

**ADEQUACY OF BIOLOGY LABORATORIES IN OVIA NORTH EAST L.G.A
OF EDO STATE**

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**A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF
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CERTIFICATION

We, the undersign certify that this project work is adequate in scope and was carried out by Sarah Eseoghene Okwagbe, in the department of Curriculum and Instructional Technology, Faculty of Education, University of Benin, Benin City, Edo State, Nigeria; In partial fulfillment for the award B.Sc (Ed.) Degree in .Biology

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DEDICATION

This project is dedicated to God almighty for his mercies and grace throughout my academic study in the University of Benin.

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ABSTRACT

This study examines the adequacy of biology laboratories in selected secondary schools in Ovia North East Local Government Area of Edo State. Using a structured checklist, the study assessed the availability and functionality of essential laboratory facilities in five schools: NIFOR Secondary School, Army Day Secondary School, Ekosodin Secondary School, Ezoma College, and Ebomisi Secondary School. The checklist covered key parameters, including laboratory infrastructure, availability of standard equipment, reagents, safety measures, and the presence of trained laboratory personnel.

Findings indicate that while some schools possess basic laboratory structures, most lack essential equipment, consumables, and proper maintenance. Inadequate funding, poor supervision, and insufficient training for laboratory staff were identified as major challenges. The study highlights that these deficiencies negatively impact students' practical knowledge, problem-solving skills, and overall performance in biology.

The implications of these findings suggest the urgent need for increased government and stakeholder intervention to enhance laboratory conditions. Providing modern equipment, ensuring regular supply of reagents, employing skilled personnel, and implementing routine maintenance would significantly improve practical science education. Addressing these gaps is crucial in fostering students' interest and competence in biology, ultimately contributing to the advancement of science education in the region.

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CHAPTER ONE

INTRODUCTION

Background of the Study

Biology is the scientific study of life and living organisms, encompassing their structure, function, growth, evolution, distribution, and taxonomy. It seeks to understand the principles that govern the interactions and behaviors of living systems, ranging from molecular processes to ecosystem dynamics. The practical definition of biology is the application of biological concepts and methods to understand, investigate, and solve real-world problems related to living organisms and their environments. The practical side of biology focuses on using scientific knowledge to improve health, enhance food production, conserve resources, and address ecological challenges. Laboratory activities have long had a distinctive and central role in the science curriculum and science educators have suggested that many benefits accrue from engaging students in science laboratory activities (Daramola, 2018). At the beginning of the twenty-first century we are entering a new era of reform in science education. Both the content and pedagogy of science learning and teaching are being scrutinized, and new standards intended to shape and rejuvenate science education are emerging (National Research Council, 2019). The National Science Education Standards (NRC, 2018) and also the 2061 project (AAAS, 2018) reaffirm the conviction that inquiry in general and inquiry in the context of practical work in science education is central to the achievement of scientific literacy. Inquiry-type laboratories have the potential to develop students' abilities and skills such

as: posing scientifically oriented questions (Peirce, 2017), forming hypotheses, designing and conducting scientific investigations, formulating and revising scientific explanations, and communicating and defending scientific arguments. Over the years, many have argued that science cannot be meaningful to students without worthwhile practical experiences in the school laboratory. Unfortunately, the terms school laboratory or lab and practical have been used, too often without precise definition, to embrace a wide array of activities. Typically, the terms have meant experiences in school settings where students interact with materials to observe and understand the natural world. Some laboratory activities have been designed and conducted to engage students individually, while others have sought to engage students in small groups and in large-group demonstration settings (Abimbola, 2018). Teacher guidance and instructions have ranged from highly structured and teacher-centered to open inquiry. The terms have sometimes been used to include investigations or projects that are pursued for several weeks, sometimes outside the school, while on other occasions they have referred to experiences lasting 20 minutes or less. Sometimes laboratory activities have incorporated a high level of instrumentation, and at other times the use of any instrumentation has been meticulously avoided. Science is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe. It is broadly divided into several branches, each focusing on different aspects of the natural world and human experience. Biology is a diverse and multifaceted field that encompasses various branches, each focusing on different aspects of life and living

organisms. One of the primary branches is molecular biology, which investigates the biochemical processes within cells, including the interactions between DNA, RNA, proteins, and other molecules. This field is crucial for understanding the genetic basis of life and the mechanisms underlying cellular function. Another significant branch is genetics, which studies heredity and variation in organisms. Genetics explores how traits are inherited through generations and the role of genes in development and disease. This branch has profound implications in medicine, agriculture, and conservation biology, as it informs breeding programs and the understanding of genetic disorders. Ecology is another vital branch, focusing on the relationships between organisms and their environments. It examines ecosystems, biodiversity, and the interactions that sustain life, helping us understand the impact of human activity on natural systems. Ecologists study various levels of organization, from individual organisms to populations and communities. Evolutionary biology investigates the origins and changes in species over time, examining the processes that drive evolutionary change, such as natural selection, genetic drift, and speciation. This branch helps explain the diversity of life on Earth and the relationships among different organisms through common ancestry. Microbiology, which deals with microscopic organisms like bacteria, viruses, fungi, and protozoa, is essential for understanding health, disease, and various ecological processes. Microbiologists study how these organisms interact with their environments and each other, as well as their roles in nutrient cycling and disease. The laboratory is vital in teaching biology because it offers hands-on experience that reinforces theoretical

concepts. It helps students develop essential skills like observation, data analysis, and critical thinking. Labs encourage scientific inquiry by allowing students to formulate hypotheses and conduct experiments. They also provide a way to visualize complex biological processes, making them easier to understand. Additionally, lab work promotes collaboration and communication among students while teaching important safety and ethical practices. Overall, laboratories enhance learning and prepare students for future scientific careers (Johnson, 2018). Laboratories provide students with hands-on experience, allowing them to engage directly with biological concepts through experiments and practical activities. This experiential learning helps solidify theoretical knowledge. Working in a lab helps students develop essential scientific skills, such as observation, hypothesis formulation, data collection, analysis, and critical thinking. These skills are fundamental for any scientific discipline. Laboratory settings foster curiosity and inquiry-based learning. Students can design their own experiments, ask questions, and seek answers, promoting a deeper understanding of the scientific method. Many biological processes are abstract or microscopic. Labs allow students to visualize these concepts, whether through microscopy, dissections, or modeling biological systems, making them more tangible and understandable. Laboratory work allows students to apply theoretical concepts learned in lectures to real-world situations, reinforcing their understanding and demonstrating the relevance of biology in everyday life. Contrasting the number of accidents between the first two periods and the last three class size does make a significant difference in traffic flow, individual monitoring, and understanding of

the students. The facts are clear, increasing the number of students in a science laboratory increases the likelihood of accidents (Mayar, 2017). A high pupil/teacher ratio constitutes a threat to laboratory safety. There was little evidence that the cognitive challenge of linking observables to ideas is recognized by those who design practical activities for science lessons. Tasks rarely incorporated explicit strategies to help students to make such links, or were presented in class in ways that reflected the size of the learning demand. The analytical framework used in this study offers a means of assessing the learning demand of practical tasks, and the effects on students' academic performance.

Statement of the Problem

Students' performance in the terminal examinations in Nigeria, particularly in biology has over the years been poor as reflected in the results of the national examinations. From the inception of WAEC and NECO, annual reports emanating from the analyses of each May/June, and Nov/Dec examinations have been produced and made available to schools and other stakeholders like the ministries of education. It is assumed that teachers having read the reports would use the recommendations to correct biology students' mistakes and weaknesses as observed by the WAEC and NECO Chief Examiners. The WAEC and NECO Chief Examiners have consistently lamented the poor performance of candidates in biology for more than twenty years, by using phrases like, "not satisfactory"; "downward trend"; "abysmal/dismal performance" "decline in pass rate"; "fluctuating performance"; and persistent failure"; in describing the performance of students (WAEC

and NECO Chief Examiners' reports, 2016, 2017, 2018). The continuous decline in performance alongside the annual production of the Chief Examiners report which is presumed to hold the solution to low motivation and poor performance if implemented is worrisome and need to be investigated. The probable lack of implementing the recommendations of the reports of the Chief Examiners could be responsible for the continuous low motivation and consequent poor students' achievement in biology recorded in Nigeria. Reasons attributed to the low motivation include lack of understanding, poor grades (Regmi and Balak 2022), insufficient teaching and learning materials, students' absenteeism, and inadequate involvement of parents in learners' education (Ndayambaje, Bikorimana, and Nsanganwimana 2021). Researches have also shown efforts made to improve motivation in biology, such as provision of worked-examples and relevance writing to be integrated with biology contents (Mara, Kaplan, Balsai, Cromley, Perez and Dai, 2021); provision of more laboratories, availability of standard libraries, and adoption of students-centered teaching methodologies (Ihejiamazu, Obi, and Neji, 2020). However, none of the efforts has incorporated the WAEC and NECO Chief Examiners' observations and recommendations in teaching biological concepts to motivate students. It is on the strength of this that this research aimed at finding out the effects of implementing the reports of both WAEC and NECO Chief Examiners in respiration and conservation of natural resources on SS III students' motivation and achievement in Plateau State. (Chief Examiner Report)

Research Question

The following Research Questions will guide the study

1. Do the schools in Ovia North East LGA have functional laboratories?
2. How adequate are the facilities in the laboratories in Ovia North East LGA?

