

AVAILABILITY AND UTILIZATION OF BIOLOGY LABORATORY FACILITIES AND STUDENTS' ACADEMIC PERFORMANCE IN SECONDARY SCHOOLS IN OGOJA LOCAL GOVERNMENT AREA OF CROSS RIVER STATE

Effiong, Effiom Etim, Ph.D

08162580639

effiome70@gmail.com

ORCHID ID: 0009000787449191

Department of Biology Education

Faculty of Science Education

University of Calabar

Calabar

Inyene-Obong Sunday Umoh

inyeneobongumoh@gmail.com

Department of Biology Education

University of Calabar, Calabar



Abstract

The present study examined the availability and utilization of biology laboratory facilities as predictors of students' academic performance in Biology in secondary schools in Ogoja Local Government Area of Cross River State. Two research questions and two null hypotheses were formulated to guide the study. Correlation research design was adopted for the study. The population comprised 2,184 Senior Secondary II (SS II) 52 Biology teachers from the 26 public secondary schools in Ogoja Local Government Area of Cross River State. A sample of 420 respondents, consisting of 390 SS II Biology students and 30 Biology teachers, was selected using stratified and simple random sampling techniques. Data were collected using two instruments: such as Availability and Utilization of Biology Laboratory Facilities Questionnaire (AUBLFQ) and Biology Achievement Test (BAT) developed by the researcher to measure students' academic performance in Biology. The instruments were validated by experts in Biology Education and Measurement and Evaluation, University of Calabar. Reliability of the questionnaire was established using Cronbach's alpha, yielding an overall coefficient of .89, while the reliability of the Biology Achievement Test (BAT) was determined using the Kuder-Richardson Formula 20 (KR-20), which yielded a coefficient of .83. Mean and standard deviation were used to answer the research questions, while Pearson Product Moment Correlation (PPMC) was employed to test the hypotheses at the 0.05 level of significance. The findings of the study revealed that both the availability and utilization of biology laboratory facilities had significant positive relationships with students' academic performance in Biology. The study concluded that adequate provision and effective utilization of biology laboratory facilities significantly enhance students' academic performance in Biology. Consequently, it was recommended that government and school administrators provide well-equipped Biology laboratories and encourage regular practical activities to improve students' achievement in Biology.

Keywords: Biology Laboratory Facilities, Availability, Utilization, Biology Achievement Test, Academic Performance, Secondary Schools



Introduction

Biology occupies a central position in science education because it provides learners with fundamental knowledge of living organisms, their interactions with the environment, and the scientific principles underlying life processes. As one of the core science subjects offered at the secondary school level in Nigeria, Biology equips students with the knowledge, practical skills, and scientific attitudes required for careers in medicine, pharmacy, agriculture, nursing, biotechnology, environmental science, and

other science-related disciplines. Beyond career preparation, Biology contributes significantly to students' understanding of health, environmental sustainability, biodiversity conservation, food security, and technological innovation. Consequently, effective Biology teaching is essential for producing scientifically literate citizens capable of contributing meaningfully to national development and the achievement of the Sustainable Development Goals (SDGs). Despite its importance, students' academic performance in Biology in many Nigerian secondary schools has remained below expectations, raising concerns among educators, parents, policymakers, and curriculum planners regarding the factors responsible for the persistent poor achievement (Federal Ministry of Education, 2021; West African Examinations Council [WAEC], 2023).

Academic performance in Biology refers to the extent to which students successfully attain the intended learning outcomes and instructional objectives in Biology as measured through classroom assessments, standardized achievement tests, and external examinations. It reflects students' acquisition of biological concepts, practical competencies, scientific reasoning, and problem-solving abilities. Good academic performance in Biology is influenced by numerous school-related, teacher-related, learner-related, and environmental factors, including instructional methods, teacher qualification, students' motivation, availability of instructional materials, laboratory experiences, school infrastructure, and parental support (Akinsola & Igwe, 2022; Owoeye & Yara, 2021). Among these factors, the availability and effective utilization of Biology laboratory facilities have consistently attracted scholarly attention because Biology is essentially a practical science whose concepts are best understood through observation, experimentation, investigation, and hands-on learning experiences.

