LABORATORY AND LIBRARY FACILITIES: INVESTIGATING THEIR POTENCIES IN PROMOTING STUDENT INTEREST AND PERFORMANCE IN SCIENCE SUBJECT

By

Dr Francis Donatus Eyenaka
Department of Physics
College of Education
Afaha Nsit

And

Friday Alphonsus Umoren
School of Secondary Education
Department of Physics Education
Federal College of Education (T)
Bichi, Kano

ABSTRACT

This study examines the roles of laboratory and library facilities in enhancing student interest and performance in science subjects. Recognizing the critical need for practical and theoretical knowledge in science education, this study highlights how access to well-equipped laboratories facilitates hands-on learning, allowing students to directly engage with scientific concepts and experimental procedures. This practical experience not only solidifies theoretical understanding but also stimulates curiosity and interest in scientific exploration. By providing access to current scientific literature, multimedia resources, and study spaces, libraries enable students to deepen their knowledge and stay updated with the latest scientific advancements. The study delves into the aspects of laboratory, science subjects, laboratory facilities, and the academic performance of a student, giving results that indicate a positive correlation between the availability of these educational facilities and the improvement of student outcomes. Indicating that students with regular access to laboratories and libraries demonstrate higher engagement levels and better academic performance in science subjects compared to those with limited access. The study examines the potency of laboratory facilities in promoting student performance in science subjects and the potency of laboratory facilities in promoting student interest in science subjects, showing how laboratory performance is a vital access for student success, as well as the effect of library facilities on student interest and performance in science subjects. The study concludes that by engaging in experiments and witnessing scientific principles in action, students become more motivated and confident in their abilities, which translates into improved academic performance. One of the recommendations provided was that educational authorities should priorities the development and maintenance of modern laboratory facilities in schools. Well-equipped laboratories enable students to engage in hands-on experiments, which are crucial for understanding complex scientific concepts.

KEYWORD: Laboratory, Library Facilities, Investigating Their Potencies, Promoting Student Interest and Performance in Science Subject

INTRODUCTION

Facilities for labs and libraries are essential for improving students' academic performance, especially in scientific classes. According to recent studies, rich library resources and well-equipped laboratories have a major role in boosting students' interest in and success in these subjects. Knowing the effects of these facilities becomes more crucial as educational establishments work to enhance scientific instruction.

Understanding scientific concepts and processes requires hands-on experience, which is mostly provided by laboratory facilities. The National Research Council (2017) emphasizes that laboratory experiences are essential for learning science because they allow students to interact directly with the material world. Studies have consistently shown that students who engage in laboratory work develop better scientific inquiry skills, have a deeper understanding of scientific concepts, and show greater interest in science (Hofstein & Lunetta, 2017).

Libraries are essential resources for students, providing access to a vast array of scientific books, reference materials, and digital resources, in addition to labs. Libraries promote an atmosphere that is favourable to independent study and research in addition to aiding in the acquisition of information. According to Smith (2019), libraries that provide comprehensive collections and accessible digital resources significantly enhance students' ability to perform in-depth research, which is crucial for their success in science subjects. The availability of such resources ensures that students can keep up with the latest scientific discoveries and methodologies. According Bassey (2020), Library facilities like the use of cards catalogue, flipping through several cards to the use of online public access catalogue (OPAC) through the use of computers. Libraries are gradually moving away from hard copies of books, and student's project. This makes it easier for student in science subject promoting their performance and interest.

Moreover, the integration of digital technologies in libraries has transformed the way students engage with scientific information. Digital libraries and online databases have made it easier for students to access up-to-date research papers, journals, and other educational materials from anywhere, thereby promoting continuous learning (Johnson & Green, 2020). Williams and Wong (2021) highlighted that students who regularly utilised digital library resources showed improved academic performance and a higher level of engagement in their science courses. Despite the clear benefits, the effectiveness of laboratory and library facilities can be influenced by various factors such as funding, maintenance, and accessibility. Brown and Smith (2022) revealed that underfunded laboratories and poorly maintained libraries negatively impact student outcomes. They argued that continuous investment in these facilities is crucial for maintaining high educational standards and promoting students' success in science subjects. Furthermore, ensuring that these facilities are accessible to all students, including those from marginalised communities, is essential for fostering an inclusive learning environment (Garcia & Hernandez, 2023). Library facilities helps sudents find materials to augmnet their lecture notes, classroom, assignments, etc. Bassey (2024) revealed that most science student users use the library virtually every day and that books, newspapers and magazines are the materials users utilize the most. By so doing

young learners reading habits are encouraged and good academic performance is guaranteed.