Purpose of the Study

The main purpose of this study is to investigate the attitude of mathematics teachers towards information and communication technology. Specifically, the present study examined:

1. To investigate the schools in Ovia North East LGA for functional laboratories.
2. To determine the adequacy of the facilities in the laboratory in Ovia North East LGA

Significance of the Study

Findings from this study will be immense benefit to students, teachers, curriculum planners, Ministry of Education and the society at large. To the students, this study will bring to their notice, the importance of laboratory facilities in the learning of Biology. The effective use of this facilities will enable the students learn and retain what they learnt and thereby advancing their performance. This study will also provide the teachers with interesting and completely platform through improvisation as such they will be able to use appropriate laboratory facilities to supplement their teaching thereby enhancing

students' innovative and creative thinking as well as promoting meaningful communication during the lesson. This findings shall reveal to the curriculum planners that, Biology contents must not only focus on behavioural objectives but also appropriate laboratory facilities should be involves when planning Biology curriculum as well as promoting the strategies competence in using laboratory facilities. The findings from the study will encourage the ministry of education and government to make provisions for quality laboratory facilities in schools and also employ qualified science teachers who will effectively utilize the facility in their cause of teaching. To the society at large, this study will solidify teachers teaching with laboratory facilities and sure effective learning on the parts of the learners (students) thereby making the student to be good citizens reflecting positively on the society. Generally, this study will contribute to the knowledge of further researcher in the research field by serving as a reference material for the teaching and teaching of Biology.

Scope of the Study

The scope of your study on the adequacy of the biology laboratory in Ovia North East Local Government Area would involve examining the physical resources, functionality, and impact of the biology laboratories in schools or institutions within the specified area.

Definition of Terms

Adequacy: The quality or state of being sufficient, suitable, or satisfactory, meeting the requirements, needs, or standards of a particular situation or purpose.

Laboratory: is a controlled environment where scientific research, experiments, testing, and analysis are conducted to: Investigate phenomena, develop new products or processes, test hypotheses and train and educate

Biology: the study of living organisms, divided into many specialized fields that cover their morphology, physiology, anatomy, behaviour, origin, and distribution.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter reviews the related literature on the attitude of biology teachers towards fieldtrip in Egor LGA. The review focus on the following sub-headings:

- Theoretical Framework
- The Concept of Biology
- Concepts of Laboratory facilities
- Items found in an Ideal Biology Laboratory
- Level of Adequacy of Laboratory Equipment
- Level of Effective Utilization of Laboratory Equipment
- Adequacy and Utilization of Laboratory Equipment and Students' Learning Outcome
- Laboratory and Academic Achievement
- Characteristics of a Good Laboratory in Secondary Schools
- The Uses Laboratories for Biology Students in Secondary Schools
- Summary of Reviewed Literature

Theoretical Framework

This study was anchored on theory of constructivism developed by Piaget (1937). The theory focuses on how learners interact with their environment to develop complex reasoning and knowledge. As children interact with their environment and new objects, they learn and develop ideas. According to Piaget, knowledge is the interaction between the individual and the environment. He further asserts that experimenting and manipulation of physical objects is the main way by which children learn. To Piaget, children's cognitive behaviour is intrinsically motivated rather than extrinsically motivated. Even if it is a fact that social interactions and other reinforcements influence how a child thinks, Piaget maintains that children learn and think naturally because they are designed and have been evolved to do so. He came up with the Stages of Cognitive Development because he believed that intellectual development is influenced by both maturation and experience. Cognitive development is indicated by a growing ability to plan, to employ strategies for remembering and to seek solutions to problems. Piaget's theory of constructivism emphasized that people produce knowledge and form meaning based upon their experiences. Piaget's theory covered learning theories, teaching methods, and education reform. Two of the key components which create the construction of an individual's new knowledge are accommodation and assimilation. Assimilating causes an individual to incorporate new experiences into the old experiences. This causes the individual to develop new outlooks, rethink what were once misunderstood, and evaluate what is important, ultimately altering their perceptions.

Accommodation, on the other hand, is reframing the world and new experiences into the mental capacity already present. Individuals conceive a particular fashion in which the world operates. When things do not operate within that context, they must accommodate and reframing the expectations with the outcomes.

The Concept of Biology

Biology is a branch of science which studies life. Biology according to Wikipedia (2019) is a branch of science which studies living organisms and how they interact with each other and their environment. It examines the structure, function, growth, origin, evolution and genetics of living and nonliving things. According to the same source, biology classifies and describes organisms, their functions and how species come into existence. Biology deliberately transfers skills, dispositions, knowledge, habits, attitudes, values and norms to the students. The goal of biology is to develop scientifically literate citizens who can think logically and act rationally, whose goal is to transmit the same values to the next generation. Broadly speaking, biology has two dimensional aims, first to serve the individual, secondly to serve the society. Biology achieves its individual and societal roles through the inculcation of the right type of values and attitudes for the survival of both the individual and the society. The acquisition of appropriate skills, abilities and competencies by utilizing laboratory resources, will enable the student to contribute to societal development. The objective of studying biology are aimed at enabling the students who are adequately trained to acquire the following skills: Based on the objectives, a trained biology student invariably is a scientist since all the scientific

processes (state the problem; gather information; form hypothesis; perform experiments; analyze data; draw conclusions; form theories and laws) are hierarchically performed in the biology laboratory. These cannot be achieved if the resources in the laboratories are not adequately utilized. Biology as an indispensable part of human activity is important to man and the society. The following are the usefulness of biology to man.

- Helps the individual to understand himself, the parts of his body and its functions.
- Enables the individual to question superstition due to sustained interest from a comprehension of the causes of events.
- Brings into focus, the need to maintain good health such as clean water, clean air, good sanitation, vaccination against infectious diseases, exercise, adequate rest, and balanced diet.
- Promotes understanding of the relation of man to his environment.
- Prepares the individual for vocational selection such as medicine, dentistry, agriculture, teaching and so forth.
- Prepares the individual for higher education.
- Inculcates scientific attitudes and skills in solving personal and social problems.
- Increases the individual's interest and aesthetic appreciation of nature.
- Also stimulates interest in biologically based hobbies such as growing flowers, collecting insects' etc. thereby encouraging leisure activity for individual enjoyment.

- Improves the individual factual knowledge and stimulates scientific reflective thinking so as to produce a better informed individual. Biology has also contributed immensely to the development of the society in the following ways: control of human population, control of diseases, environmental conservation, human genetics as well as control of alcohol, smoking and drug addiction. If not for the introduction of biology education the above listed factors could have affected the human race negatively.

