

# Exploring the Nexus between Laboratory Work, Student Attitudes and Academic Performance of Secondary School Biology Students in Osun State, Nigeria

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## Abstract

*The study investigates the interrelationship between laboratory work, student attitudes and academic performance in Biology among secondary school students in Biology. The study adopts descriptive survey research design. The study comprised all senior secondary school students in Osun State. The sample consisted of 360 SSS II students selected using multistage sampling technique. Data collected were analysed using descriptive statistics. The findings revealed a significant shortage of Biology laboratory equipment as indicated by a grand mean of 1.50 meanwhile, a grand mean of 3.79 indicated that students perceive laboratory activities as contributing to improving academic performance. The study concludes that while the lack of adequate laboratory equipment is a major challenge, practical laboratory activities play a crucial role in enhancing students' attitude and academic performance in Biology. The findings suggest that improving both the availability of laboratory resources and the quality of practical sessions can significantly elevate Biology education in the study area.*

**Keywords:** Science, Laboratory Work, Attitudes, Academic Performance

## INTRODUCTION

Science is a great enterprise which nations depend on, in-order to advance technologically. Science, therefore, is receiving much emphasis on education because of its significance and relevance to life and society. In contemporary educational practice, science education holds a prominent and indispensable position in the advancement of science and technology which is considered vital for a nations overall economic development (Bathsheba, 2020) Fafunwa cited in Olufisayo (2024) stresses that this significance stems from the universal emphasis on the teaching of science subjects, as educators worldwide maintain that no nation can afford to disregard the teaching of science in school. The study of science subjects namely Physics, Chemistry, and Biology at the senior secondary school level may, however, be shaped by various environmental factors, including the availability and adequacy of laboratory and library facilities.

Biology as a branch of science and the prerequisite subject for many fields of learning contributes immensely to the technological growth of the nation. This includes medicine, forestry, agriculture, biotechnology and nursing. The study of Biology in senior secondary school can equip students with useful concepts, principles and theories that will enable them

to face the challenges before and after graduation. Practical activities in biology provide opportunities for students to do science as opposed to learning about science. Nzewi (2010) asserted that practical activities can be regarded as a strategy that could be adopted to make the task of a teacher (teaching) more real to the students as opposed to the abstract or theoretical presentation of facts, principles and concepts of the subject matters. Nzewi maintained that practical activities should engage the students in hands-on, mind-on activities, using a variety of instructional materials/equipment to drive the lesson home. Nwagbo (2010) stated that the use of a practical approach to the teaching of biological concepts should therefore be a rule rather than an option for biology teachers if we hope to produce students who would be able to acquire the necessary knowledge, skills and competence needed to meet the scientific and technological demands of the nation.

Biology is one of the science subjects offered at the secondary school level in Nigeria which attracts the greatest patronage of both science oriented. This status is enhanced by the national policy on education stipulation (FME, 2014). Biology as a science course involves the use of process skills and different approaches to bring about meaningful learning in the learners. However, there appears to be a continuous annual poor academic performance of students in public examinations (Okebukola, 2016). Alarming reports continue to come from examination bodies such as the West African Examination Council (WAEC, 2014) concerning poor performance in the sciences despite various educational improvement efforts of the government such as financing and provision of instructional materials to popularize science in secondary schools (WAEC, 2009, 2010, 2011, 2012, 2013, 2014, 2015 & 2016).

This poor situation does not augur well for Nigeria in general and the educational career of science students in particular given the importance of Biology to our day-to-day lives. This assertion is confirmed by Ogbeba (2009) who notes that Biology deals with the study of life and so it helps to make people aware of their health, environment and their body among other things. The subject is therefore of paramount importance to any nation including developing ones. Thus, Maduabum (2005) notes that a sound working knowledge of biology is a prerequisite for entry into; medicine, pharmacy, agriculture, nursing, and science education (Maduabum, 2005). A sound theoretical and practical knowledge of biology is very necessary

for the management of our natural resources, provision of good health facilities for people, adequate food supply and a favourable life environment (Ogbeba, 2009). Researchers such as Nwagbo and Obiekwe (2006); and Samba and Eriba (2012) blame this poor performance on poor pedagogy. Generally, some scholars have suggested the inquiry method as a more effective method for teaching biology in senior secondary school (Berry, Mulhall, & Loughran, 2004). These scholars opined that one way of enabling students to learn and understand science and acquire science process skills is to teach science as inquiry. However, Nwagbo and Obiekwe (2006) indicated that an overwhelming majority of biology teachers still prefer the traditional expository method of teaching and shy away from innovative activity-oriented teaching methods such as inquiry, discovery, laboratory approach, cooperative learning which are learner-centred and have the potentials of improving students' achievement. In the same vein, Orokpo (2009) laments that the use of the traditional lecture method of “chalk and talk” has gained prominence in the teaching of biology with practical work relegated to the background.