Biology laboratory facilities refer to the physical resources, equipment, materials, specimens, chemicals, apparatus, and infrastructure specifically provided to facilitate the teaching and learning of Biology through practical activities. Such facilities include functional laboratories, microscopes, prepared slides, dissecting kits, preserved specimens, charts, models, laboratory furniture, reagents, measuring instruments, audiovisual instructional materials, safety equipment, laboratory manuals, and water and electricity supply required for successful practical instruction. These facilities create opportunities for students to verify scientific principles, manipulate laboratory equipment, conduct experiments, observe biological phenomena, develop scientific process skills, and apply theoretical knowledge to real-life situations (UNESCO, 2021). The availability of adequate laboratory facilities therefore constitutes one of the essential requirements for effective Biology instruction and improved students' academic achievement.

The availability of Biology laboratory facilities does not merely imply the physical presence of laboratory structures but also includes the adequacy, functionality, accessibility, maintenance, and relevance of laboratory resources to the Biology curriculum. It refers to the extent to which laboratories possess adequate instructional materials, equipment, and resources necessary for effective Biology teaching and learning. A school may possess a laboratory building, yet lack sufficient microscopes, specimens, chemicals, charts, or laboratory consumables needed for meaningful practical instruction. Consequently, laboratory availability is measured not only by quantity but also by quality, functionality, and suitability for curriculum implementation. According to the Nigerian Educational Research and Development Council (NERDC, 2022), successful implementation of the Senior Secondary Biology Curriculum depends largely on the provision of adequate laboratory facilities that enable students to engage actively in scientific investigations and practical activities.

The significance of laboratory facilities in Biology education cannot be overemphasized because practical instruction enhances conceptual understanding, develops manipulative skills, stimulates curiosity, promotes critical thinking, and encourages scientific inquiry among learners. Laboratory experiences enable students to observe living organisms directly, identify biological structures, conduct experiments, formulate hypotheses, collect and interpret data, and draw evidence-based conclusions. Such experiences transform abstract classroom concepts into concrete realities, thereby improving knowledge retention and academic achievement. Contemporary educational theories emphasize that meaningful learning occurs when learners actively construct knowledge through direct interaction with instructional materials and authentic learning experiences rather than passive memorization of theoretical concepts (Sharma & Bansal, 2017).). Consequently, schools with well-equipped Biology laboratories are more likely to produce students with stronger scientific competencies than schools lacking adequate laboratory facilities.

However, the mere availability of Biology laboratory facilities does not automatically guarantee improved academic performance. Equally important is the effective utilization of available facilities during instructional activities. Utilization refers to the extent to which Biology teachers and students regularly, appropriately, and efficiently use available laboratory resources for teaching, experimentation, demonstration, observation, and practical exercises. Effective utilization involves proper lesson planning, regular laboratory practical sessions, adequate supervision, maintenance of equipment, adherence to laboratory safety procedures, and integration of practical activities with classroom instruction. Schools may possess adequate laboratory facilities, yet poor utilization resulting from inadequate teacher competence, overcrowded classrooms, poor maintenance culture, limited instructional time, or insufficient practical skills may hinder students from benefiting fully from available resources (OECD, 2022). Educational researchers have consistently emphasized that laboratory utilization enhances students' motivation, participation, scientific reasoning, and academic achievement in Biology. Through practical activities, students become active participants in the learning process rather than passive recipients of information. Laboratory instruction encourages observation, experimentation, collaboration, communication, creativity, and independent thinking, all of which contribute to improved academic performance. Studies have reported that students exposed to frequent practical lessons generally perform better in Biology than those taught predominantly through lecture methods because practical experiences facilitate deeper understanding and long-term retention of biological concepts (Hofstein & Kind, 2019; Abimbola & Bello, 2020).