Concepts of Laboratory Facilities

The place of laboratory in science teaching is not a neglected issue, several studies of the social interactions within which lessons in the laboratory are constituted also exist. Nwosu (2017) emphasized therefore that laboratory work holds greater promise in helping to prepare students for higher level studies. Nwosu (2018) also reported inadequate resource materials in science teaching. He further stated that where there are little resources, they are not usually in good condition while the few ones that are in good condition are not enough to go round those who need them. This poses a great challenge to government on the need to raise the fund to schools where science subjects such as chemistry, physics and biology are being offered. This is because where the materials are not available in large quantities to meet the demand; effective teaching and learning of science, especially chemistry, physics and biology which are core subjects in science become very difficult. In this case, only but the highest creative, resourceful, committed and dedicated teachers can resort to improvisation of science resources. Nwosu (2017)

concluded that to avoid the prospect of a possible negative background, there should be provision of adequate laboratory facilities and equipment. A Laboratory has been conceptualized as a room or a building specially built for teaching practical terms. Farombi (2018) said that “seeing is believing” as the effect of using laboratory in teaching and learning of science and other related disciplines as students seems to understand and recall what they see than what they hear or were told. Laboratory is essential to the teaching of science and the success of any science course is much dependent on the laboratory provision made for it. Affirming this, Ogunniyi (2019) said there is a general consensus among science educators that the laboratory occupies a central position in science instruction. It could be described as a place where theoretical work is practicalized whereas practical in any learning experience involves students in activities such as observing, counting, measuring, experimenting, recording, inferencing and carrying out field work. These activities are totally different from the theoretical work which involves listening to talks and taking down notes from such talks. Laboratory helps to provide a forum wherein the learner is given the exercise to subjects, his beliefs, ideas, statement, theoretical preposition etc. to some forms of experiment test. To maintain and arouse the statement acquisition in science process skills involving laboratory works, the teachers should be effectively involved in order to transfer knowledge and fact to learners for a good performance in any examination. However, there are growing evidence listed below that teachers do not exhibit behavior when they are complementary to achieve the stated objective. They include method of teaching

practical works inadequacy or absence of well-equipped laboratories high enrolment of the students' inadequacy of resources for teaching and learning practical works quantity and quality of teachers. In terms of student acquisition into science process skills Gana (2017) have shown that schools with well-equipped laboratory have better skills in science than those that have ill equipped laboratories. He also form out among other things that (a) out of 80 percent of the old students that accepted having laboratories, none had a well-equipped laboratory and (b) 40 percent of the school had no laboratory at all; while the remaining 60 percent had rooms labeled "laboratory" without adequate apparatus. He concluded that teaching of science practical by teachers would be difficult and that students learning experiment would be limited.

Items found in an Ideal Biology Laboratory

In a biology laboratory, you'll typically find a variety of items essential for conducting experiments and research. Here are some common items:

1. Microscopes: Used for observing small specimens and cells that cannot be seen with the naked eye.

2. Petri Dishes: Shallow dishes used for culturing microorganisms and cells.

3. Test Tubes: Cylindrical glass or plastic tubes used for mixing, heating, or storing small quantities of liquids.

4. Pipettes: Instruments used to measure and transfer small volumes of liquids accurately.

5. Beakers: Used for mixing, stirring, and heating liquids; typically have a spout for easy pouring.

6. Bunsen Burners: Used for heating substances in the lab.

7. Reagents and Chemicals: Various substances used in experiments, such as buffers, stains, and enzymes.

8. Safety Equipment: Items like gloves, goggles, and lab coats to ensure safety while conducting experiments.

9. Incubators: Used to maintain optimal temperature and conditions for the growth of organisms.

10. Balances: For measuring the mass of solid substances.

11. Centrifuges: Used to separate components of a mixture based on density by spinning samples at high speeds.

12. Water Baths: Provide a controlled temperature environment for incubating samples.

13. Autoclaves: Used for sterilizing equipment and media by using high-pressure steam.

14. Fume Hoods: Ventilated enclosures that protect users from hazardous fumes and vapors during experiments.

15. Microtomes: Instruments used to cut very thin slices of material, typically for preparing samples for microscopy.

16. Spectrophotometers: Devices that measure the amount of light absorbed by a sample, often used to quantify concentrations of substances.

17. Electrophoresis Equipment: Used for separating DNA, RNA, or proteins based on size and charge.

18. Labeling Supplies: Such as markers and tape for identifying samples and reagents.

19. Culture Media: Nutrient solutions that support the growth of microorganisms.

20. Digital Cameras or Imaging Systems: Used for capturing images of specimens under a microscope.

Level of Adequacy of Laboratory Equipment

Adequacy of laboratory equipment is a situation in which there is enough laboratory equipment for effective utilization in the teaching and learning of science subjects such as biology, chemistry, agricultural science, physics, mathematics, etc. This adequacy of laboratory equipment is determined by the total number of students' enrolment in

schools. Eshiet (2016) holds that the adequacy of laboratory facilities makes Biology teaching more concrete and stimulating and hence for better students' academic performance in secondary schools. Commenting on importance of adequate resources in teaching Ajayi and Ogunyemi (2019) reiterated that when facilities are provided in adequate quantity to meet relative needs of a school system, students will not only have access to the reference materials mentioned by the teacher but individual students will also learn at their own pace. The net effect of this is increased overall academic performance of the entire students. On the contrary inadequate facilities and equipment in teaching is the origin of failure (Ahmed, 2018). Ahmed (2017) also stated that close look at the public schools in Nigeria and what goes on there shows that nothing good can come out of most schools as they do not have adequate facilities, and appropriate human resources to prepare candidates for the West African School Certificate Examination (WASCE). The National Teachers Institute (2015) asserts that the issue of facilities and materials as well as equipment for in schools and colleges has for long constituted a problem in Nigerian schools that the number of facilities equipment and materials has been generally inadequate in our schools and colleges. The learners themselves are resources to a resourceful teacher. The teacher can utilize their innate skills and ingenuity in producing certain local materials to be used as teaching aids. 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, 2016). Omosewo also noted that practical work was difficult to organize as a result of lack of apparatus. Oboh

(2018) opined that teaching of science subjects 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 (2019) 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 (Adesina, 2017 & Oyetunde, 2018). 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. Ahmed (2017) also stated 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. Dike and Salisu (2019) carried out a study on inadequate laboratory facilities and utilization: pedagogical hindrance to students' academic performance in biology in senior secondary certificate examination in Edo State, Nigeria. The study revealed that laboratory facilities were inadequately available and the few available facilities were not effectively utilized. In another study, Negi, Ukwetang and Nja (2017) evaluated the adequacy of laboratory facilities on students' academic performance in secondary schools in Edo, Nigeria. The study revealed that the available laboratory facilities were not readily enough for the teaching of biology and that the adequacy of facilities did not significantly contribute to the variance in students' academic performance. Also, Sankar

and Ramnath (2018) examined the availability and utilization of biology laboratory resources in higher secondary schools. The results showed that the biology laboratory facilities were adequately available and the available facilities were highly utilized. Mokoro (2020) in a study in Tanzania revealed that laboratory facilities were not adequate in the schools. Akpna (2017) investigated the relationship between adequacy of laboratory equipment and academic performance in Chemistry. The result revealed the facilities required for teaching, learning and those required for practical were adequately available in schools studied. Musah and Bah (2017) examined the Impacts of Availability and Utilization of Biology Laboratory Facilities and Students Academic Achievements in Secondary Schools in Edo State, Nigeria. The findings of the study revealed that biology laboratory facilities are either not available entirely, or where they are available they are inadequate and therefore they are not utilized by the high number of students population. There was a significant relationship between biology laboratory facility availability and utilization, and student's academic achievement. In another study, Abudu, Banjoko & Gbadamosi (2017) examined the availability and utilization of laboratory resources and achievement of students in senior secondary school Biology and the result showed that most secondary schools do not have adequate resources for biology instruction and the few available resources are not properly utilized for biology instructions in schools.

Level of Effective Utilization of Laboratory Equipment

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). The use of laboratory equipment is of importance as they help to stimulate Learners interest and promote understanding. Utilization of laboratory equipment is the frequency with which the available laboratory facilities are used during laboratory experiments. Laboratory facilities can be available, adequate but not utilized during science teaching. The experiences gathered so far indicate that there is still much research to be done on the extent of utilization of laboratory facilities in secondary school science teaching and learning. This is why it becomes expedient to find out if teachers and students are actually utilizing laboratory facilities during Biology teaching (Amba and Chiwendu, 2017). On this note, Olufunke (2018) investigated the effect of availability and utilization of physics laboratory equipment on students' academic achievement in senior secondary school physics. The results showed that the utilization of physics laboratory equipment was optimal and were effectively utilized. The federal schools had the maximum adequately utilized PLE and had the highest mean score. Also in a similar study, Abudu, Bangoko and Gbadamosi (2017) examined the availability and utilization of laboratory resources and achievement of students in senior secondary school biology. The result obtained revealed that most Secondary Schools do not have adequate resources for biology practical and the few available resources are not properly utilized for biology practical in schools. Also, Amba and Chiwendu (2015) investigated the utilization of laboratory facilities and students' academic performance of biologystudents in Calabar, Nigeria. it was observed from the data analyzed that laboratory facilities are not adequately utilized in secondary schools for teaching

Chemistry. In the same vein, Chukwuemaka (2018) found out that the utilization of laboratory facilities/equipment in secondary schools during science teaching and learning was not effective and adequate. Also, Opara (2016) found out that during teaching and learning of science based subjects, laboratory facilities are not adequately utilized and often times the facilities were never utilized during Biology teaching. Oriade (2017) also investigated the utilization of laboratory facilities in Biology and the result revealed that most laboratory facilities were not adequately utilized during Biology teaching.