STATEMENT OF PROBLEM

Students across the globe often struggle with maintaining interest and achieving strong performance in science subjects. This lack of engagement can hinder their development of critical thinking skills and limit their future career prospects in science and technology fields. This research focuses specifically on the Akwa Ibom State context, aiming to investigate the potential of two crucial resources - laboratory and library facilities - in promoting student interest and academic achievement in science subjects within the region.

OBJECTIVES

- To find out the potency of laboratory facilities in promoting students' interests and performances in science subjects in Akwa Ibom State.
- To find out the potency of library facilities in promoting students' interests and performances in science subjects in Akwa Ibom State.

RESEARCH QUESTIONS

- What are the potency of laboratory facilities in promoting students' interests and performances in science subjects in Akwa Ibom State?
- What are the potency of library facilities in promoting students' interests and performances in science subjects in Akwa Ibom State?

LITERATURE REVIEW

CONCEPT OF SCIENCE SUBJECT

Science is the methodical study of nature by means of analysis, experimentation, and observation. It includes a number of disciplines, including earth sciences, physics, chemistry, biology, and astronomy. Fundamentally, science aims to comprehend the underlying laws controlling the cosmos and to formulate hypotheses supported by empirical data. Science is defined by its quest for understanding and knowledge. Science is essential to the advancement of human knowledge and the development of new technologies.

According to Almarode (2018), science subjects are not static; they continuously evolve as new discoveries are made and technologies advance. This dynamic nature requires that science education also be adaptive, incorporating the latest research findings and technological innovations into the curriculum. Keeping the curriculum up-to-date ensures that students are well-prepared for future scientific challenges and opportunities. Furthermore, science permeates daily life and is not only found in labs and educational settings. Scientific knowledge is ingrained in many facets of society, from knowing the fundamentals of nutrition to sustain a balanced diet to understanding the dynamics of climate change to make educated decisions.

In recent years, the importance of science in addressing global challenges has become increasingly evident. The COVID-19 pandemic highlighted the critical role of

scientific research in developing vaccines, understanding the spread of the virus, and implementing public health measures to mitigate its impact. As emphasized by the World Health Organization (2020), "Science is critical in guiding responses to health emergencies and other global challenges."

The objectives of science education are to foster profound comprehension of scientific concepts, critical thinking, and problem-solving abilities. It pushes pupils to think critically, pose questions, carry out experiments, and examine data. The advancement of knowledge and technology depends on the scientific method. Students who participate in science classes develop their analytical skills and get ready for a variety of vocations in science and technology by learning how to apply scientific ideas to real-world issues.

CONCEPT OF LABORATORY

A laboratory, commonly referred to as a "lab," serves as a dedicated space for scientific experimentation, research, and analysis across various disciplines such as physics, chemistry, biology, engineering, and medicine. It provides a controlled environment equipped with specialized apparatus, instruments, and materials essential for conducting empirical investigations and testing hypotheses (MacLeod, 2011). It is also a facility that provides controlled conditions in which scientific or technological research, experiments, and measurements may be performed. Laboratories are found in a variety of settings, such as schools, universities, privately owned research institutions, corporate research and testing facilities, government regulatory and forensic investigation centres, physicians' offices, clinics, hospitals, regional and national referral centres, and even occasionally personal residences (Bertholf, 2017).