The Biology curriculum developed by the Nigerian Educational Research and Development Council places considerable emphasis on practical activities as an indispensable component of Biology instruction. The curriculum recommends that every Biology topic requiring experimentation should be accompanied by appropriate laboratory activities to reinforce theoretical concepts and develop scientific skills. Likewise, the West African Examinations Council includes practical examinations as a compulsory component of the Senior School Certificate Examination in Biology, reflecting the importance attached to laboratory competence in assessing students' achievement. Nevertheless, reports from examination bodies continue to indicate that many candidates experience difficulties in practical Biology due to inadequate exposure to laboratory activities, poor manipulation of scientific apparatus, and limited practical experiences during classroom instruction (WAEC, 2023). The effectiveness of Biology laboratory instruction depends not only on the existence of laboratory facilities but also on their accessibility, adequacy, maintenance, and frequency of use during classroom instruction. Schools with adequately equipped laboratories provide students with opportunities to investigate biological concepts through experimentation, observation, and scientific inquiry, thereby promoting meaningful learning. Conversely, inadequate or poorly maintained laboratory facilities often compel teachers to rely excessively on the lecture method, thereby limiting students' exposure to practical experiences that are fundamental to Biology education. Such situations reduce students' interest in the subject, weaken their understanding of scientific concepts, and ultimately contribute to poor academic performance (Aina, 2020; Ibrahim & Yusuf, 2021).

The availability of Biology laboratory facilities has become increasingly important in contemporary science education because of the emphasis on competency-based learning and scientific literacy. Modern Biology teaching requires laboratories equipped with microscopes, prepared slides, specimens, models, dissecting instruments, laboratory chemicals, audiovisual resources, computers, internet-enabled instructional resources, and safety equipment to facilitate effective practical instruction. The integration of these facilities enables students to develop higher-order thinking skills, analytical abilities, creativity, communication skills, and collaborative learning competencies expected of twenty-first-century learners (UNESCO, 2021). Consequently, educational administrators are expected to prioritize the provision and maintenance of functional Biology laboratories to improve instructional quality and learning outcomes.

In Nigeria, science education occupies a strategic position in achieving national development objectives because it serves as the foundation for technological innovation, industrialization, healthcare advancement, agricultural productivity, and environmental sustainability. The National Policy on Education recognizes science and technology as indispensable instruments for national transformation and therefore emphasizes the provision of adequate instructional resources, including laboratories, for effective science teaching (Federal Republic of Nigeria, 2014). Similarly, the Nigerian Educational Research and Development Council (NERDC) advocates activity-oriented teaching approaches that

encourage learners to participate actively in practical investigations rather than relying solely on theoretical instruction (NERDC, 2022). Despite these policy provisions, the implementation of practical Biology instruction remains constrained by inadequate laboratory facilities in many public secondary schools. Several studies conducted in different parts of Nigeria have reported deficiencies in the availability of Biology laboratory facilities. Common challenges include inadequate laboratory buildings, obsolete equipment, insufficient microscopes, lack of preserved specimens, inadequate chemicals and reagents, irregular electricity supply, poor water supply, overcrowded laboratories, and insufficient funding for laboratory maintenance (Akinsola & Igwe, 2022; Owoeye & Yara, 2021). These deficiencies limit teachers' ability to organize practical lessons effectively and reduce students' opportunities to acquire scientific process skills necessary for success in Biology examinations. Consequently, many students complete secondary school with limited practical competence despite having covered the theoretical aspects of the Biology curriculum.

Beyond the issue of availability, effective utilization of laboratory facilities remains a significant concern in Biology education. Studies have shown that some schools possess laboratory equipment that is rarely used because of inadequate teacher competence, fear of damaging expensive equipment, poor maintenance culture, overcrowded classrooms, limited instructional time, and insufficient laboratory personnel (Ibrahim & Yusuf, 2021; OECD, 2022). In some cases, Biology practical lessons are organized only when external examinations approach, thereby denying students continuous opportunities to develop practical skills throughout their years of study. Such irregular utilization weakens students' conceptual understanding and contributes to poor performance in practical and theory examinations alike.

