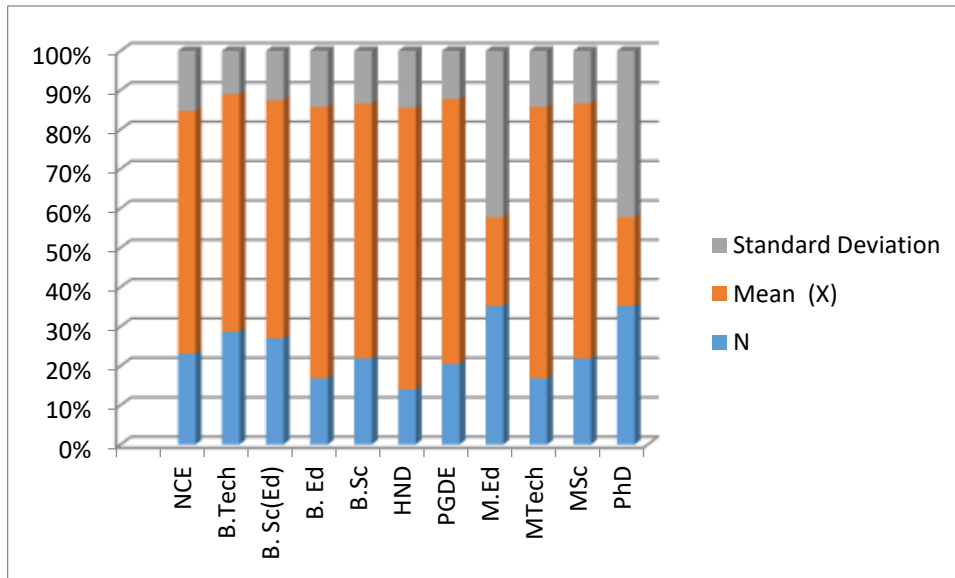
Mean of the respondent on gender influences on biology teacher awareness of laboratory safety guides





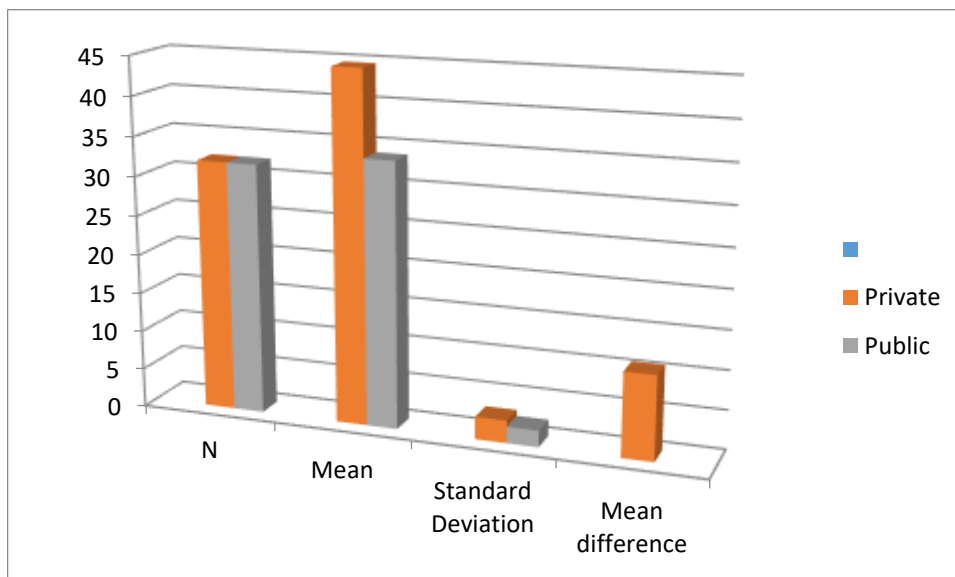
Mean of the respondent on teacher qualification influences biology teacher

awareness of laboratory safety guides



Mean of the respondent on how school type influences biology teacher laboratory

safety guides



RESEARCH INSTRUMENT VALIDATION FORM

Sir/Ma,

The candidate Balogun Seun Ape with Admission Number 201718/692508 is a student of the department. You are requested to make amendments or inputs that will improve the quality of the instrument. Your professional expertise is expected to assist the researcher towards the award of the degree.

Thank you



Dr. Babio A. Bello

DD (Signature, Date & Official Stamp)

Title of the Research Instrument: Survey of Biology Teachers Awareness of Laboratory Safety Guides in Bosso Local Government Area Niger State (CABRILATASOG)

SECTION A

1. Appropriateness of the Research Instrument title: It is quite appropriate
2. Suggest amendment if not appropriate: —
3. Completeness of Bio-data Information: Completed
4. Suggest inputs if incomplete: —
5. Suitability of items generated: Items generated are suitable enough
6. Structure of the questionnaire/ test items generated: well structured
7. Structure of the instrument in line with the objectives of the study: Instrument is quite in line with the objectives
8. Item coverage and distribution across constructs and domains measured: Extent of Coverage is okay
9. Appropriateness of the instrument in relation to the type of data to be collected: Quite appropriate
10. What is the general overview and outlook of the instrument?: Generally satisfactory
11. Rate the instrument between 1-10: 8

SECTION B

Name of the validator: Dr. Babagana, M.


Designation/Rank: LI

Name of institution: F.U.T. MA

Department/ School: Science Education

Telephone No/GSM No: 08066553470

E-Mail Address: mohd.babagana@futura.edu.ng

 25/07/21

Signature, Date and stamp (if available)

RESEARCH INSTRUMENT VALIDATION FORM

Sir/Ma,

The candidate Enyuan Serina Nke with Admission Number 20718/692508x is a student of the department. You are requested to make amends or inputs that will improve the quality of the instrument. Your professional expertise is expected to assist the researcher towards the award of the degree.

Thank you.



Dr. Rabiu M. Bello

HOD (Signature, Date & Official stamp)

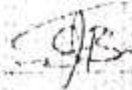
Title of the Research Instrument: Survey of Biology Teachers Awareness of Laboratory Safety guides in Rural local Government Area, Niger state. (QUBITNASEG)

SECTION A

1. Appropriateness of the Research Instrument title: Appropriate
2. Suggest amendment if not appropriate: \_\_\_\_\_
3. Completeness of Bio-data Information: Okay
4. Suggest inputs if incomplete: \_\_\_\_\_
5. Suitability of items generated: Suitable
6. Structure of the questionnaire/ test items generated: well structure
7. Structure of the instrument in line with the objectives of the study. Adequate
8. Items coverage and distribution across constructs and domains measured: Okay
9. Appropriateness of the instrument in relation to the type of data to be collected: Appropriate
10. What is the general overview and outlook of the instrument? Simple and clear
11. Rate the instrument between 1-10: 8

SECTION B

Name of the validator: Mrs Sarah Baijor  
Designation/Rank: Ass. Lecturer  
Name of institution: F U T Mining  
Department/School: Science Education  
Telephone No/GSM No: 07056590753  
E-Mail Address: Sarah.Baijor@futminna.edu.ng

 14/7/2021

Signature, Date and stamp (if available)



**Federal University of Technology, Minna**  
P.M.B 65, Minna, Niger State.

**Official Receipt**

No. **140220**

Date **30/8/21**

Received from **Balogun Sekinat A**  
the sum of **Five hundred**

Being **Payment for tuition** in Naira **only** kobo

With thanks

Total Amount

**N 500.00**

Code(s) 1 **235** N **500**

Cheque No...../Cash.....

2 N

**MB 024177**

3 N

4 N

5 N

6 N

7 N

8 N

**BURSAR**