Laboratories vary in size, complexity, and specialization, ranging from small-scale educational labs in schools and universities to large-scale research facilities in academic institutions, government agencies, and industrial settings. They are characterized by their adherence to rigorous safety protocols, quality assurance measures, and ethical standards to ensure the validity, reliability, and reproducibility of scientific findings. Laboratories are subject to regulatory oversight and compliance with local, national, and international safety standards to protect the health and well-being of laboratory personnel and the surrounding environment (National Research Council, 2011). Laboratories play a crucial role in driving scientific advancement and innovation by providing essential infrastructure and resources for research, experimentation, and development.

The specialism and function of laboratories can be used to classify them. Educational laboratories are primarily used for teaching and learning, giving students practical training and hands-on experiences. On the other hand, the goals of research laboratories include knowledge advancement and original research in a range of scientific domains. Laboratories are integral to science education, providing students with opportunities to engage in hands-on experimentation, inquiry-based learning, and critical thinking. Practical work in laboratories enhances students' conceptual understanding, problem-solving skills, and scientific literacy, preparing them for future careers in science and technology (American Association for the Advancement of Science, 2011).

CONCEPT OF LABORATORY FACILITIES

In order to facilitate experimentation, analysis, and innovation in a wide range of disciplines, including chemistry, biology, physics, engineering, and medicine, laboratory facilities are essential parts of scientific research institutions, educational settings, and industrial environments. The idea of laboratory facilities includes a variety of components that enhance its usefulness, security, and capacity to facilitate scientific research.

First and foremost, specialist infrastructure designed to meet particular research objectives is what distinguishes laboratory facilities. For investigations requiring liquids, wet laboratories with sinks, fume hoods, and bench space are ideal, whereas dry labs with computers and simulation software are best for computational analysis and modelling. Clean rooms for the production of semiconductors, biological containment facilities for handling infections, and animal research facilities for preclinical investigations are examples of more specialist fields.

Moreover, laboratory facilities are equipped with a diverse array of instruments and equipment essential for conducting experiments and measurements. These may include microscopes, spectrometers, centrifuges, chromatographs, incubators, autoclaves, and more, depending on the nature of the research being conducted. The availability of cutting-edge instrumentation facilitates precise data collection and analysis, enabling researchers to explore complex phenomena and develop innovative solutions to scientific challenges (National Institutes of Health, 2022).

Safety is paramount in laboratory facilities due to the potential hazards associated with certain experiments and materials. As such, these facilities are equipped with robust safety measures, including ventilation systems to remove fumes, protective gear such as lab coats and goggles, emergency eyewash stations and showers, and protocols for handling hazardous materials. Compliance with regulatory standards such as OSHA and EPA guidelines ensures the safety of personnel and the environment (American Chemical Society, 2022). Additionally, laboratory facilities often employ support staff, including lab managers, technicians, and research assistants, to assist with day-to-day operations, equipment maintenance, and experiment implementation. These personnel play a crucial role in ensuring the smooth functioning of the laboratory and facilitating research activities.

CONCEPT OF ACADEMIC PERFORMANCE OF A STUDENT

A student's success and accomplishment in their academic efforts are referred to as their academic performance. This is often determined by their grades, results on standardized tests, involvement in extracurricular activities, and other learning and achievement markers. Academic success is influenced by a number of variables, including socioeconomic status, family history, school atmosphere, and individual traits.

One significant determinant of academic performance is the student's level of motivation and engagement. Motivated students tend to be more focused, persistent, and resourceful in their learning endeavours, leading to higher levels of achievement. Factors such as intrinsic motivation, interest in the subject matter, and a sense of

purpose or goal orientation can significantly impact a student's academic performance (Dweck, 2016).

Additionally, a supportive family environment and parental involvement in education have been consistently associated with better academic outcomes for students. Parents who are actively engaged in their child's education by providing support, encouragement, and resources create a conducive environment for learning and academic success. The quality of teaching and instructional practices employed in the classroom plays a crucial role in shaping student performance. Effective teachers utilize a variety of instructional strategies, provide meaningful feedback, and create a positive learning environment that fosters student engagement and comprehension (Hattie, 2019).