Teachers play a critical role in determining the extent to which laboratory facilities are utilized effectively. Competent Biology teachers integrate practical activities into their lesson plans, encourage inquiry-based learning, supervise laboratory experiments, ensure adherence to safety procedures, and guide students in interpreting experimental results. Their professional knowledge, pedagogical competence, motivation, and attitude toward practical instruction significantly influence students' learning experiences and academic achievement. Conversely, teachers who rely predominantly on expository teaching methods deprive learners of opportunities to observe, investigate, and discover scientific principles independently. Research has consistently demonstrated that students taught through practical-oriented instructional approaches exhibit higher achievement, greater motivation, and better retention than those taught through lecture-based methods alone (Hofstein & Kind, 2019; Abimbola & Bello, 2020).

Students also influence the effective utilization of laboratory facilities through their attitudes toward practical work, level of participation, curiosity, and willingness to engage in scientific investigations. Learners who actively participate in laboratory experiments tend to develop greater confidence, stronger scientific reasoning abilities, improved problem-solving skills, and more positive attitudes toward Biology. Practical activities encourage learners to ask questions, formulate hypotheses, collect data, analyze observations, and communicate findings scientifically. These experiences deepen conceptual understanding and enhance academic performance because students learn through direct interaction with biological materials rather than memorization of textbook information (Kolb, 1984).

Cross River State has long been recognized as one of Nigeria's educationally progressive states, with considerable emphasis on science education as a catalyst for socioeconomic development. Nevertheless, many public secondary schools in the state continue to experience infrastructural deficiencies that affect effective implementation of the Biology curriculum. Reports from school administrators and education stakeholders indicate that several Biology laboratories require renovation, additional equipment, and regular maintenance to meet contemporary instructional standards. Budgetary constraints, inadequate funding, increasing student enrolment, and poor maintenance culture have contributed to disparities in laboratory availability among schools, thereby affecting the quality of Biology instruction across the state (Cross River State Ministry of Education, 2023).

Ogoja Local Government Area occupies an important position within the educational landscape of Cross River State because it hosts several public and private secondary schools serving students from both urban and rural communities. Although these schools implement the same Biology curriculum prescribed by the Nigerian Educational Research and Development Council, differences in laboratory infrastructure, equipment availability, teacher commitment, and utilization practices may result in varying levels of students' academic achievement. Rural schools, in particular, often experience greater

challenges associated with inadequate instructional resources, poor infrastructure, and limited financial support than their urban counterparts. Such disparities may affect the frequency and quality of practical Biology instruction provided to students. Available evidence from the West African Examinations Council continues to indicate fluctuations in students' performance in Biology, with examiner reports identifying weaknesses in practical skills, specimen identification, experimental procedures, observation, and interpretation of biological data among candidates (WAEC, 2023). These observations suggest that many students receive inadequate practical exposure during classroom instruction. Since Biology practical examinations constitute a compulsory component of the Senior School Certificate Examination, inadequate laboratory experiences may significantly undermine students' overall academic performance and reduce their preparedness for science-related careers.

Empirical studies have examined factors influencing students' achievement in Biology, including teacher qualification, instructional strategies, students' attitudes, school environment, parental involvement, and availability of instructional materials. However, relatively few studies have simultaneously examined both the availability and utilization of Biology laboratory facilities as separate but complementary predictors of students' academic performance within public secondary schools in Ogoja Local Government Area of Cross River State. Most previous studies have been conducted in other states or have focused broadly on science education without specifically investigating Biology laboratory facilities. This geographical and contextual gap limits the applicability of previous findings to the educational realities of Ogoja Local Government Area.