### **Statement of Problem**

The persistent poor performance in Biology among students highlights the necessity of exploring effective teaching strategies for the successful learning of biological concepts. Over the years, research studies have consistently demonstrated subpar performance among Biology students, attributing the issue to various factors, including the inadequate use of effective teaching methodologies in secondary schools. Moreover, the debate surrounding gender disparity in biology achievement continues among researchers.

Given the significance of Biology in everyday life, it is crucial to reassess the teaching methods employed in senior secondary schools. The underperformance in Biology should serve as a wake-up call to re-evaluate these methodologies, preventing them from hindering the educational progress of numerous Nigerian students studying Biology.

The purpose of this study is to investigate the present attitude of students towards laboratory in Biology and its impact on academic performance in Osun state.

Specifically, the study seeks to:

1. examine the availability of Biology laboratory equipment in secondary schools

2. assess the influence of laboratory activities in enhancing students' attitude towards Biology.
3. determine the impact of laboratory activities on students' academic performance in Biology.

### Research questions

The following questions have been prepared for the study:

1. How available are Biology laboratory equipment in secondary schools
2. How does laboratory activities enhance students' attitude towards biology.
3. What is the impact of laboratory activities on students' academic performance in Biology.

### METHODOLOGY

The study adopted descriptive research survey design. The population for the study consisted of secondary school students in State. A total sample of 360 Biology students were randomly selected using multistage sampling technique. One Local Government each were randomly selected from each of the three senatorial districts in Osun State. From the three local Government selected, four secondary schools were randomly selected making a total of 12 schools. From each selected secondary school, thirty biology students were randomly selected. Data collected were analysed using descriptive statistics, including mean scores and frequency distribution.

### RESULTS

**Question One:** How available are Biology laboratory equipment in secondary schools?

To answer this question, Questionnaire were designed to elicit information about how the respondents responds to the availability of Biology Laboratory Equipment in their secondary schools. All the items were positively structured items in the Section, and they were graded such that Strongly Agree was 4, Agree (3), Disagree (2) and Strongly Disagree (1). A Mean and Standard Deviation table were created using the calculated mean of each respondent and then grouped as shown below (average Mean =2.5), responses with less than 2.5 signifies that the respondents disagree to the items.

**Table 1:** Showing the availability of Biology Laboratory equipment in the Secondary schools sampled.

S/N	Item Statement	Mean	Std. Deviation	Remark
1	I often do have access to the Biology laboratory?	1.55	.787	Disagreed
2	The Biology laboratory in my school is well-equipped with the necessary materials and instruments.	1.37	.647	Disagreed
3	The equipment in the Biology laboratory is regularly maintained and functional.	1.28	.621	Disagreed
4	There are enough laboratory instruments for all students during practical sessions.	1.37	.484	Disagreed
5	The laboratory has up-to-date and modern equipment.	1.37	.484	Disagreed
7	There are sufficient consumables (e.g., chemicals, specimens) available for practical work.	1.64	.646	Disagreed
8	The laboratory is spacious enough to accommodate all students during practical sessions.	1.73	.618	Disagreed
9	Safety equipment (e.g., fire extinguishers, first aid kits) is available in the laboratory.	1.64	.646	Disagreed
10	The laboratory has sufficient reference materials (e.g., textbooks, charts, models) to aid learning.	1.63	.647	Disagreed
<b>Grand Mean</b>		<b>1.5028</b>	<b>.6232</b>	

**Decision Mean: 2.5**

**Mean < 2.5:** Indicates that most respondents disagree (i.e., low availability of Biology Laboratory Equipment).

**Mean > 2.5:** Indicates that most respondents Agree (i.e., high availability of Biology Laboratory Equipment).

Table 1 shows the availability of Biology Laboratory Equipment in the selected secondary schools. The results in Table 1 reveal that students disagreed with all the items listed, with mean (1.50) which are: "I often do have access to the Biology laboratory," "The Biology laboratory in my school is well-equipped with the necessary materials and instruments," "The equipment in the Biology laboratory is regularly maintained and functional," "There are enough laboratory instruments for all students during practical sessions," "The laboratory has up-to-date and modern equipment," "There are sufficient consumables (e.g., chemicals, specimens) available for practical work," "The laboratory is spacious enough to accommodate all students during practical sessions," "Safety equipment (e.g., fire extinguishers, first aid kits) is available in the laboratory," "The laboratory has sufficient reference materials (e.g., textbooks, charts, models) to aid learning," and "The laboratory is accessible to students outside regular class hours for additional practice."