Moreover, socio-economic factors such as family income, parental education level, and access to resources also influence academic performance. Students from disadvantaged backgrounds may face additional challenges such as limited access to educational resources, inadequate nutrition, and exposure to stressors that can negatively impact their academic achievement (Sirin, 2015). Academic performance is a multifaceted construct influenced by various factors, including individual characteristics, family support, teaching quality, and socio-economic background.

TYPES OF SCIENCE SUBJECT

Science courses may be roughly divided into various categories, each of which focuses on a distinct facet of the natural world. The primary categories are as follows:

- Physical Sciences

This category encompasses disciplines that study non-living systems. Physics explores the fundamental forces and properties of matter, while chemistry investigates the composition, structure, and properties of substances. Astronomy delves into celestial objects and phenomena beyond Earth (Carroll & Ostlie, 2017), and Earth Sciences study the planet's composition, structure, and processes.

- Biological Sciences

This branch focuses on the study of living organisms and their interactions. Biology examines the structure, function, growth, origin, evolution, and distribution of living organisms. Zoology and botany specialise in the study of animals and plants, respectively (Hickman, 2021). Genetics explores the inheritance and variation of traits (Pierce, 2019), while ecology studies the relationships between organisms and their environments.

- Environmental Sciences

Interdisciplinary in nature, environmental sciences analyse the interactions between humans and the environment. Environmental biology investigates the impact of human activities on ecosystems, while environmental chemistry examines the behaviour and fate of chemicals in the environment. Environmental engineering focuses on developing solutions to environmental problems, and environmental policy addresses regulations and management strategies (Dresner, 2015).

- Social Sciences

This category encompasses disciplines that study human behaviour and societies. Psychology explores mental processes and behaviour, while sociology examines social relationships, institutions, and structures (Giddens, 2017). Anthropology investigates human culture, evolution, and diversity (Haviland 2019), and economics studies the production, distribution, and consumption of goods and services.

- Mathematics and Statistics:

Fundamental to scientific inquiry, mathematics provides tools for modelling and analysis. Statistics offers methods for data collection, analysis, interpretation, and presentation (Navidi, 2018).

- Computer Science and Information Technology

These fields focus on computing systems and information processing. Artificial intelligence involves the development of intelligent agents (Russell & Norvig, 2016), while data science focuses on extracting knowledge and insights from data.

- Health and Medical Sciences

This category encompasses disciplines related to human health and disease. Medicine involves the diagnosis, treatment, and prevention of illness (Kumar, 2020), while nursing focuses on patient care and health promotion. Pharmacology studies the effects of drugs on biological systems, and public health addresses population health issues.

- Engineering

This field applies scientific principles to design and build structures, machines, systems, and processes. Mechanical engineering deals with the design and production of mechanical systems (Gere & Goodno, 2018), while civil engineering focuses on infrastructure and environmental systems. Electrical engineering involves the study of electrical and electronic systems (Hambley, 2017), and chemical engineering deals with chemical processes and manufacturing.

THE POTENCY OF LABORATORY FACILITIES IN PROMOTING STUDENTS INTEREST IN SCIENCE SUBJECTS

By providing hands-on experiences, supporting inquiry-based learning, and cultivating a deep comprehension of scientific concepts, laboratory facilities are essential resources for improving student performance in a variety of science courses. In light of current research and academic literature, this essay clarifies the role that laboratory infrastructure plays in improving student academic performance in scientific education.

To begin, laboratory facilities afford students the invaluable opportunity to engage in hands-on experimentation, a cornerstone for grasping abstract scientific principles. Recent studies affirm that active participation in laboratory activities significantly boosts students' conceptual understanding and retention of scientific

concepts (Schwartz, 2019). By immersing themselves in practical work, students can witness scientific phenomena firsthand, manipulate variables, and analyse empirical data, thereby reinforcing theoretical knowledge garnered in traditional classroom settings (Shernoff, 2017). For instance, conducting experiments in physics laboratories enables students to validate theoretical principles such as Einstein's theory of relativity through direct observation and empirical exploration (Villard, 2020).