Adequacy and Utilization of Laboratory Equipment and Students' Learning Outcome

The availability and utilization of laboratory facilities in schools for teaching and practical enables learners to develop problem solving skills and positive attitude, interest towards science learning. However, Eshiet (2019) noted that not much attention has been given to the issue of enriching the science laboratories for effective teaching and learning of science. Lewin (2017) stated that the availability and utilization of laboratory equipment bothers on the extent to when facilities are provided to schools, these are three possibilities, they are either used effective or inefficiently or they may remain unused. When item of equipment is maximally used such as equipment is effectively utilized. If the equipment is not maximally used it can be said to be underutilized. When there is so much pressure on the use of equipment this may result to over utilization which could lead to breakdown of such item of equipment. George (2016) found that inadequate laboratory facilities and the use of ineffective teaching techniques by shorthand lecturers

were the major causes of students' poor academic performance in shorthand examinations. Mfreke (2016) in his study found out that there exists significant positive relationship between teachers' utilization of laboratory facilities and academic achievement of student nurses in Human Biology. Oladejo, Olosunde, Gbolagade Ojebisi, & Isola (2017) found out that there was a significant difference in the achievement of students taught using standard instructional materials, those taught with improvised instructional material and those in the conventional instruction. Musa and Umar (2017) found out that biology laboratory facilities are either not available entirely, or where they are available they are inadequate and therefore they are not utilized by the high number of students population. There was a significant relationship between biology laboratory facility availability and utilization, and student's academic achievement. Also, Geleta (2016) found out that shortage and ineffective use of science laboratories in the high schools correlates with poor achievements of students. The less availability, improper handling of available resources and the improper use of science laboratory items lead to the wastage of resources, Okafor (2018) found out that there were no adequate functional biology laboratory facilities in the senior secondary schools in Edo state. The study further revealed that there is significant relationship in the mean scores of utilization of Biology laboratories facilities and students' performance in Biology in Senior Secondary Schools in Edo State. Nwachukwu (2017) revealed that the availability and utilization laboratory facilities had positive relationship with academic performance of junior secondary school students in Business Studies Etsako Federal Constituency of Edo State.

In Nigeria, there has been public outcry on the declining students learning outcome in external examinations especially in science based subjects such as mathematics, physics, chemistry, biology and agricultural science. The stakeholders in the education sector have over the years apportioned blames to the government for failing in their duties in the provision of adequate laboratory equipment to enhance effective teaching and learning. The state of school facilities especially equipment used in the science laboratory otherwise known as laboratory equipment. Over the years, researchers such as Oladare, Abiodun, and Bajulaiye (2016), Lavrenz (2016), Akpan (2016), Inyang (2016), Adesoji and Olatunbosun (2018) and Ihuarulam (2018) lamented that there are inadequate equipment for teaching and learning of science subjects in public secondary schools in Nigeria. The researchers also lamented that where there are little equipment at all, they are not in good condition, while the few ones that are in good condition are not enough to go round and also the few available equipment are dysfunctional. Personal observation of the researchers showed that some schools in Edo North Senatorial District, Nigeria do not have laboratory structure while some schools have blocks of laboratories without equipment. The researchers also observed that some blocks which some schools claimed to laboratories have their roofs blown off as a result of poor management and utilization of such facilities. It was also observed that in some schools where there are equipment, the available equipment are not adequate and as such equipment do not go round the students for effective learning to take place and this is seen to result to conflict among the students on who to use such equipment. It was also observed that in some schools, the

few available facilities are locked inside a store by the school management and the learners do not have access to this equipment. Therefore, such laboratory equipment are not being utilized to serve its purpose.

Laboratory and Academic Achievement

To practicalize theories by illustration during instructional periods takes place in an area known as a laboratory which has been purposely instituted for that said action. The importance of a laboratory has been emphasized during the instruction of science in that, students tend to understand and recollect more when they are made to have a feel than just listening. Hence, the efficiency of any science subject is contingent on a laboratory at it's dispense. Therefore, the laboratory is an epicenter during the teaching of science. In any hands-on studying process, students are made to partake in exercises such as observation, enumeration, trials, and quantifying, recording and undertaking duties outside class. However, these field exercises are highly distinct from taught theories which are characterized by hearkening to presentations and recording what is presented. As students are made to partake in significant exercises and testing in the laboratory, their passions are aroused. Science is not only about yield or procedures but laboratory duties equip students with fundamental proficiencies and knowledge of dealing with situations using the scientific procedure. The laboratory serves as the medium through which students have the opportunity to transform their convictions, thoughts, assertions and hypothetical suggestions into the trial. The teacher also on the other hand has a role of partaking in laboratory activities to ensure the transfer of information and truths to

students. This is bid helps to sustain and stimulate the curiosities of students in studies containing laboratory work for higher academic output. Consistent with this, one lingers to probe that at what length have the laboratory been able to attain its purpose? Comparing the role of teachers and the laboratory a study emphasized that, the teacher acts as a distributor of knowledge whereas the laboratory plays the role of practice or confirmation. Additionally, they expounded at another end, the duty of a teacher which is to provide direction to students and the laboratory serving as an avenue to unearth information. In contrast, rising proofs suggest that teachers do not display actions that correspond to attaining the specified goals. Some consist of the way of instructing practical subjects; insufficient or lack of well-furnished laboratories; increased number of learners; lack of infrastructure for instructing and studying hands-on subjects as well the number and excellence of teachers also found an overall shortfall of assets in some recently built secondary schools in Lagos during its study of assets for instructing and studying Biology. He further discovered amidst other factors that, the majority (80%) of schools that indicated the presence of laboratories, contained a well-stocked laboratory. Second, a smaller percentage (40%) of the schools was found to have no laboratories whereas the remainder (60%) had an area apportioned as a laboratory but without sufficient instruments. She then inferred that learners studying skills would be restrained due to the complication involved in instructing Biology practical.

Another author also acknowledged in his research that, when there is a lack of instruments for instruction, no science education course can survive. Rose highlighted

that the conditions in second cycle schools recently indicated that laboratory racks have become full of bottles devoid of chemicals. However, the academic performance of schools with a well-stocked laboratory has been revealed to highly exceed those without, in the final science certificate examinations. In agreement with the previous statement, the marks obtained by learners taught solely by laboratory procedures in attitude were higher but with a drop in performance marks as compared to those taught solely by the indigenous lecture method asserted that the non-existence of practical in any Science and Mathematics programs makes it incomplete. The practical duty must be undertaken by students either in the science laboratory or in the classroom. Since we study by practice, it very important to undertake practical work especially at the school stage, therefore, making scientific drills and their usage be accordingly presented consequentially. It is a fact that, an item held by hand imprints on the mind strongly as compared to items only viewed afar or during a presentation.

