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**IMPLEMENTATION OF SAFETY PRACTICES IN BIOLOGY LABORATORIES AMONG  
SECONDARY SCHOOL STUDENTS IN OBIO/AKPOR LOCAL GOVERNMENT AREA**

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**ABSTRACT**

*This study looked at how secondary school students in the Obio/Akpor local government area implemented safety procedures in biology labs. Four inquiries served as the study's compass. This study used a simple survey design. 12,327 SS2 pupils from two specially chosen coeducational senior secondary schools in the Obio/Akpor local government area made up the study's population. A sample size of 200 people was selected using random sampling procedures. Questionnaire on Implementation of Safety Practices in Biology Laboratories [QISPBL] was the instrument used to collect data. Using Pearson product moment correlation, a reliability coefficient of 0.79 was found. The mean and standard deviation were used to answer the research questions. The results demonstrated that the biology labs in public secondary schools in the Obio/Akpor local government area are lacking in laboratory safety supplies. The study comes to the conclusion that low student achievement is correlated with a lack of access to and ineffective use of science lab supplies in the study area. It also suggests raising awareness of these safety material measures to ensure that lab safety is closely monitored. It is imperative that the government provides a suitable number of scientific teachers, laboratory assistants/attendants, and laboratory materials to ensure successful teaching and learning.*

*Keywords: Safety, Laboratories, Biology, Practices, Implementation.*

## **Introduction**

Various scientists have described biology as a subfield within the general body of knowledge (science) based on their individual perspectives and comprehension of the subject. Industrialization and other economic sectors depend heavily on biology. It is a practical-based topic that gives pupils knowledge and abilities to help them deal with life's everyday challenges. The goal of studying biology is to give students the knowledge they need to alter or manage their surroundings for the good of themselves, their families, and their communities (Fred, 2015). After listing the value of biology to society, it is evident how much it has contributed to the nation's advancements and economic progress. The teaching and study of biology in Nigeria, however, has encountered numerous challenges because the topic is relevant to all other science courses in the curriculum.

The Nigerian federal government has improved and encouraged the study of science, technology, and mathematics in the nation by implementing a variety of initiatives in the past several years (Jebson, 2013). Her efforts to support the teaching and learning of sciences in secondary schools by creating additional specialized science and vocational centers are indicative of this. Additionally, experts have consistently called attention to the serious ramifications of our secondary school students' persistent decline in science performance, particularly when it comes to public examinations like the West African Senior Secondary Certificate Examination and the National Examination Council (Aina et al., 2013). According to Abimbola (2013), there was no discernible improvement in students' performance in science subjects over a seven-year period (2010-2017). Additionally, candidates' performance in Biology at the senior secondary examination during that time never increased above 50%. Since biology is the cornerstone and foundation of the scientific courses taught in our secondary schools, it may be worthwhile to examine the teaching strategies used in this topic (Ogundele et al., 2014). Furthermore, it is important to first assess students' past knowledge, examine it, identify any confusions, and then create opportunities for the collision of old and new ideas in order to teach toward understanding of major concepts in biology and achieve conceptual change in students' learning outcomes. It is ineffective to only cover additional content and provide a long list of new ideas without getting students involved in their own meta-cognitive examination when teaching toward conceptual change. The experiments feature links to carefully chosen further reading and are set in real-world scenarios. A useful science is biology.

In addition to being entertaining and motivating, practical activities help students apply and expand their biological knowledge and understanding in fresh, investigative contexts, which can improve memory and learning and pique interest. As a result, the biology practicals comprise a series of experiments that illustrate various biological principles and mechanisms. The world is becoming more scientifically advanced, which makes studying biology in secondary and university education more difficult but also more enjoyable. One of the main ingredients for a good biology education is the availability of a functioning laboratory. The issue of staff and student safety during practical work has become increasingly important since the incorporation of laboratory experience in Biology education (Owoyemi & Olowofela, 2013).