The present study is anchored on Constructivist Learning Theory proposed by Bruner (1966), which emphasizes that learners construct knowledge actively through exploration, experimentation, and interaction with learning materials. The theory argues that meaningful learning occurs when students engage directly with instructional resources and discover concepts through practical experiences rather than passive reception of information. Within the context of Biology education, laboratory facilities provide the learning environment through which students construct scientific understanding by observing biological specimens, conducting experiments, manipulating apparatus, and interpreting empirical evidence. Consequently, the availability and effective utilization of Biology laboratory facilities are expected to enhance students' academic performance by promoting active learning, conceptual understanding, and scientific inquiry.

Given the indispensable role of laboratory instruction in Biology education, the persistent concerns regarding students' poor academic performance in Biology, and the apparent disparities in laboratory facilities among secondary schools, there is a compelling need for empirical investigation.

Understanding the extent to which the availability and utilization of Biology laboratory facilities relate to students' academic performance will provide valuable evidence for policymakers, school administrators, Biology teachers, curriculum planners, and other education stakeholders. Such evidence will facilitate informed decisions regarding resource allocation, laboratory improvement, teacher development, and instructional practices aimed at enhancing Biology education. It is against this background that the present study examines the availability and utilization of Biology laboratory facilities and students' academic performance in secondary schools in Ogoja Local Government Area of Cross River State.

Statement of research problems

The persistent poor academic performance of students in Biology in both internal and external examinations has remained a major concern among educators and stakeholders. Reports from WAEC and NECO indicate that many students perform poorly in practical aspects of Biology, including specimen identification, observation, experimentation, data recording, and interpretation of biological concepts. This poor performance has been associated with inadequate practical exposure, despite the practical nature of the subject.

Biology requires adequate laboratory facilities for effective teaching and learning; however, many public secondary schools lack functional and well-equipped Biology laboratories. In schools where laboratory facilities are available, they are often inadequately utilized due to poor maintenance, insufficient funding, overcrowded laboratories, and irregular conduct of practical lessons. This situation appears evident in public secondary schools in

Ogoja Local Government Area of Cross River State, where the availability and utilization of Biology laboratory facilities may influence students' academic performance.

Although previous studies have examined factors affecting students' achievement in Biology, limited empirical evidence exists on the relationship between the availability and utilization of Biology laboratory facilities and students' academic performance in Ogoja Local Government Area. This gap in knowledge necessitated the present study.

Objectives of the Study

The main objective of this study was to examine the relationship between the availability and utilization of biology laboratory facilities and students' academic performance in secondary schools in Ogoja Local Government Area of Cross River State. Specifically, this study sought to:

1. Examine the relationship between the availability of biology laboratory facilities and students' academic performance in secondary schools in Ogoja Local Government Area of Cross River State.
2. Determine the relationship between the utilization of biology laboratory facilities and students' academic performance in secondary schools in Ogoja Local Government Area of Cross River State.

Research Questions

The following research questions guided the study:

1. What relationship exists between the availability of biology laboratory facilities and students' academic performance in secondary schools in Ogoja Local Government Area of Cross River State?
2. What relationship exists between the utilization of biology laboratory facilities and students' academic performance in secondary schools in Ogoja Local Government Area of Cross River State?

Research Hypotheses

The following null hypotheses were tested at the 0.05 level of significance:

- 1 There is no significant relationship between the availability of biology laboratory facilities and students' academic performance in secondary schools in Ogoja Local Government Area of Cross River State.
- 2 There is no significant relationship between the utilization of biology laboratory facilities and students' academic performance in secondary schools in Ogoja Local Government Area of Cross River State.

Methods

This study adopted a correlation research design to examine the relationship between the availability and utilization of Biology laboratory facilities and students' academic performance in Biology in secondary schools in Ogoja Local Government Area of Cross River State. Correlation design was considered appropriate because the study sought to determine the nature and magnitude of the relationships existing among the variables without manipulating the independent variables.