This is because all the items had a mean lower than 2.50, which is the decision mean. The students' disagreement with the above-listed items indicates a low availability of Biology Laboratory equipment, suggesting that the students are not adequately taught through the use

of Biology practical. The overall mean of 1.5 compared to the decision mean of 2.5 further solidifies this interpretation, signifying that the standard of teaching and learning of Biology practical is low and is negatively affected by the conditions stated in the items above.

**Question 2:** How does laboratory activities enhance students’ attitude towards biology?

**Table 2:** Showing the Influence of Laboratory Activities in enhancing Students' Attitude Towards Biology

S/N	Item Statement	Mean	Std. Deviation	Remark
1	Laboratory activities make Biology more interesting to me.	3.72	.756	Agreed
2	I look forward to Biology laboratory sessions.	3.73	.869	Agreed
3	Laboratory activities help me understand Biology concepts better.	3.63	.777	Agreed
4	I am more engaged in Biology classes that involve laboratory work.	3.82	1.034	Agreed
5	I feel more prepared for practical examinations after participating in laboratory activities.	3.73	.968	Agreed
7	I find it easier to relate theoretical knowledge to real-life situations through laboratory activities.	3.55	.787	Agreed
8	Laboratory activities motivate me to study Biology more.	3.46	.660	Agreed
9	The hands-on experience in the laboratory helps me retain Biology concepts better.	3.46	.660	Agreed
10	My interest in pursuing a career in science has increased due to laboratory activities.	3.46	.660	Agreed
<b>Grand Mean</b>		<b>3.6110</b>	<b>.7958</b>	

Mean < 2.5: Indicates that most respondents disagree (i.e., Negative influence of Laboratory Activities on Student’s attitude towards Biology).

Mean > 2.5: Indicates that most respondents Agree (i.e., Positive influence of Laboratory Activities on Student’s attitude towards Biology).

Table 2 shows the influence of laboratory activities in enhancing students' attitudes towards Biology. The results in Table 3 reveal that students agreed with all the items listed, with grand mean (3.6110) which are: "Laboratory activities make Biology more interesting to me," "I look forward to Biology laboratory sessions," "Laboratory activities help me understand Biology concepts better," "I am more engaged in Biology classes that involve laboratory work," "I feel more prepared for practical examinations after participating in laboratory activities," "I find it easier to relate theoretical knowledge to real-life situations through laboratory activities," "Laboratory activities motivate me to study Biology more," "The hands-on experience in the laboratory helps me retain Biology concepts better," and "My interest in pursuing a career in science has increased due to laboratory activities."

All items had a mean higher than 2.50, which is the decision mean. The agreement on these items indicates a positive influence of laboratory activities on students' attitudes towards Biology. The grand mean of 3.61 further supports this interpretation, suggesting that laboratory activities play a significant role in enhancing students' engagement, interest, and understanding of Biology. This positive response highlights the effectiveness of practical laboratory work in motivating students, improving their comprehension of biological concepts, and fostering a greater interest in pursuing science careers.

**Question Three (3):** What is the impact of laboratory activities on students' academic performance in Biology?

**Table 3:** Showing the Impact of Laboratory Activities on Students' Academic Performance in Biology

S/N	Item Statement	Mean	Std. Deviation	Remark
1	My performance in Biology has improved due to laboratory activities.	3.64	.986	Agreed
2	Laboratory activities help me perform better in Biology exams.	3.73	.968	Agreed
3	I find it easier to answer practical questions in Biology exams after participating in laboratory activities.	3.83	1.034	Agreed
4	The practical knowledge gained from laboratory activities is useful in real-life situations.	3.92	1.00	Agreed
5	Overall, laboratory activities have a positive impact on my academic performance in Biology.	3.92	1.00	Agreed
7	I have better problem-solving skills in Biology due to laboratory activities.	3.00	.876	Agreed
8	Laboratory activities have improved my critical thinking skills in Biology.	3.92	1.09	Agreed
9	I am able to complete Biology assignments more efficiently after participating in laboratory activities.	3.64	.887	Agreed
10	The grades I receive in Biology practicals are higher compared to theoretical tests.	3.46	.500	Agreed
	<b>Grand Mean</b>	<b>3.798</b>	<b>.934</b>	

Table 3 shows the impact of laboratory activities on students' academic performance in Biology. The results in Table 3 reveal that students agreed with all the items listed, with grand mean (3.798). The items are: "My performance in Biology has improved due to laboratory activities," "Laboratory activities help me perform better in Biology exams," "I find it easier to answer practical questions in Biology exams after participating in laboratory activities," "The practical knowledge gained from laboratory activities is useful in real-life situations," "Overall, laboratory activities have a positive impact on my academic performance in Biology," "I have better problem-solving skills in Biology due to laboratory activities," "Laboratory activities have improved my critical thinking skills in Biology," "I am able to complete Biology assignments more efficiently after participating in laboratory activities," "The grades I receive in Biology practicals are higher compared to theoretical tests."

assignments more efficiently after participating in laboratory activities," and "The grades I receive in Biology practicals are higher compared to theoretical tests."