A biology laboratory is a space used for biological research, analysis, and experimentation. It is a place where, with the aid of a compound microscope, cells and tissues from both plants and animals are studied. It is also a place where bones and other body structures, like skeletons, are kept for educational purposes and where biological models allow visitors to see vital organs like the heart. Consumables, reagents, test tubes, incubators, autoclaves, biological fume hoods, heating facilities, pallets, shakers, balances, biological microscopes, cooling systems (freezer, refrigerator, cryogenic tank, cold storage systems), liquid treatment tools (pipettes, etc.), and other items are kept in this area. A standard biology lab comprises workbenches equipped with a reagent rack, water faucet, and sink. Base cabinets for storing glasses, equipment, etc., can also be added to these lab benches. Chemicals are kept in special cabinets. Workbenches have the gas and water hookups needed to carry out a variety of experiments. Safety in the lab requires the growth of abilities and accountability, and it ought

to be a fundamental component of any biology curriculum. This suggests that in order to safeguard students from potential accidents sustained when handling laboratory equipment and chemicals, safety awareness needs to be incorporated into all laboratory practical lessons.

Students can practically apply what they learn in class in a laboratory, which is an essential component of teaching and learning (Sayyadi & Batagarawa, 2020). A vital part of education, the laboratory is at the center of instruction. The laboratory serves as a teaching tool for students, teaching them how to operate equipment, think for themselves, recognize potential hazards, and take preventative or preventive action as necessary. Practical exercises are a common usage for the biology labs. Activities that students perform in a laboratory setting with chemicals and equipment are referred to as practical activities.

Additionally, increasing student experimentation options should coincide with a growing awareness of chemicals and other dangerous materials as well as laboratory safety. Chemicals have many benefits that improve quality of life, but when students use them carelessly, they put the environment in peril. Teachers need to be aware of the possible risks associated with chemicals in science labs. Teachers have a significant responsibility to raise students' awareness of dangerous chemicals and to continuously reinforce safe lab practices, such as correct chemical handling, storage, and disposal. All of these recommendations made by teachers should be followed by students. Put another way, both teachers and students should have the safety of the science lab as their top priority.

It is true that the use of laboratories in science education has matured and is almost as old as science itself. Due to the many advantages that participating in laboratory activities has brought to science education, a number of scholars have supported the use of laboratories in science education around the globe. Feszterova (2015) listed a number of these advantages as follows:

- Enabling learners to have a conceptual understanding of science which has been identified as being highly abstract and complex.
- Offer of opportunity for students to participate in scientific enquiry as a way to appreciate the spirit and methods of science.
- Motivating students to acquire and develop a wide range of science process skills, a variable tool for research in science and this has helped to extend the frontiers of science.
- Making Science very interesting to students and the fact that science is made enjoyable when taught in an enquiry manner.

The prevalence of laboratory accidents caused by a lack of understanding of the nature and behavior of chemicals, inadequate laboratory health management techniques, human error, and occasionally the sheer carelessness of laboratory users have plagued the laboratory experience, despite the many advantages of laboratory activities for science education. For example, the majority of laboratory experiments in physics, chemistry, and biology use chemicals, substances, and reagents of various compositions that are radioactive, flammable, toxic, and corrosive, making them dangerous for both laboratory users and the environment, especially when used improperly. Science educators have consistently emphasized the use of laboratory activities in improving students' understanding of science concepts, acquisition of science process skills and attitudes, problem solving abilities, and understanding of how science

and scientists' work. Laboratory activities are widely acknowledged to play distinctive and central roles in the realization of the goals of science education. Usman (2013). Like other developing nations, Nigeria is actively working to boost the number of science majors enrolled in postsecondary institutions so that it can fulfill the increasing demand for qualified laborers in the workplace of the twenty-first century. Without a doubt, laboratory courses involving the handling of chemicals, reagents, and potentially hazardous materials will be a part of the training of competent scientists and technologists (Igwe, 2013). Therefore, in order to reduce laboratory accidents, it is imperative that our schools implement the finest laboratory safety management standards. However, nothing is currently known regarding the quality of safety procedures that are followed in our schools or the extent to which students are aware of the risks associated with working in a laboratory. Investigating secondary school science students' awareness and comprehension of laboratory safety procedures in Nigerian public secondary schools presents a challenge for these young academics (Feszterova, 2015).