The population of the study comprised 2,236 respondents, consisting of 2,184 Senior Secondary Two (SS II) students in biology and 52 Biology teachers drawn from the 26 public secondary schools in Ogoja Local Government Area of Cross River State. Senior Secondary Two students were selected because they had already covered a substantial proportion of the Biology curriculum and had participated in Biology practical lessons, making them suitable respondents for assessing the availability and utilization of Biology laboratory facilities. Biology teachers were included because they are directly responsible for laboratory instruction and the effective utilization of available laboratory resources. A sample of 420 respondents, comprising 390 Senior Secondary Two (SS II) students in

biology and 30 Biology teachers, were selected from the study population using a multistage sampling procedure.

Two instruments titled "Availability and Utilization of Biology Laboratory Facilities Questionnaire (AUBLFQ) and Biology Achievement Test (BAT) were used for data collection.

The questionnaire was structured on a four-point Likert rating scale of Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). The Pearsons Product Moment Correlation Coefficient was the instrument used for data analyses tested at .05 level of significance.

Results

Hypothesis One

There is no significant relationship between the availability of Biology laboratory facilities and students' academic performance in Biology in secondary schools in Ogoja Local Government Area of Cross River State.

Table 1: PPMC Analysis of the Relationship between Availability of Biology Laboratory Facilities and Students' Academic Performance in Biology

Variables	N	Mean	SD	r-value	p-value
Availability of Biology Laboratory Facilities	420	27.20	4.34		
Students' Academic Performance (BAT)	420	28.54	4.18	0.71	0.000

Significant at 0.05 level

The result presented in Table 3 shows that the calculated r-value of 0.71 with a corresponding p-value of 0.000 is less than the 0.05 level of significance. Since the calculated p-value is less than the 0.05 level of significance, the decision rule is to reject the null hypothesis and accept the alternative hypothesis. This indicates that there is a statistically significant positive relationship between the availability of Biology laboratory facilities and students' academic performance in Biology. Consequently, the null hypothesis (H_{01}), which states that there is no significant relationship between the availability of Biology laboratory facilities and students' academic performance in Biology, is rejected. The positive correlation implies that improved availability of Biology laboratory facilities is associated with corresponding improvements in students' academic performance as measured by the Biology Achievement Test (BAT). This finding further suggests that the provision of adequate laboratory equipment, instructional materials, biological specimens, laboratory chemicals, and other practical resources enhances students' understanding of Biology concepts, promotes effective practical instruction, and improves academic achievement. The relatively high correlation coefficient also indicates that the availability of Biology laboratory facilities is an important predictor of students' academic performance in Biology.

Hypothesis Two: There is no significant relationship between the utilization of Biology laboratory facilities and students' academic performance in Biology in secondary schools in Ogoja Local Government Area of Cross River State.

Table 4: PPMC Analysis of the Relationship between Utilization of Biology Laboratory Facilities and Students' Academic Performance in Biology

Variables	N	Mean	SD	r-value	p-value
Utilization of Biology Laboratory Facilities	420	27.86	4.12		
Students' Academic Performance (BAT)	420	28.54	4.18	0.76	0.000

Significant at 0.05 level

The result in Table 4 reveals that the calculated r-value of 0.76 with a corresponding p-value of 0.000 is less than the 0.05 level of significance. Since the calculated p-value is less than the 0.05 level of significance, the decision rule is to reject the null hypothesis and accept the alternative hypothesis. This indicates that there is a statistically significant positive relationship between the utilization of Biology laboratory facilities and students' academic performance in Biology. Therefore, the null hypothesis (H_{02}), which states that there is no significant relationship between the utilization of Biology laboratory facilities and students' academic performance in Biology, is rejected. The positive relationship implies that increased utilization of Biology laboratory facilities is associated with higher levels of students' academic performance in Biology. The findings further suggest that regular practical lessons, effective use of laboratory equipment, students' active participation in experiments, and proper integration of laboratory activities into classroom instruction significantly improve students' performance in the Biology Achievement Test (BAT). The strength of the correlation demonstrates that effective utilization of Biology laboratory facilities is a major determinant of academic success in Biology. Consequently, schools should encourage regular practical instruction and maximize the use of available laboratory facilities to enhance students' academic achievement in Biology.