All items had a mean higher than 2.50, indicating agreement with the statements. The grand mean of 3.80 further supports this interpretation, suggesting that laboratory activities have a significant positive impact on students' academic performance in Biology. Students perceive that laboratory activities not only enhance their practical knowledge and problem-solving skills but also improve their exam performance, critical thinking, and efficiency in completing assignments. The consistent agreement across items highlights the effectiveness of laboratory activities in boosting academic performance and overall understanding of Biology.

## DISCUSSION

The findings of this study provide crucial insights into students' attitudes towards laboratory work and its impact on academic performance in Biology. The analysis was guided by three primary research questions, and the results have been discussed in relation to existing literature and theoretical frameworks.

The study revealed a significant inadequacy in the availability of Biology laboratory equipment in the sampled schools. The grand mean of 1.4950, well below the decision mean of 2.5, indicates a consensus among students that their schools' laboratories are poorly equipped. This finding aligns with recent studies, which have similarly highlighted the challenges faced by Nigerian secondary schools regarding laboratory facilities. For instance, Oludipe (2019) found that inadequate laboratory resources significantly impact the quality of science education, corroborating the issues identified in this study.

The lack of access to well-equipped laboratories can hinder students' understanding and engagement with practical aspects of Biology. Recent research by Adeyemo (2018) and Olowokere (2021) underscores the critical role that adequate laboratory facilities play in enhancing students' performance and interest in science subjects. Without the necessary tools and materials, students miss out on the hands-on experiences crucial for deep learning and retention of scientific concepts.

Despite the poor state of laboratory facilities, the findings indicate that laboratory activities positively influence students' attitudes towards Biology. With a grand mean of 3.6110, students agreed that laboratory activities make Biology more interesting and engaging. This supports the assertion by Hofstein and Lunetta (2019) that practical work in science education is vital for developing students' interest and motivation.

Laboratory activities were found to enhance understanding, engagement, and retention of Biology concepts. This is consistent with the findings of Abrahams and Millar (2014), who emphasized that practical work helps students connect theoretical knowledge with real-world applications. The positive attitudes fostered by laboratory activities can lead to increased motivation to study Biology and pursue science-related careers, as observed in the study by Akinbode and Adeoye (2022).

The impact of laboratory activities on students' academic performance in Biology was also examined. The results indicate a positive effect, with a grand mean of 3.7980, suggesting that students perceive laboratory work as beneficial to their academic success. This finding aligns with the research by Olatoye (2019), who found that practical science experiences are strongly correlated with improved academic performance.

Students reported that laboratory activities helped them perform better in exams, enhance their problem-solving and critical thinking skills, and increase their overall interest and commitment to Biology. These outcomes are supported by constructivist learning theory, which posits that learners construct knowledge more effectively through active participation and hands-on experiences (Froyd, 2017).

However, it is noteworthy that the positive impact on academic performance occurs despite the inadequate laboratory facilities. This suggests that while well-equipped laboratories are ideal, the quality and effectiveness of the laboratory activities themselves also play a critical role. Teachers who can effectively utilize available resources and design engaging practical sessions can still significantly influence students' learning outcomes, as highlighted by Ayodele and Adekunle (2016).

The findings of this study underscore the importance of laboratory activities in shaping students' attitudes towards Biology and enhancing their academic performance. Despite the challenges posed by inadequate laboratory facilities, effective practical sessions can foster positive attitudes and improve academic outcomes. To maximize these benefits, it is essential for educational stakeholders to address the deficiencies in laboratory resources and support teachers in delivering high-quality practical science education.

## **CONCLUSION**

The study concludes that while the lack of adequate laboratory equipment is a major challenge, practical laboratory activities still play a crucial role in enhancing students' attitudes and academic outcomes in Biology. The findings suggest that improving both the availability of

laboratory resources and the quality of practical sessions can significantly elevate Biology education in the study area.

## RECOMMENDATIONS

Based on the study's findings, the following recommendations are made:

1. Educational authorities should prioritize providing and upgrading Biology lab equipment to ensure students have the necessary tools for hands-on learning.
2. Teachers should receive ongoing training to learn new and effective ways to conduct lab activities, especially in schools with limited resources.
3. The Biology curriculum should include more practical lab activities to help students connect what they learn in class with real-world applications.
4. Schools should seek partnerships with community organizations and businesses to get additional support and resources for improving lab facilities.
5. Schools should regularly assess the condition of their lab facilities and the effectiveness of their teaching methods to identify areas for improvement.
6. In the absence of adequate lab equipment, schools can explore using virtual labs or low-cost experimental setups to provide students with practical learning experiences.

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