According to Artdej (2013), the vast majority of students misinterpreted what safety signs meant. According to Ting (2020), safety moments offer a straightforward yet effective method for increasing laboratory safety awareness in academic settings. Additionally, schools do not have laboratory support, which leads to inadequate maintenance and antiquated laboratory safety equipment. Because experiments are the cornerstone of science education, teaching and learning of science, which is a practical course, requires practical laboratory activities. Biology professors have long bemoaned the lack of laboratory space and safety equipment, huge class sizes, and insufficient time allocation as some of the many barriers to an effective biology practical education. In order to determine how common safety gadgets are in science labs at secondary schools in Nigeria's Ebonyi State, Nwele (2013) carried out a study. For the study, the researcher employed 180 science teachers, laboratory assistants, and 45 secondary schools. The survey design used was descriptive. Data was gathered using a standardized eleven-item, four-point scale questionnaire. The study topic was addressed by analyzing the data using the mean and standard deviation, and testing the hypothesis at the 0.05 alpha level of significance was done using the t-test. The data analysis's findings showed that secondary schools in Nigeria's Ebonyi state have very little access to safety equipment. This implies that the state's ability to improve science laboratory abilities sustainably will be impeded. The researcher suggests that the Ebonyi State government make sure that a significant number of safety equipment are available in the state's secondary schools. The availability of laboratory safety supplies was examined in both the previous and current studies, which is why they are related. Several scholars have given differing definitions of the school laboratory.

According to Omiko (2015), a laboratory is a setting where science professors carry out experiments for the benefit of their students. Experiments and other activities that support the students' acquisition of scientific knowledge are included in the laboratory exercises. According to Igwe (2013), a laboratory can be used to conduct scientific research outdoors, such as at a field, riverside, workshop, or even a market, or it can be indoors, like the well-furnished and planned rooms seen in the majority of schools. The researcher observed that no matter what

kind of laboratory is used to teach science, students should get the same laboratory experience—that is, they should engage in a sequence of observational, demonstrating, and experimental activities that give them the chance to develop their understanding of theoretical and practical concepts by solving problems. Science labs should have safety equipment such as face shields, respirators, safety glasses, gas masks, fire blankets, first aid kits, fume cupboards, lab coats, gas masks, eye washers, and acid cabinets, among other things, according to Igwe (2013). These are employed in laboratories to avoid and manage emergencies and mishaps.

A "laboratory is a room, or building, or a special period of time equipped and set aside for practical or experimental studies to take place," according to Omiko (2015). According to him, a strong scientific curriculum revolves around the laboratory, giving students hands-on experiences that align with the objectives of scientific literacy. This suggests that at a secondary school without a laboratory where science courses are taught and learned, science instruction cannot be fully completed.

Similarly, Nwanuma (2005) reported to Nwele (2013) that students do science lab experiments without donning lab coats, safety goggles, or hand gloves. It appears that most tertiary institutions' laboratories lack safety equipment such as gas masks, vacuum desiccators, fume cupboards, fire blankets, spill kits, and vacuum desiccators. Some of the labs have first aid boxes, however they seem to be old and empty of any useful supplies. Some of the laboratories' carbon dioxide fire extinguishers appear to be devoid of the gas. In certain laboratories, it's feasible that instructors and students conduct research without using safety goggles, lab coats, or hand gloves.