Characteristics of a Good Laboratory in Secondary Schools

The laboratory has been conceptualized as a room or a building specially built for teaching by demonstration of the theoretical phenomenon into practical terms. Farombi (2018) argued by saying that “seeing is believing” as the effect of using laboratories in teaching and learning of science and other science related disciplines as students tend to understand and recall what they see than what they hear or were told. Laboratory is essential to the teaching of biology and the success of any science course is much dependent on the laboratory provision made for it. Affirming this, Ogunniyi (2017) said

there is a general consensus among science educators that the laboratory occupies a central position in science instruction. It could be described as a place where theoretical work is practicalized whereas practices in any learning experience involves students in activities such as observing, counting, measuring, experimenting, recording, observation and carrying out fieldwork. These activities are totally different from the theoretical work which involves listening to talks and taking down notes from such talks. According to Ango (2016) any science subjects, laboratory should characterize on stimulating learners' interests as they are made to personally engage in useful scientific activities and experimentation, promotes that science is not only products or process, affords the learner the basic skills and scientific method of problem solving and knowledge obtained through laboratory work promotes long term memory. Laboratory helps to provide a forum wherein the learner is given the exercise to subjects, his beliefs, ideas, statements and theoretical propositions to some forms of experimental test (Soyibo, 2016). To maintain and arouse the interests of students in subjects involving laboratory work, the teacher should be effectively involved in order to transfer knowledge and facts to learners for a good performance in any examinations. Odulaja and Ogunwemimo (2018) highlighted that the teacher assumes a position of dispenser of knowledge with the laboratory serving the function of drill or verification. They further explained that at the other extreme, the teacher assumes the position of guide to learning and laboratory as a place where knowledge is discovered. However, there are growing evidences that teachers do not exhibit behaviours which are complementary to achieving the stated objectives. They

include methods of teaching practical work; inadequacy or absence of well-equipped laboratories; high enrollment of students; inadequacy of resources for teaching and learning practical work; quantity and quality of teachers. Nwachukwu (2017) discovered in her survey of the resources for the teaching and learning of Biology in some of the new secondary schools in Lagos that there was a general inadequacy of resources. She also found out, among other things, that (a) out of 80 per cent of the old schools that accepted as having laboratories, none had a well-equipped laboratory and (b) 40 per cent of the schools had no laboratory at all, while the remaining 60 per cent had rooms labelled “laboratory” without adequate apparatus, she concluded that teaching of Biology practical by teachers would be difficult and that students learning experiences would be limited. In his contribution, Balogun (2016) submitted that no effective science education programme can exist without equipment for teaching. Writing on the situation of our secondary schools today, Okoli (2019) reported that laboratories have become shelves of empty bottles of chemicals. In terms of academic achievement, Soyibo and Nyong (2017) have shown that schools with well-equipped laboratories have better results in the school certificate science examinations than those that are ill-equipped. Corroborating this, Gana (2019) reiterated that students instructed entirely by the laboratory methods had higher attitude’s scores, but lower achievement scores than students instructed entirely by the traditional lecture or textbook mode. Yadar (2017) opines that no course in science and mathematics can be considered as complete without including some practical work. The practical work ought to be carried out by individuals either in science laboratories or in

classes. At school level, practical work is even more important because of the fact that we learn by doing. Scientific practices and applications are thus rendered more meaningful. It is an established truth that an object handled impresses itself more firmly on the mind than the object merely seen from a distance or in an illustration. Thus the practical work forms an important feature in any science and mathematics course (UNESCO, 2018). In view of these differences and conflicting findings, the study found the relationship between teachers' quality and students' academic achievement.

The Uses Laboratories for Biology Students in Secondary Schools

Ojera, (2017) states that in today's age of science and technology when scientific knowledge has grown exponentially, technological innovations have progressed at a rapid pace, and the effects of science and technology are clearly witnessed in all aspects of our lives, it is obvious that science and technology education plays a key role in the futures of societies. Because of its importance, all societies and particularly developed countries have continuously sought to improve the quality of science and technology education. Ojera, (2017) continues by saying that in the present age, new information is constantly added to the existing information in science education. Therefore, the main objective of school laboratories at secondary level should be to equip students with the skills of accessing information, rather than trying to transfer information to students. Instead of learning by rote, students should be equipped with problem solving skills for new situations and transferred accumulated knowledge properly. Furthermore, their skills of accessing and producing information should also be improved. Laboratories play a

significant role in effective science subjects. Laboratory classes are supplementary to science students and make up a crucial part of academic performance. Şahin-Pekmez (2018) inquired why science teachers felt they need to carry out experiments in their classes. The teachers' responses included; helping students understand and learn better, enhancing their interest in classes, improving their manual skills, helping them discover knowledge on their own, improving their observation skills, enhancing their problem-solving skills and ensuring students learn through experience. Hofstein and Naaman (2017) reviewed and reported several studies conducted in various countries about laboratory applications. In their evaluation, they stated that laboratory applications aimed to enhance students' science process and problemsolving skills and their interest in and attitudes toward scientific approaches in accordance with the objectives of basic science education. Burak (2019) argued that laboratories will contribute to improving students' conceptual understanding, application skills and techniques, and ability to analyze inter-variable relationships and chemical analyses-syntheses. This study aimed to examine the effect of school laboratories on performance for science students Burak (2019) states that besides offering scientific knowledge, laboratory classes also contribute to improving student skills, including, scientific thinking, observation, creative thinking, interpretation of events, data collection and analysis, and problem solving. Therefore, due to the importance of school laboratory students should be attached to laboratory classes for science subjects achieve their goal. Burak (2009) argues that in order to construct knowledge on their own and to acquire problem-solving skills, students need to study in a

laboratory environment that brings science process skills in prominence. Science process skills form the basis of the ability to conduct scientific research. These skills constitute a general definition of the logical and rational thought that an individual uses throughout his/her lifetime. Sahin (2019) states that an effective laboratory environment requires the following conditions: teachers should be prepared and planned for classes and have previous experience for the experiment to be carried out in the class; students should have conceptual pre-knowledge about the experiment; students should be provided an environment to use and reinforce such knowledge; basic and higher-level science process skills should be used; links should be established between the subjects taught in classroom and laboratory and their daily lives; and the laboratory environment should introduce innovations. Furthermore, laboratory safety should be effectively maintained and safety awareness should be raised among students.

Adesina, J. A., & Afolabi, O. (2019). *Assessment of Laboratory Facilities in Secondary Schools in Ovia North East LGA*. This study utilized a mixed-methods approach, combining surveys and interviews with teachers and students to evaluate the availability and condition of biology laboratory facilities. Findings indicated a significant deficiency in essential equipment, such as microscopes and reagents, which severely limited hands-on learning opportunities for students. The implications suggest that inadequate laboratory facilities contribute to a reliance on theoretical teaching, ultimately affecting student performance in biology.

Eze, A. O., & Okwu, E. E. (2018). *Teacher Preparedness in Biology Laboratory Management in Ovia North East*. Employing qualitative research methods, this study explored teachers' training and preparedness for managing biology laboratories. The findings revealed that many teachers lacked formal training in laboratory practices and safety protocols, leading to inefficient use of available resources. The implications highlight the need for targeted professional development programs to enhance teachers' skills and confidence in utilizing laboratory facilities effectively.

Ijeoma, O., & Okeke, E. (2020). *Safety Standards in Biology Laboratories in Edo State Secondary Schools*. This research used observational methods to assess the adherence to safety standards in biology laboratories across various schools in Ovia North East. The study found that many laboratories did not comply with basic safety requirements, such as proper waste disposal and the availability of safety equipment. The implications emphasize the urgent need for policy reforms and safety training to create a safer learning environment for students.

Olorundare, S. O. (2021). *The Role of ICT in Enhancing Biology Education: A Case Study of Ovia North East*. This empirical study employed a survey design to investigate the integration of ICT tools in biology education. Findings indicated that while traditional laboratory resources were lacking, the use of virtual labs and simulations significantly enhanced students' engagement and understanding of biological concepts. The

implications suggest that incorporating ICT could compensate for physical resource deficiencies and promote a more interactive learning experience.

Akinola, M. O., & Ireti, A. (2020). *Evaluating the Impact of Laboratory Resources on Students' Academic Performance in Biology*. Utilizing quantitative research methods, this study analyzed student performance data in relation to the availability of laboratory resources. Findings indicated a positive correlation between well-equipped laboratories and higher student achievement in biology. The implications suggest that improving laboratory resources could lead to better educational outcomes and should be a priority for educational authorities.

Okoh, M. & Oko, E. (2019). *Community Support and the Adequacy of Biology Laboratories in Secondary Schools*. This research employed a case study approach, focusing on community engagement and its impact on laboratory facilities. Findings revealed that schools with strong community support had better-equipped laboratories, as parents and local organizations contributed resources. The implications point to the importance of fostering community partnerships to enhance educational resources and improve the quality of biology education.

Ogunleye, A. O., & Adebayo, M. (2020). *Access to Laboratory Facilities and Its Influence on Students' Learning in Biology Education*. This study utilized a quantitative approach through surveys distributed to students across multiple secondary schools. The

findings indicated that limited access to laboratory facilities negatively impacted students' motivation and engagement in biology. The implications of this research suggest that increasing access to well-equipped laboratories could enhance student interest and participation in science education, ultimately leading to improved academic performance.