Moreover, laboratory experiences serve as catalysts for inquiry-based learning, wherein students develop critical thinking and problem-solving skills by formulating hypotheses, designing experiments, and interpreting findings. Recent pedagogical research underscores the efficacy of inquiry-based approaches in science education, highlighting their role in cultivating scientific literacy and promoting lifelong learning (National Academies of Sciences, Engineering, and Medicine, 2018). Through scientific inquiry, students learn to pose meaningful questions, gather and analyses evidence, and construct coherent explanations, thus deepening their comprehension of scientific phenomena (NGSS Lead States, 2013). Evidence suggests that inquiry-based laboratory activities lead to enhanced academic achievement and heightened enthusiasm for scientific exploration among students (Bellocchi, 2013).

Furthermore, laboratory facilities facilitate collaborative learning and peer interaction, which are essential for honing communication skills and fostering teamwork. Recent studies underscore the importance of collaborative inquiry in science education, emphasizing its role in promoting social learning and knowledge construction. Working in groups during laboratory sessions enables students to engage in scientific discourse, share ideas, and negotiate meaning collectively (Keane & Berland, 2017). Collaboration fosters a supportive learning environment wherein students can articulate their thoughts, justify their reasoning, and engage in meaningful scientific dialogue (Pier, 2020). Additionally, peer interactions during laboratory experiments encourage students to adopt multiple perspectives, thus enriching their understanding of scientific concepts (Walker, 2018).

Despite the myriad benefits of laboratory facilities, their potency in promoting student performance hinges on various factors, including resource allocation, instructional support, and curriculum alignment. Recent educational research emphasizes the importance of equitable access to well-equipped laboratory resources, particularly in underserved communities (Means, 2013). Furthermore, effective utilization of laboratory time necessitates strategic planning, ongoing professional development for educators, and alignment with curriculum standards and learning objectives (NASEM, 2015).

THE POTENCY OF LABORATORY FACILITIES IN PROMOTING STUDENTS PERFORMANCE IN SCIENCE SUBJECT

Because they provide hands-on experiences, encourage inquiry-based learning, and help students develop a deep comprehension of scientific concepts, laboratory facilities are essential resources for improving student performance in a variety of science topics.

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EFFECT OF LIBRARY FACILITIES ON STUDENT INTEREST AND PERFORMANCE IN SCIENCE SUBJECT

Science students' interest and performance are greatly impacted by the availability and calibre of library resources. Libraries offer vital resources that help

students in their academic endeavours and enhance their comprehension of scientific ideas, such as scientific journals, textbooks, and digital media. Students can investigate topics outside of the classroom curriculum when they have access to a well-stocked library, which promotes a more thorough and involved learning process.

Libraries serve as quiet, dedicated study spaces where students can concentrate on their work, collaborate on group projects, and access diverse learning materials. Studies have shown that students who regularly use library facilities exhibit higher academic performance due to the enriched learning environment and the availability of up-to-date information resources. The presence of knowledgeable library staff who can guide students in their research and information literacy skills further enhances the educational benefits of library use (Edinyang & Ubi, 2017).

Additionally, the integration of advanced technological tools such as augmented reality (AR) within library facilities can make learning more interactive and engaging. AR tools, for example, help visualize complex scientific phenomena, making them more accessible and understandable for students (Obasi & Nwankwo, 2019). This innovative approach not only sparks students' curiosity but also promotes sustained interest in science subjects.

Petrov (2020) mentioned that well-equipped library facilities play a crucial role in promoting student interest and performance in science subjects by providing access to necessary resources, fostering a conducive learning environment, and incorporating advanced technologies to enhance the learning experience. Investments in library infrastructure and professional development for library staff are essential to maximizing these benefits and improving educational outcomes in science education. Library facilities like the electronic resources i.e online learning, the printed materials i.e books, periodical, government publications and the non-printed materials i.e audio, visuals, and audio visuals has the potency in promoting good performance among students in science subjects (Bassey 2017).