Ibrahim et al.'s (2021) study on the relationship between students' academic achievement in biology and the availability of safety equipment and supplies found that there are insufficient classrooms and laboratories. In addition to having inadequate facilities and safety gear, laboratories also have very little supplies of chemicals and reagents needed for experiments. Additionally, a lack of laboratory assistants in schools contributes to the outdated and badly maintained safety equipment in laboratories. Because experiments are the cornerstone of science education, practical laboratory activities are necessary for the teaching and learning of science, which is a practical course. Nonetheless, it has been noted that safety devices and the physical structure of biology are insufficient. According to Ajayi (2018), biology teachers have long bemoaned the several barriers to a successful biology practical education program, including a lack of laboratory space and safety equipment, huge class sizes, and insufficient time allotment.

In order to determine how common safety gadgets are in science labs at secondary schools in Nigeria's Ebonyi State, Nwele (2013) carried out a study. The data analysis's findings showed that secondary schools in Nigeria's Ebonyi state have very little access to safety equipment. This implies that the state's ability to improve science laboratory abilities sustainably will be impeded. The researcher suggests that the Ebonyi State government make sure that a significant number of safety equipment are available in the state's secondary schools. The availability of laboratory safety supplies was examined in both the previous and current studies, which is why they are related. Additionally, Azubuike (2014) conducted research to determine how much knowledge instructors and students have about safety

procedures and equipment when working in the biology labs during practical sessions. After the data was evaluated, it was found that 71% of students and 73% of teachers were knowledgeable of safety procedures in biology labs. The majority of biology teachers at the secondary schools that were chosen have a B.Sc.Ed., and 65% have worked for five to ten years. The first aid kits in the majority of the chosen biology laboratories are insufficient. Cotton wool, bandages, Delton solution, and iodine solution were the only supplies on hand. The results showed that both educators and pupils at the chosen schools were well-versed in safety procedures. But most schools had insufficient first aid kits and no safety equipment.

An assessment of the safety protocols in biology labs at particular secondary schools in the Gumel Emirate, Jigawa State, Nigeria, was conducted by Adams and Azubuike (2014). The purpose of the study was to determine how much knowledge instructors and students have regarding safety procedures and equipment when using them in the biology labs for practical sessions. After the data was evaluated, it was found that 71% of students and 73% of teachers were knowledgeable of safety procedures in biology labs. The majority of biology teachers in the chosen secondary schools hold a B.Sc. in Education, and 65% of them have five to ten years of professional experience. The first aid kits in the majority of the chosen biology laboratories are insufficient. Cotton wool, bandages, Delton solution, and iodine solution were the only supplies on hand. The results showed that both educators and pupils at the chosen schools were well-versed in safety procedures. But most schools had insufficient first aid kits and no safety equipment. It is crucial to look into how well the equipment that is currently accessible works.

In general, the state of any facility or piece of equipment can be determined by its functionality. Functionality, according to Hornby (2014), is the capacity of a tool or piece of equipment to carry out a specific job well. Many pieces of equipment related to safety materials are kept in the lab. The functionality of these tools, which include fire extinguishers and safety goggles among others, is crucial as science labs seem to be more vulnerable to risks, hazards, and mishaps due to the presence of hazardous chemicals. The majority of tertiary institutions in Nigeria have partially burned scientific labs due to non-functioning Bunsen burners and a lack of fire blankets and working extinguishers. It becomes crucial to look into how these facilities are used and how it affects teaching and learning if the laboratory supplies and equipment are readily available and in working order.