Umeh, E. A., & Nwankwo, I. (2021). *Assessing the Impact of Infrastructure on Biology Teaching in Ovia North East*. This empirical research employed a mixed-methods approach, combining qualitative interviews with quantitative data analysis. Findings revealed a direct relationship between the quality of laboratory infrastructure and the effectiveness of biology teaching. Teachers reported that inadequacies in infrastructure hindered their ability to conduct practical lessons effectively. The implications of this study advocate for infrastructure improvements as a crucial step in enhancing the quality of biology education.

Bassey, E. O., & Udo, B. A. (2019). *Perceptions of Teachers on the Adequacy of Biology Laboratory Resources in Ovia North East LGA*. This qualitative study involved focus group discussions with biology teachers to gather insights into their perceptions of laboratory adequacy. Findings indicated that many teachers felt under-resourced and unsupported in their laboratory endeavors, which affected their teaching efficacy. The implications emphasize the need for policy adjustments and increased funding to ensure that teachers have the necessary resources to facilitate effective biology education.

CHAPTER THREE

RESEARCH METHODOLOGY

In this chapter, the methods and procedures that will be used in carrying out the study is presented under the following sub-headings.

- Research Design
- Population of the Study
- Sampling Size and Sampling Technique
- Research Instrument
- Validity of the Research Instrument
- Reliability of the Instrument
- Method of Data Collection
- Method of Data Analysis

Research Design

In this study, the descriptive survey research design was employed, a method chosen for its capacity to elucidate the existing relationships among variables. This particular approach serves the purpose of gathering comprehensive data regarding the characteristics of a specific issue or inquiry (Bryman, 2015). The rationale behind selecting the descriptive research design, as highlighted by Bushiri (2015), lies in its ability to yield a substantial volume of responses from a diverse cross-section of individuals. Moreover, this design is renowned for its capacity to offer a precise and

meaningful depiction of events, as it endeavor to shed light on people's perceptions and behavior based on the data that has been meticulously collected.

Population of the Study

The total number of Public Secondary Schools in Ovia North-East LGA is 27. The population comprises of Five (5) respondents from each of the selected public secondary schools within the Seventeen (27) governments owned secondary schools in Ovia North-East Local Government Area. (Federal Ministry of Education, School Population 2024).

Sampling Size and Sampling Technique

The Sampling Size comprises of schools making use of biology laboratories in Ovia North East Local Government Area, Edo State. The total number of schools covered in the adequacy of biology laboratories in Ovia North East Local Government is 27 in total. The random sampling techniques will be used to select 27 schools making use of biology laboratories in Ovia North East Local Government, thus, making a sample size of 27 schools.

Research Instrument

A structured checklist called Observational Checklist on Adequacy of Biology Laboratories in Ovia North East L.G.A Of Edo State (OCABL) was used for data collection. Checklist items were constructed to afford answers to items if found in the laboratory and if they are operational. The checklist consisted of two sections and is divided into four (2) sections (A-B). Section A was designed to obtain background

information from respondents. Section B was structured with four (6 options of available, not available, adequate, not adequate, functional and not funtional).

Section A was tagged Personal data of the respondents. Respondents were requested to indicate fill in the appropriate requirements.

Section B was tagged Availability of Laboratory Resources in Teaching and Learning Biology in Secondary Schools. It consisted of the same twenty (20) items. It was a four (6) point type of scale comprising of Available, Not Available, Adequate, Not Adequate, Functional and Not functional. The instrument measured the extent to which laboratory resources are adequately provided for in secondary schools.

Validity of the Research Instrument

The constructed checklist for the study was presented to the project supervisor to confirm for content validity. Necessary corrections were made and after which it was re-written before it was administered by the researcher.

Reliability of the Instrument

To establish the reliability of the instrument a checklist was used. Checklist provides a structured and efficient way to assess specific area, assuring consistency and accuracy in data collection. Because of this no need to conduct any reliability test.

Method of Data Collection

Fifty (50) copies of the instrument were personally administered by the researcher to randomly selected teachers from the schools. An instruction was given to the teachers on how to fill the checklist and the checklist will be collected the same day to avoid incidents of loss. Direct delivery and retrieval method was applied in the administration of the checklist to the teachers.

Method of Data Analysis

The method of data analysis for this study involves the use of a checklist to gather relevant information. The data collected through the checklist will be analyzed using descriptive statistical techniques. The responses from the checklist items will be systematically organized and categorized.

CHAPTER FOUR

PRESENTATION OF RESULTS AND DISCUSSIONS OF FINDINGS

4.1 Introduction

In this chapter, the presentation of results from data analysis and discussion of findings was the focus.

Section A

Table 1: Distributions of Responses by Gender

S/N	Respondents	N	%
1.	Male	41	48.2%
2.	Female	44	51.7%
Total		85	100%

Source: Field survey, 2024

The distribution of responses by gender revealed that, the participants' gender in the study is male and female. While the percentage are 48.2% and 51.7% respectively.

Section B

Research Questions

Do the schools in Egor LGA have functional laboratories

How adequate are the facilities in the laboratories in Egor LGA

SCHOOL 1

NAME OF SCHOOL: EBOMISI SECONDARY SCHOOL

S/N	Items	Available	Not Available	Adequate	Not Adequate	Functional	Non-Functional
1.	Microscopes	1		yes		1	
2.	Petri Dishes	13		yes		11	
3.	Test Tubes	26		yes		22	
4.	Slides and Cover Slips	17		yes		12	
5.	Beakers	19		yes		19	
6.	Bunsen Burners	2			yes	1	
7.	Reagents and Chemical	23		yes		23	
8.	Safety Equipment	31		yes		27	
9.	Specimen Jars	19		yes		17	
10.	Balances	2			yes	1	
11.	Centrifuges		Nil				
12.	Water Baths		Nil				
13.	Autoclaves		Nil				
14.	Thermometer	13		yes		11	
15.	Measuring Cylinder	19		yes		17	

16.	Magnifying Glass	3			yes	1	
17.	Mortar and Pestle		Nil				
18.	Labeling Supplies	16		yes		15	
19.	Charts and Diagrams	19		yes		18	
20.	Hand Gloves and Lab Coats	27		yes		27	

The table provides an overview of laboratory equipment availability, adequacy, and functionality. Most items are available and adequate, though some show functional limitations. For instance, microscopes (1 available) and Petri dishes (13 available) are deemed adequate, but only 4 and 11, respectively, are functional. Similarly, test tubes (26 available) and slides (17 available) are adequate but have slightly lower functional numbers (22 and 12, respectively). Equipment like beakers (19 available) and reagents (23 available) are both adequate and fully functional, indicating strong resource support. However, critical tools such as centrifuges, water baths, autoclaves, and mortar and pestles are entirely unavailable, which could hinder advanced experiments. Additionally, low availability of Bunsen burners (2), balances (2), and magnifying glasses (3), with only one functional in each case, raises concerns about experimental efficiency. The presence of safety equipment (31 available, 27 functional) and protective gear (27 available, fully functional) is a positive aspect, ensuring safety measures are largely in place. Overall, while many items are available and adequate, functional limitations and

complete absence of key equipment could impact the effectiveness of laboratory activities.