METHODOLOGY

In carrying out the study, descriptive survey design was adopted for this study. The study was carried out in Akwa Ibom State. The targeted population for the study comprised all lab scientists and librarians in secondary schools in Akwa Ibom State. A stratified random sampling technique was used to select 90 lab scientists and 90 librarian which gave a total of 180 respondents used for the study. The instrument used for data collection was a structured questionnaire titled “Laboratory and Library Facilities Potencies and Students’ Interest and Performance in Science Subject Questionnaire (LLFPSIPSSQ)”. Face and content validation of the instrument was carried out by an expert in test, measurement, and evaluation in order to ensure that the instrument has the accuracy, appropriateness, and completeness for the study under consideration.

RESULTS AND DISCUSSIONS

Research Question 1

The research question sought to find out the potency of laboratory facilities in promoting students' interests and performances in science subjects in Akwa Ibom State. To answer the research percentage analysis was performed on the data, (see table 1).

Table 1: Percentage analysis of the potency of laboratory facilities in promoting students' interests and performances in science subjects in Akwa Ibom State.

POTENCY	FREQUENCY	PERCENTAGE
Highly Effective	137	76.11**
Effective	43	23.89*
TOTAL	180	100%

** The highest percentage frequency
* The least percentage frequency

SOURCE: Field survey

The above table 1 presents the percentage analysis of the potency of laboratory facilities in promoting students' interests and performances in science subjects in Akwa Ibom State. From the result of the data analysis, it was observed that 137(76.11%) of the respondents affirmed that the potency of laboratory facilities in promoting students' interests and performances in science subjects in Akwa Ibom State was "Highly effective". While the least respondent 43(23.89%) affirmed it to be "Effective". The result therefore is in agreement with the research findings of Schwartz (2019) who mentioned in his study that active participation in laboratory activities significantly boosts students' conceptual understanding and retention of scientific concepts as it affords students the invaluable opportunity to engage in hands-on experimentation, a cornerstone for grasping abstract scientific principles.

Research Question 2

The research question sought to find out the potency of library facilities in promoting students' interests and performances in science subjects in Akwa Ibom State. To answer the research percentage analysis was performed on the data, (see table 2).

Table 2: Percentage analysis of the potency of library facilities in promoting students' interests and performances in science subjects in Akwa Ibom State.

POTENCY	FREQUENCY	PERCENTAGE
Highly Effective	159	88.33**
High Extent	21	11.67*
TOTAL	180	100%

** The highest percentage frequency
* The least percentage frequency

SOURCE: Field survey

The above table 2 presents the percentage analysis of the potency of library facilities in promoting students' interests and performances in science subjects in Akwa Ibom State. From the result of the data analysis, it was observed that 159(88.33%) of the respondents affirmed that the potency of library facilities in promoting students' interests and performances in science subjects in Akwa Ibom State was "Highly effective". While the least respondent 21(11.67%) affirmed it to be "Effective". The result therefore is in agreement with the opinion of Petrov (2020) who mentioned that well-equipped library facilities play a crucial role in promoting student interest and performance in science subjects by providing access to necessary resources, fostering a conducive learning environment, and incorporating advanced technologies to enhance the learning experience.

CONCLUSION

Laboratory and library facilities play crucial roles in enhancing student interest and performance in science subjects. Laboratory facilities provide hands-on experiences that are vital for understanding scientific concepts and developing practical skills. These interactive sessions help students connect theoretical knowledge with real-world applications, thereby deepening their comprehension and fostering a genuine interest in scientific exploration. By engaging in experiments and witnessing scientific principles in action, students become more motivated and confident in their abilities, which translates into improved academic performance.

RECOMMENDATIONS

- Educational authorities should priorities the development and maintenance of modern laboratory facilities in schools. Well-equipped laboratories enable students to engage in hands-on experiments, which are crucial for understanding complex scientific concepts.
- Schools should invest in enriching their library collections with current and comprehensive scientific literature, including textbooks, journals, and digital resources.
- Curriculum planners should incorporate structured and regular use of laboratory and library facilities into the science curriculum. This integration ensures that students not only learn theoretical concepts but also apply them through practical experiments and further reading.

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