In Sardauna LGA of Taraba State, Nigeria, Amos et al. (2022) looked into the effects of resource adequacy and use on students' academic performance. The survey design was descriptive. In the Sardauna Local Government Area of Taraba State, twenty (20) public secondary schools were randomly selected using a basic random sampling technique. The results demonstrated a strong positive correlation between students' academic achievement and the availability of adequate resources. Nonetheless, study showed a weakly positive correlation between students' academic achievement and their use of resources. Among other goals, increasing funding and resources for public secondary schools was suggested as a way to improve students' academic performance. The use of instructional materials as tools for students' effective academic performance was assessed by Bukoye (2019): Implications for

Counseling. The results showed that most schools were not using instructional materials to their full potential and that most teachers were unaware of the benefits of using materials effectively in the classroom. The people that used them did not do it in a proper manner. It makes sense that a large percentage of pupils fail external exams. Based on the results, the state's professional counselors should hold seminars and workshops to educate all school administrators, teachers, and other educators on the value and effective use of instructional resources. Among other suggestions, the government ought to make an effort to release adequate funding. A number of issues work against the availability and application of safety resources in biology laboratories, as well as the efficient application of safety procedures. These elements consist of;

**Insufficient funds:** According to Nwele (2013), one of the main obstacles to the availability and usage of laboratory safety resources is the insufficient and inappropriate use of funding. Money is required to supply resources, maintain machinery, and fix broken machinery. Nwele continued, saying that people who use funds granted by the government for other projects make matters worse and endanger the sustainability and upkeep of educators, students, and instructional resources. When their salaries are not paid on time, instructors at these universities go on strike due to a shortage of funding. The attainment of educational objectives is likely to be impacted by these financial restrictions and its accompanying effects.

**Political restraints:** Development is hampered by political instability. Numerous science laboratory and instructional programs and projects were shelved due to the frequent changes in government. Certain school buildings that were either under construction or in need of refurbishment have remained unoccupied to this day. Likewise, Imogie (2013) disclosed that political unrest impacting Nigeria's economy has resulted in shortcomings within our educational systems.

**Lack of training:** A lot of instructors and students are unaware of the value of incorporating safety resources from biology laboratories into their lessons and the proper teaching techniques to employ in order to successfully meet learning objectives. The propensity of vandalism among students, who destroy school property whenever they rebel against the administration, is another example of this ignorance. Since most educators are unable to use the most recent safety supplies that are offered by the institutions, how are they supposed to teach others something they are unsure of?

**Enrollment explosion:** Because the amount of resources provided does not match the amount used, schools with large enrollments are more likely to have poor resources. Large laboratories are more likely to be impoverished, in part because larger populations require higher income requirements. Imogie (2013) found in their research that the high enrollment of students in science courses, like biology, has placed an undue amount of strain on the resources currently available for laboratory safety. Despite the fact that the Federal Republic of Nigeria has declared in NPE (2014) that "the teacher to student ratio shall be kept at 1:20 for effective participation of students in practical work." The same issue of an excessive student population also exists in postsecondary institutions. In this case, there will be a significant gap even if an experienced teacher tries to include every student in a single practical assignment. Insufficient

manpower: The absence of sufficient people, both in terms of number and quality, is a persistent feature of Nigerian education. Considering biology's importance to both humans and society as a whole, there are very few experts in the field. According to a 2013 study by Okoli and Osuafor, 50% of the schools surveyed lacked laboratory safety supplies overseen by qualified staff members. This finding was verified by sampling six educational zones based on the number of lab assistants and attendees. One reason for the underutilization of laboratory safety resources in schools was a lack of technical skills.

**Inadequate safety resources for instruction:** Postsecondary universities' laboratory resource materials are in a sorry state. In a similar line, Imogie (2013) cautioned that the number of students attending these schools has expanded and that their laboratories are no longer large enough to accommodate them all. These findings demonstrate that the amount of resources supplied to biology laboratories is inadequate, and the way in which those resources are managed is inefficient.