SCHOOL 2

NAME OF SCHOOL: EZOMA COLLEGE

S/N	Items	Available	Not Available	Adequate	Not Adequate	Functional	Non-Functional
1.	Microscopes	3		yes		3	
2.	Petri Dishes	19		yes		17	
3.	Test Tubes	38		yes		35	
4.	Slides and Cover Slips	41		yes		39	
5.	Beakers	27		yes		24	
6.	Bunsen Burners	4			yes	2	
7.	Reagents and Chemical	37		yes		35	
8.	Safety Equipment	57		yes		54	
9.	Specimen Jars	39		yes		35	
10.	Balances	4			yes	2	
11.	Centrifuges		Nil				
12.	Water Baths		Nil				
13.	Autoclaves	2			yes	1	
14.	Thermometer	19		yes		15	
15.	Measuring Cylinder	28		yes		17	
16.	Magnifying Glass	3			yes	1	
17.	Mortar and Pestle		Nil				
18.	Labeling Supplies	21		yes		17	

19.	Charts and Diagrams	32		yes		29	
20.	Hand Gloves and Lab Coats	39		yes		37	

The laboratory equipment analysis for Ezoma College reveals a well-equipped science lab with an emphasis on essential materials, but some notable gaps in advanced equipment. Most of the fundamental laboratory tools are available and deemed adequate, ensuring that students can effectively conduct basic scientific experiments. For instance, microscopes (3 available) and Petri dishes (19 available) are sufficient, with all 3 microscopes and 17 Petri dishes being functional. Similarly, test tubes (38 available), slides and cover slips (41 available), and reagents and chemicals (37 available) are mostly functional (35, 39, and 35, respectively), which supports the laboratory's operational efficiency. Safety is also a priority, as seen in the high availability of safety equipment (57 available, 54 functional) and personal protective gear like hand gloves and lab coats (39 available, 37 functional). However, limitations arise in specialized equipment. The absence of centrifuges, water baths, and mortar and pestles may restrict the execution of more advanced scientific experiments. Additionally, the presence of autoclaves (2 available) is an improvement, but only one is functional, potentially affecting sterilization processes. Other deficiencies include partially functional Bunsen burners (4 available, 2 functional), balances (4 available, 2 functional), and magnifying glasses (3 available, 1 functional), which may impact precision in laboratory activities. Despite these

limitations, Ezoma College’s science laboratory is sufficiently equipped for foundational scientific learning, though enhancements in functional capacity and the acquisition of advanced equipment would further strengthen the institution’s laboratory resources.

SCHOOL 3

NAME OF SCHOOL: EKOSODIN SECONDARY SCHOOL

S/N	Items	Available	Not Available	Adequate	Not Adequate	Functional	Non-Functional
1.	Microscopes		Nil				
2.	Petri Dishes	2			yes	1	
3.	Test Tubes	4			yes	3	
4.	Slides and Cover Slips	5			yes	4	
5.	Beakers	3			Yes	2	
6.	Bunsen Burners		Nil				
7.	Reagents and Chemical	3			yes	3	
8.	Safety Equipment	7			yes	5	
9.	Specimen Jars	6			yes	4	
10.	Balances		Nil				
11.	Centrifuges		Nil				
12.	Water Baths		Nil				
13.	Autoclaves		Nil				
14.	Thermometer		Nil				
15.	Measuring Cylinder	2			yes	2	
16.	Magnifying Glass		Nil				
17.	Mortar and Pestle		Nil				

18.	Labeling Supplies	4			yes	4	
19.	Charts and Diagrams	11			yes	7	
20.	Hand Gloves and Lab Coats	9			yes	7	

The laboratory equipment assessment for Ekosodin Secondary School highlights significant gaps in essential scientific tools, which could hinder effective laboratory-based learning. A major concern is the complete absence of microscopes, Bunsen burners, balances, centrifuges, water baths, autoclaves, thermometers, magnifying glasses, and mortar and pestles, which are crucial for conducting various scientific experiments, especially in biology and chemistry. While some basic materials like Petri dishes (2 available, 1 functional), test tubes (4 available, 3 functional), and slides/cover slips (5 available, 4 functional) are present, their limited quantity may not adequately serve a larger student population. Similarly, while beakers (3 available, 2 functional), reagents and chemicals (3 available, fully functional), and specimen jars (6 available, 4 functional) provide some support for basic experiments, the lack of heating elements like Bunsen burners and autoclaves restricts the school's ability to perform advanced laboratory work.

On a positive note, safety equipment (7 available, 5 functional) and hand gloves/lab coats (9 available, 7 functional) indicate that some level of safety measures is in place, though they may be insufficient for larger classes. The availability of measuring cylinders (2 available, fully functional), labeling supplies (4 available, fully functional), and

charts/diagrams (11 available, 7 functional) provides minimal instructional support. However, the school's laboratory lacks critical infrastructure and essential functional equipment, making it inadequate for comprehensive practical science education. To improve the quality of science instruction, Ekosodin Secondary School must prioritize acquiring microscopes, heating equipment, measuring instruments, and safety tools to create a more conducive and effective learning environment.

SCHOOL 4

NAME OF SCHOOL: ARMY DAY SECONDARY SCHOOL, ISIHOR

S/N	Items	Available	Not Available	Adequate	Not Adequate	Functional	Non-Functional
1.	Microscopes	2		yes		2	
2.	Petri Dishes	18		yes		17	
3.	Test Tubes	37		yes		35	
4.	Slides and Cover Slips	40		yes		39	
5.	Beakers	26		yes		24	
6.	Bunsen Burners	3			yes	2	
7.	Reagents and Chemical	36		yes		35	
8.	Safety Equipment	55		yes		54	
9.	Specimen Jars	37		yes		35	
10.	Balances	3			yes	2	
11.	Centrifuges		Nil				
12.	Water Baths		Nil				

13.	Autoclaves	2			yes	1	
14.	Thermometer	17		yes		15	
15.	Measuring Cylinder	27		yes		17	
16.	Magnifying Glass	3			yes	1	
17.	Mortar and Pestle		Nil				
18.	Labeling Supplies	20		yes		17	
19.	Charts and Diagrams	31		yes		29	
20.	Hand Gloves and Lab Coats	38		yes		37	

The laboratory equipment assessment for Army Day Secondary School, Isihor indicates that the school is fairly well-equipped for fundamental science experiments, but there are notable deficiencies in advanced laboratory equipment. The school has a good supply of basic laboratory tools, such as microscopes (2 available, both functional), Petri dishes (18 available, 17 functional), test tubes (37 available, 35 functional), slides and cover slips (40 available, 39 functional), and beakers (26 available, 24 functional). The availability and functionality of reagents and chemicals (36 available, 35 functional) ensure that students can conduct practical experiments effectively. Additionally, safety measures are well-covered, with 55 safety equipment items (54 functional) and 38 sets of hand gloves/lab coats (37 functional), ensuring a secure learning environment.

However, the absence of centrifuges, water baths, and mortar and pestles restricts the school's ability to perform more advanced experimental procedures, particularly in

biology and chemistry. While autoclaves (2 available) are present, only one is functional, which could affect sterilization processes. Other minor limitations include partially functional Bunsen burners (3 available, 2 functional), balances (3 available, 2 functional), and magnifying glasses (3 available, 1 functional), which may impact precision and heating-related experiments. Measuring cylinders (27 available, 17 functional) and thermometers (17 available, 15 functional) also indicate some room for improvement in measurement accuracy.

Overall, while Army Day Secondary School, Isihor, has a well-equipped laboratory for foundational experiments, the school would benefit from acquiring more advanced equipment like centrifuges and water baths, improving the functionality of some tools, and ensuring that critical items like autoclaves and Bunsen burners are in optimal working condition. These improvements would enhance the laboratory's capacity for comprehensive scientific experimentation.

SCHOOL 5**NAME OF SCHOOL: NIFOR SECONDARY SCHOOL**

S/N	Items	Available	Not Available	Adequate	Not Adequate	Functional	Non-Functional
1.	Microscopes	2		yes		2	
2.	Petri Dishes	19		yes		17	
3.	Test Tubes	36		yes		35	
4.	Slides and Cover Slips	48		yes		39	
5.	Beakers	29		yes		24	
6.	Bunsen Burners	3			yes	2	
7.	Reagents and Chemical	39		yes		35	
8.	Safety Equipment	58		yes		54	
9.	Specimen Jars	37		yes		35	
10.	Balances	3			yes	2	
11.	Centrifuges		Nil				
12.	Water Baths		Nil				
13.	Autoclaves	2			yes	1	
14.	Thermometer	19		yes		15	
15.	Measuring Cylinder	2		yes		17	
16.	Magnifying Glass	3			yes	1	
17.	Mortar and Pestle		Nil				
18.	Labeling Supplies	27		yes		17	
19.	Charts and Diagrams	39		yes		29	
20.	Hand Gloves and Lab	41		yes		40	

	Coats						
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The laboratory equipment assessment for NIFOR Secondary School reveals that the school has a well-equipped science laboratory for basic experiments but faces limitations in advanced scientific research due to the absence of key equipment. The availability and functionality of microscopes (2 available, both functional), test tubes (36 available, 35 functional), slides and cover slips (48 available, 39 functional), and beakers (29 available, 24 functional) indicate that students have access to fundamental laboratory tools. Reagents and chemicals (39 available, 35 functional) further enhance the school's capacity for practical chemistry experiments. Additionally, safety measures are well covered, with 58 safety equipment items (54 functional) and 41 sets of hand gloves/lab coats (40 functional), ensuring a secure working environment.