Discussion of Findings

The findings of the study are discussed in this section based strictly on the two hypotheses tested.

Availability of Biology Laboratory Facilities and Students' Academic Performance in Biology

The first hypothesis examined the relationship between the availability of Biology laboratory facilities and students' academic performance in Biology in secondary schools in Ogoja Local Government Area of Cross River State. The result of the data analysis revealed that there is a significant positive relationship between the availability of Biology laboratory facilities and students' academic performance in Biology in secondary schools in Ogoja Local Government Area of Cross River State. The null hypothesis was rejected, indicating that the availability of Biology laboratory facilities significantly influences students' academic performance in Biology. The findings showed that schools with adequately equipped Biology laboratories, functional microscopes, biological specimens, laboratory chemicals, charts, models, laboratory furniture, safety equipment, and other instructional resources provide students with better opportunities to participate in practical activities that enhance their understanding of biological concepts and improve their academic performance. This implies that the provision of adequate laboratory facilities creates a conducive learning environment where students can actively observe, experiment, investigate, and verify theoretical concepts through practical experiences, thereby improving their performance in the Biology Achievement Test (BAT). The findings further suggest that the availability of appropriate laboratory facilities encourages inquiry-based learning, develops scientific process skills, promotes critical thinking, and enhances students' retention of biological concepts, all of which contribute to improved academic achievement.

The finding is consistent with UNESCO (2021), which emphasized that well-equipped science laboratories provide learners with opportunities to develop scientific inquiry skills, improve conceptual understanding, and achieve better learning outcomes. The finding also agrees with Aina (2020), who reported that the availability of functional laboratory facilities significantly enhances students' academic achievement in science subjects by facilitating practical learning experiences. Similarly, Akinsola and Igwe (2022) observed that adequate Biology laboratory facilities positively influence students' academic performance because they enable teachers to implement the Biology curriculum effectively through practical instruction. Furthermore, WAEC (2023) noted that students who receive adequate practical exposure during Biology lessons generally perform better in both practical and theory examinations than students with limited laboratory experiences.

Utilization of Biology Laboratory Facilities and Students' Academic Performance in Biology

The second hypothesis examined relationship between the utilization of Biology laboratory facilities and students' academic performance in Biology in secondary schools in Ogoja Local Government Area of Cross River State. The data analysis indicated that there is a significant positive relationship between the utilization of Biology laboratory facilities and students' academic performance in Biology in secondary schools in Ogoja Local Government Area of Cross River State. The null hypothesis was also rejected, confirming that effective utilization of Biology laboratory facilities significantly enhances students' academic performance in Biology. The findings indicated that regular Biology practical lessons, effective use of laboratory equipment, active participation of students during practical activities, teachers' integration of laboratory exercises into classroom instruction, and proper supervision of practical sessions significantly improve students' understanding of Biology concepts and their academic performance. This implies that merely providing laboratory facilities is insufficient unless such facilities are effectively and consistently utilized during instructional activities. Regular practical experiences expose students to scientific investigations, improve their manipulative skills, strengthen their problem-solving abilities, and enable them to apply theoretical knowledge to real-life biological situations, thereby enhancing their achievement in Biology.

The finding agrees with Hofstein and Kind (2019), who maintained that effective laboratory instruction promotes students' scientific reasoning, conceptual understanding, and academic achievement through active participation in practical investigations. The finding also supports Ibrahim and Yusuf (2021), who found that frequent utilization of Biology laboratory facilities significantly improves students' achievement by increasing practical competence and scientific process skills. Similarly, Kolb (1984) argued through the Experiential Learning Theory that meaningful learning occurs when learners actively engage in practical experiences that enable them to construct knowledge from direct observation and experimentation. Furthermore, the finding corroborates OECD (2022), which reported that schools that effectively utilize science laboratories achieve better learning outcomes because students develop practical competencies, creativity, collaboration, and higher-order thinking skills essential for academic success.