In a study titled "Utilization of Biology Laboratory Teaching Facilities and Equipment in Senior Secondary Schools in Borno State, Nigeria," Ibrahim et al. (2021) discovered that all of the tested schools had reasonably accessible biology laboratory supplies and equipment. Similar to this, it was discovered that the following laboratory supplies and equipment were used to a sufficient degree: filter funnels, test tube racks with 12 holes, test tube holders, prepared slides of typical animal cells, conical flasks, soil sieves, specimen bottles, litmus paper, dropping pipettes, chemical balance, Petri dishes, beakers, entomological pins, and soil test kits. Ibrahim et al. (2021) added that inadequate funding, an inadequate number and caliber of facilities, a lack of dedicated time for practicals, an excessive number of biology topics for teachers to cover, overcrowded classrooms, and inadequately equipped laboratories are some of the other factors impeding the effective use of biology laboratory facilities and equipment. The misuse of biology lab safety resource materials is also thought to be hindered by a number of serious issues, such as inadequate supply and poor handling of both human and material resources. We should talk about these elements to see how much of an impact they have on biology instruction.

When Biology Laboratory Safety resources are used effectively, biology is made more engaging, fascinating, and intelligible for students. Students studying biology need to feel safe in the lab in order to succeed academically. This also depends on whether safety supplies are used and available in the labs. Regretfully, the majority of public senior secondary schools in Rivers State do not have the necessary safety supplies in their biology labs. The lack of these crucial safety supplies in the biology lab foreshadows peril for the pupils. This is because there's a chance of an accident where pupils come into contact with hazardous materials and get hurt or killed. Additionally, observations have demonstrated that even in cases where some of these safety supplies for laboratories are accessible, their management and use become dubious. Without a doubt, these anomalies could have an impact on students' involvement in experiments and biology practicals in the state's public senior secondary schools. Thus, this study examines how senior secondary school students in Obio/Akpor Local Government Area of



Rivers State follow safety procedures in biology laboratories, taking into account the issues that have been described thus far.

The following research questions guided the study:

- (i). What are the available laboratory safety materials in the Biology Laboratories in public senior secondary schools in Obio/Akpor Local Government Area?
- (ii). To what extent can we confirm the functionality of the laboratory safety equipments/materials in public secondary schools in the area?
- (iii). To what extent do students utilize Biology Laboratory Safety Materials in public secondary schools in Obio/Akpor Local Government Area?
- (iv). What are the factors that militate against the effective use of Biology Laboratory Safety Materials among students in public secondary schools in Obio/Akpor Local Government Area?

### **Research Methodology**

200 Senior Secondary Two (SSII) students—110 females and 90 males—were selected from a population of 12,327 SS11 pupils from 23 public secondary schools in Obio/Akpor LGA. A survey research design was used for the study. There are 7,147 females and 5,180 males in this. Voting was used to choose 13 schools for the study using a basic random sample technique. The researcher collected data for the study using a standardized questionnaire called the "Implementation of Safety Practices in Biology Laboratory Questionnaire (ISPBLQ)". There were two sections in the questionnaire. Parts A and B. The respondent's biographical information is the main focus of Section A, while 25 item statements in Section B are meant to generate opinions on the topic. In order to measure them, five items each from the following research questions and ten (10) things from the first research question were raised. A 4-point rating scale with a range of 4–1 was used to score the responses: strongly agree (SA=4), agree (A=3), disagree (D =2), and severely disagree (SD = 1). According to the decision rule, an item will be termed opposed if its mean score is equal to or less than 2.49, and agreed upon if its mean score is equal to or greater than (>) 2.50%.

Two specialists in the field of Biology Education at the Department of Biology, Faculty of Natural and Applied Sciences, Ignatius Ajuru University of Education, Port-Harcourt Rivers State, examined the face validity of the questionnaire. The final edition of the questionnaire included their revisions and suggestions regarding the wording and applicability of the various items. Twenty copies of the research instrument were given to twenty students from different public secondary schools who were not chosen and were not involved in the study in order to assess the instrument's reliability. The Pearson Product Moment Correlation (PPMC) process was used to analyze the data generated in order to guarantee the instrument's reliability. The procedure yielded a correlation coefficient ( $r$ ) of 0.79, indicating that the instrument was deemed reliable. With the assistance of a qualified research assistant who also assisted in distributing and retrieving the instrument, the researcher gave the respondents the instrument. It was delivered and collected in a manner that maximized return in less than two weeks.