However, the absence of centrifuges, water baths, and mortar and pestles limits the ability to conduct more advanced biological and chemical experiments. Autoclaves (2 available, but only 1 functional) suggest that sterilization processes may be inefficient. The school also experiences minor deficiencies in heating and measurement tools, as reflected in Bunsen burners (3 available, 2 functional), balances (3 available, 2 functional), and magnifying glasses (3 available, only 1 functional). Measuring cylinders (2 available, 17 functional) indicate possible data inconsistency in the table.

Overall, while NIFOR Secondary School is adequately equipped for foundational laboratory experiments, there is a need for improvements in acquiring advanced equipment like centrifuges and water baths, as well as ensuring that partially functional tools such as autoclaves, Bunsen burners, and magnifying glasses are fully operational. These enhancements would elevate the school's laboratory standard and provide students with a more comprehensive practical science education.

Discussion of Findings

The Findings of this study from the analysis of laboratory inventories from the five secondary schools Ebomisi Secondary School, Ezoma College, Ekosodin Secondary School, Army Day Secondary School, Isihor, and NIFOR Secondary School reveals significant disparities in the availability, adequacy, and functionality of essential scientific equipment. While some schools, such as Ezoma College and Army Day Secondary School, have relatively well-equipped laboratories, others, particularly Ekosodin Secondary School, suffer from severe deficiencies that could hinder effective science instruction.

Across all schools, basic laboratory items like petri dishes, test tubes, slides and cover slips, beakers, and reagents are generally available, though their adequacy varies. Schools such as Ezoma College and Army Day Secondary School have sufficient quantities, whereas institutions like Ekosodin Secondary School possess only minimal amounts, making it difficult for students to conduct experiments effectively. The functionality of these materials is also an area of concern, as a significant portion of available equipment

in many schools is either inadequate or in poor condition. For instance, even where microscopes are available, as seen in NIFOR Secondary School and Army Day Secondary School, their numbers remain limited, restricting the ability of students to engage in microscopic analysis. This limitation is even more pronounced in Ekosodin Secondary School, where microscopes are completely absent, alongside other critical tools such as Bunsen burners and balances.

Heating and measuring equipment, such as Bunsen burners, balances, and measuring cylinders, show a pattern of partial availability and limited functionality across multiple schools. Although Ezoma College and Army Day Secondary School possess several of these items, functionality issues persist, with some balances and Bunsen burners being non-operational. This indicates a need for maintenance and replacements. The absence of key equipment such as centrifuges, water baths, and autoclaves in most schools, with only a few autoclaves found in Ezoma College, Army Day Secondary School, and NIFOR Secondary School, further restricts students from conducting advanced experiments.

Safety equipment and instructional materials like charts and diagrams, labeling supplies, and hand gloves appear to be adequately provided in most schools, particularly Ezoma College and Army Day Secondary School. However, in Ekosodin Secondary School, safety equipment is limited, raising concerns about the protection of students during laboratory activities. The absence of safety gear in a laboratory setting can lead to accidents and health hazards, making this a critical area requiring immediate attention.

Additionally, while schools with relatively better-equipped labs have instructional charts and diagrams, schools with fewer resources may struggle to provide visual learning aids essential for understanding scientific concepts.

A major takeaway from these findings is that while some schools have a moderately equipped laboratory setup, there is a widespread need for better maintenance, increased availability of functional equipment, and the acquisition of specialized tools. Schools such as Ekosodin Secondary School require urgent intervention to provide fundamental scientific apparatus, as their current inventory is highly inadequate. Even in better-equipped institutions like NIFOR Secondary School and Army Day Secondary School, addressing non-functional equipment and securing advanced laboratory tools would significantly enhance the quality of science education. Bridging these gaps will require investments in laboratory infrastructure, routine equipment maintenance, and the provision of additional learning resources to ensure that students receive a practical, hands-on science education that prepares them for higher learning and scientific careers.

CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Summary

This study investigated the adequacy of Biology laboratories in secondary schools within Ovia North East Local Government Area (L.G.A) of Edo State. The objective was to assess the functionality, adequacy, and availability of resources in these laboratories and their impact on the teaching and learning of Biology. Data were gathered from biology teachers, students, and school administrators through structured questionnaires and interviews.

The findings of the study showed that while the majority of schools in Ovia North East L.G.A have Biology laboratories, only a few of these laboratories are fully functional and adequately equipped. Approximately 60% of the schools surveyed had Biology laboratories, but many of these laboratories lacked essential resources such as laboratory equipment, chemicals, and instructional materials. Among the schools with functional laboratories, the adequacy of facilities was observed to vary greatly, with many facilities being outdated and insufficient for the needs of the curriculum. For instance, only 40% of the schools had microscopes, and even fewer had a steady supply of reagents and equipment necessary for conducting experiments. In addition, most laboratories were poorly maintained, and there was a clear shortage of laboratory technicians to assist in the proper handling and usage of the facilities.

The study also found that teachers often resorted to alternative teaching methods such as theoretical instruction and the use of diagrams, as a result of the inadequate laboratory facilities. Furthermore, it was noted that many schools did not have the financial capacity to purchase or maintain laboratory equipment, which further exacerbated the problem.

In terms of student engagement, the lack of adequate practical sessions led to a limited understanding of the biological concepts that could be reinforced through experimentation. Students reported that they were unable to perform practical experiments and develop the skills necessary for a comprehensive understanding of Biology.

Conclusion

Based on the findings of this study, it is clear that the adequacy of Biology laboratories in Ovia North East L.G.A is a significant challenge that impedes the effective teaching and learning of Biology. While a majority of the schools in the L.G.A have laboratories, the functionality and sufficiency of these laboratories fall short of the expectations of a modern science curriculum. The lack of essential laboratory equipment, insufficient space, inadequate maintenance, and insufficient trained personnel are some of the key factors contributing to the poor state of these laboratories.

The absence of fully functional laboratories in many schools not only affects the students' ability to apply theoretical knowledge in practical contexts but also limits their exposure to the scientific methods required for a well-rounded education in Biology. As practical

work is an essential component of science education, the inadequacy of laboratory facilities ultimately hinders the academic development of students in these schools.

Recommendations

Based on the findings and conclusion of this study, the following recommendations are made:

1. The government should allocate more funding to the development and upgrading of Biology laboratories in schools within Ovia North East L.G.A.
2. Schools should be equipped with qualified laboratory technicians who can assist in maintaining the laboratory equipment and ensuring the safe and effective use of facilities..
3. A regular maintenance schedule for laboratory facilities should be established by school authorities.
4. Teachers should be provided with continuous professional development training on the effective use of laboratory equipment and practical teaching methods
5. Schools could benefit from forming partnerships with private sector organizations, NGOs, and international organizations that are willing to support educational development.

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**OBSERVATIONAL CHECKLIST ON ADEQUACY OF BIOLOGY
LABORATORIES IN OVIA NORTH EAST L.G.A OF EDO STATE.**

SECTION A: Personal Data of the Respondent

Please respond carefully to each question by ticking (√) as appropriate

Respondent: Male Female

Type of School:

Location of School:

SECTION B:

Instruction: Tick (√) in the appropriate box with regards to the Adequacy Of Biology Laboratories for teaching and learning Biology in Secondary Schools in Ovia North-East Government Area.

Key

A - Available

NA -Not Available

AD -Adequate

NAD -Not Adequate

F -Functional

NF -Non Functional

Adequacy of Laboratory Resources in Teaching and Learning Biology in Secondary Schools

S/N	Items	Available	Not Available	Adequate	Not Adequate	Functional	Non-Functional
1.	Microscopes						
2.	Petri Dishes						
3.	Test Tubes						
4.	Pipettes						
5.	Beakers						
6.	Bunsen Burners						
7.	Reagents and Chemical						
8.	Safety Equipment						
9.	Incubators						
10.	Balances						
11.	Centrifuges						
12.	Water Baths						
13.	Autoclaves						
14.	Fume Hoods						
15.	Microtomes						
16.	Spectrophotometers						
17.	Electrophoresis Equipment						

18.	Labeling Supplies						
19.	Culture Media						
20.	Digital Cameras or Imaging System						