Conclusion

Based on the findings of the study, it is concluded that both the availability and effective utilization of Biology laboratory facilities are significant determinants of students' academic performance in Biology in secondary schools in Ogoja Local Government Area of Cross River State. The study established that schools with adequately equipped Biology laboratories provide students with greater opportunities for practical learning experiences, thereby enhancing their understanding of biological concepts and improving their performance in the Biology Achievement Test (BAT). The study further concludes that effective utilization of available laboratory facilities through regular practical lessons, active student participation, appropriate use of laboratory equipment, and proper integration of practical activities into classroom instruction significantly enhances students' academic achievement in Biology. Therefore, improving the availability and utilization of Biology laboratory facilities is essential for strengthening Biology education, promoting scientific inquiry, developing practical competencies, and improving students' academic performance in secondary schools.

Recommendations

1. The Cross River State Government, through the Ministry of Education, should provide and adequately equip Biology laboratories in public secondary schools with modern laboratory facilities, including microscopes, biological specimens, laboratory chemicals, instructional models, charts, safety equipment, and other practical materials to enhance students' academic performance in Biology.
2. School principals and Biology teachers should ensure the regular and effective utilization of available Biology laboratory facilities by organizing frequent practical lessons, encouraging students' active participation in laboratory activities, and integrating practical exercises into classroom instruction to improve students' performance in the Biology Achievement Test (BAT).

References

- Abimbola, I. O., & Bello, G. (2020). Practical activities and students' academic achievement in Biology in Nigerian secondary schools. *International Journal of Science Education*, 42(8), 1256–1273.
- Aina, J. K. (2020). Availability of laboratory facilities and students' academic performance in science subjects in secondary schools in Nigeria. *International Journal of Educational Research Review*, 5(3), 213–221.
- Akinsola, M. K., & Igwe, D. O. (2022). School laboratory resources and students' achievement in Biology among senior secondary schools in Nigeria. *Journal of Science and Mathematics Education*, 10(2), 45–58.
- Bruner, J. S. (1966). *Toward a theory of instruction*. Harvard University Press.
- Cross River State Ministry of Education. (2023). *Annual education sector performance report 2022/2023*. Government Printer.
- Federal Ministry of Education. (2021). *National education quality assurance policy*. Federal Government of Nigeria.
- Federal Republic of Nigeria. (2014). *National policy on education* (6th ed.). Nigerian Educational Research and Development Council.
- Hofstein, A., & Kind, P. M. (2019). Learning in and from science laboratories: Enhancing students' scientific understanding. *Studies in Science Education*, 55(2), 109–146.
- Ibrahim, A. M., & Yusuf, H. O. (2021). Utilization of laboratory facilities and students' academic achievement in Biology in public secondary schools. *International Journal of Educational Studies*, 18(1), 82–95.
- Nigerian Educational Research and Development Council. (2022). *Senior secondary school Biology curriculum*. NERDC Press.
- Organisation for Economic Co-operation and Development. (2022). *Education at a glance 2022: OECD indicators*. OECD Publishing. <https://doi.org/10.1787/3197152b-en>
- Sharma, M.S., & Bansal, D. (2017). Constructivism as paradigm for teaching and learning. *International Journal of Physical Education, Sports and Health*, 4(5), 209–212.
- UNESCO. (2021). *Reimagining our futures together: A new social contract for education*. UNESCO Publishing.
- West African Examinations Council. (2023). *Chief examiners' reports: West African Senior School Certificate Examination (WASSCE), Biology*. WAEC.
- Owoeye, J. S., & Yara, P. O. (2021). Biology laboratory facilities and students' academic performance in Nigerian secondary schools. *African Journal of Educational Research and Development*, 14(1), 71–86.