**Research Question 1:** What are the available laboratory safety materials in the Biology laboratories in public senior secondary schools in Obio/Akpor Local Government Area?

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**Table 1: Mean and Standard Deviation on the Availability of Laboratory Safety Materials in the Biology Laboratories**

S/No	Item	Mean	Std.dev	Decision
1	We have fire extinguishers in the laboratory	1.70	0.90	Not Available
2	We have first aid materials in the laboratory	1.40	0.49	Not Available
3	We have safety goggles in the laboratory	1.70	0.90	Not Available
4	We have hand gloves in the laboratory	2.20	0.98	Not Available
5	We have fume cupboards in the laboratory	2.00	0.63	Not Available
6	We have laboratory safety coat	1.60	0.49	Not Available
7	Gas masks are available in the laboratory	1.60	0.80	Not Available
8	Safety glasses are available in the laboratory	2.80	0.98	Available
9	Protective foot wears are available in the laboratory	2.20	0.75	Not Available
10	Face shields are available in the laboratory	1.80	0.75	Not Available
11	Acid cabinets are available in the laboratory	1.40	0.49	Not Available

Table 1 presents result of availability of laboratory safety materials in the Biology laboratories in public senior secondary schools in Obio/Akpor Local Government Area. Only item 8 (safety glasses) was indicated as available because it had a mean above the criterion mean 2.50. This is an indication that only safety glasses were the available laboratory safety material in most Biology laboratories in public senior secondary schools in Obio/Akpor Local Government Area.

**Research Question 2:** To what extent can we confirm the functionality of the laboratory safety equipments/materials in public senior secondary schools in the area?

**Table 2: Mean and Standard Deviation Showing the Extent of Functionality of the Laboratory Safety Equipments/Materials**

S/No	Item	Mean	Std.dev	Decision
12	Safety materials are working effectively	1.20	0.40	Not Accepted
13	Safety materials in the laboratory are operational whenever use	2.00	0.63	Not Accepted

14	Fire extinguishers are functional whenever used in the laboratory	1.40	0.49	Not Accepted
15	Safety instruments such as gas masks, spill kits and fire blankets are functional in the laboratory	1.40	0.49	Not Accepted
16	All the available safety materials in the laboratory are in good condition	1.40	0.49	Not Accepted

All the items in table 2 have a mean score less than the criterion mean 2.50. This is an indication that laboratory safety equipment/materials in public senior secondary schools are not functional in the study area.

**Research Question 3:** To what extent do students utilize Biology laboratory safety materials in public senior secondary schools Obio/Akpor Local Government Area?

**Table 3: Mean and Standard Deviation on the utilization of Biology laboratory safety materials in public senior secondary schools**

S/No	Item	Mean	Std.dev	Decision
17	Students use laboratory safety materials in the conduct of experiment	2.20	0.98	Not Accepted
18	Use of safety materials in the laboratory by students is encouraging	1.80	0.75	Not Accepted
19	Students don't know anything about laboratory safety materials	1.40	0.49	Not Accepted
20	Regular and periodic laboratory exercises are carried out with every safety materials handy	2.20	1.17	Not Accepted
21	Low utilization of safety materials in the laboratory result in students lack of interest in science	2.34	1.15	Not Accepted

As shown in table 3, all the items have a mean score less than 2.50. It implies that students don't utilize Biology laboratory safety materials in public senior secondary schools.

**Research Question 4:** What are the factors that militate against the effective use of Biology laboratory safety materials among students in public senior secondary schools in Obio/Akpor Local Government Area?

**Table 4: Mean and Standard Deviation the Factors That Militate Against the Effective Use of Biology Laboratory Safety Materials among Students**

S/no	Item	Mean	Std.dev	Decision
22	Lack of sufficient fund militate against effective use of laboratory safety	3.40	0.49	Accepted
23	Lack of trained personnel militate against effective use of material	3.40	0.49	Accepted
24	Overcrowded laboratory militates against	3.52	0.67	Accepted

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	effective use of safety materials			
25	Lack of electricity in the laboratory militate against effective use of laboratory safety materials	3.73	0.44	Accepted
26	Inadequate provision of safety materials and equipment militates effectiveness use of it by students	3.17	0.86	Accepted

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Table 4 present result on the factors that mitigate against the effective use of Biology laboratory safety materials among students in public senior secondary schools in Obio/Akpor Local Government Area. All the items have a mean greater than the criterion mean. This means that they are all factors that mitigate against the effective use of Biology laboratory safety materials among students in public senior secondary schools.

#### **Summary of Findings**

1. Laboratory safety materials are not available in the Biology laboratories in public senior secondary schools in Obio/Akpor Local Government Area.
2. Laboratory safety materials are not functional in the Biology laboratories in public senior secondary schools in Obio/Akpor Local Government Area.
3. Students don't utilize Biology laboratory safety materials in public senior secondary schools Obio/Akpor Local Government Area.
4. All the factors listed in table 4 militate against the effective use of Biology laboratory safety materials among students in public senior secondary schools in Obio/Akpor Local Government Area.

#### **Discussion of Findings**

Result on table 1 showed that laboratory safety materials are not available in the Biology laboratories in public secondary schools in Obio/Akpor Local Government Area, this finding agrees with Nwele (2013) whose study revealed that the extent of availability of safety instruments was low. It also corroborates Omiko (2015) and Ibrahim et al (2021) who reported that there are no enough laboratory safety equipment. Although table 1 reveals that safety glasses were available, it was quite insignificant. Furthermore, table 2 revealed that laboratory safety materials are not functional in the Biology laboratories in public secondary schools in Obio/Akpor Local Government Area, even when very few are available. Since very few respondents agreed to availability of safety materials, it becomes really difficult to determine functionality of these materials. Moreover, this result agrees with Sayyadi, & Batagarawa, (2020) and Ibrahim et al (2021) who reported that the few available materials or equipment are obsolete due to lack of maintenance.

Students donnot utilize Biology laboratory safety materials in public senior secondary schools Obio/Akpor Local Government Area, as revealed on table 3. This is in line with Nwanuma (2005) in Nwele (2013) who found out that students carry out experiments in the laboratory without using safety gadgets. Various factors militate against the effective use of

Biology laboratory safety materials among students in public senior secondary schools in Obio/Akpor Local Government Area. Result on table 4 show that all the listed factors actually militate against effective use of safety materials in the laboratory. This finding agrees with Omiko (2015) and Nwele (2013) who posited that the various factors listed are actually responsible for ineffective use of laboratory safety materials. Result on table 4 agrees with Ibrahim et al (2021) who stated that factors hindering effective utilization of Biology laboratory materials and equipment in secondary schools include, too many Biology topics to teach, large class size, lack of funding and inadequate supplies of these laboratory materials and equipment.

### Conclusion

This study concluded that, most science laboratory safety materials are unavailable in the study area. The few available ones are obsolete and so, lack functionality. It was also concluded that lack of funds, inadequate supply of laboratory staff, high rate of enrollment into schools as well as other factors militate against effective use of Biology laboratory safety materials and equipment. This will enhance the implementation of safety practices.

### Recommendations

- (i) Safety materials should be made available in every Biology laboratory in secondary schools.
- (ii) Adequate number of science teachers, laboratory assistants/attendants and laboratory materials should be provided by the government for effective implementation of safety practices.
- (iii) The government should endeavour to release enough funds for regular supplies and maintenance of safety materials in Biology laboratories.

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