



IMPROVING BIOLOGY EDUCATION: THE IMPACT OF LABORATORY FACILITIES ON STUDENT ACHIEVEMENT IN ABEOKUTA

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Abstract: The fluctuating academic achievement of students in Biology over the years has been a source of concern to stakeholder such as parents, educators and government. Previous studies have examined factors like Teachers' characteristics, Students' attitudes, Parents' factors, teaching methods, laboratory facilities in teaching and a host of others as part of the reasons for the fluctuation, but none of these studies was carried out in the present location of this research work. This study examined Laboratory Facilities and Public Senior Secondary School Students' Academic Achievement in Biology in Abeokuta Metropolis, Ogun State. Descriptive survey research design was used for the study where the population for the study was 6677 Senior Secondary School II Biology Students and 53 Biology Teachers in the 49 Public Senior Schools in Abeokuta. Multi-stage sampling procedure was used to obtain 43 schools, 602 students and 53 Biology teachers. Two self-constructed instruments, tested for reliability - Biology Teachers Questionnaire (BTQ) (0.85) and Biology Students Achievement Test (BSAT) (0.92) were used for data collection. Data were analyzed using frequency count, mean, standard deviation and multiple regression analysis. The results revealed that laboratory facilities were not adequately available, with low level of usability. Laboratory facilities were found to enhance teaching of Biology to high extent. There was a significant positive correlation between availability and usability of laboratory facilities among secondary schools in Abeokuta metropolis... The study concluded that: Equipment ($\beta=0.191$; $t=2.547$, $p<0.05$); Specimen ($\beta=0.173$; $t=2.971$, $p<0.05$) revealed relative influence and can be used to predict academic achievement in Biology. It was recommended among others that teachers should use the available laboratory facilities during Biology teaching and government should provide more laboratory facilities to schools.

Keywords: Laboratory, Laboratory facilities, Biology achievement, Public senior secondary school

Introduction

Biology can be defined as the systematic study of life and their improvement. It is regarded to as the science of life. Biology is a branch of science that deals with the study of living organisms. Biology as natural science subject has many branches such as Botany, Zoology, Genetics, Anatomy, Ecology, Morphology, Microbiology,

Entomology, Molecular Biology, and Evolution and so on. It contributes greatly to human existence and the world at large (Adesoji & Olatunbosun, 2018). It is a core science subject offered by students in senior secondary school across Nigeria, a core subject that formed Science, Technology, Engineering and Mathematics (STEM) upon which the national development of the country depends. It is a way of passing the biological ideas to the incoming generation through its teaching in schools (Etebu & Amatari, 2020). The aim of teaching Biology in school is to breed scientists who will be able to contribute to the society using the scientific knowledge acquired, develop the mental capability of learners in the science field; to enhance the career prospect of science student if they are found in career that need more than science knowledge, apply knowledge of science in solving problems to name a few (Agbogboroma, 2015; Crescentia & Amos, 2016). The importance of Biology is evident with great achievement recorded in the field of Ecology, Genetics, Biochemistry, in solving human problem such as pollution, population, radiation, disease, health, family life, hygiene management and natural resources conservation. It serves as prerequisite for further studies in higher institutions of learning for science-oriented courses such as Medicine, Nursing, Engineering, Pharmacy, Zoology, Botany, Human Kinetic to mention a few (Umar, Yagana & Aliyu, 2018; Biology explorer, 2020). The relevance of Biology to agricultural skills in planting crops, environmental protection, animal husbandry and production of raw materials for industry are obvious. Biology is an inevitable instrument for accomplishing success in any chosen professional life. It is therefore obvious that Biology has direct impact not only on the students or study of life, but on the world at large (Ihejiamaizu & Ochui 2016; Ziyadulla, 2019). Despite the importance of Biology to national development, it is amazing that students' academic achievement in Biology is not encouraging at 'O' level Senior Secondary Schools Certificate Examination (SSCE) such as in the Chief Examiners' Report of West African Examination Council (www.waec.org). This may be due to various factors such as laboratory facilities, teachers' qualification, broad curriculum, students' attitudes to name a few. Academic achievement is important in education system. According to Umar (2018) academic achievement reveals the strength and weakness of any institution, has direct effect on socioeconomic development of a nation and it is a great tool in measuring education standard. It is the most valid indicator for judging or determining the success of any institution or organization. Previous studies conducted on student academic performance in science subject showed low performance over the years (Salisu, Bilikisu & Sani, 2018; Bathsheba et al., 2020).

Table 1: Students' Academic Performance in Biology in West African Examination Council (WAEC) from 2015 to 2019

Year	Total Enrolment	Mean Score	Standard Deviation
2015	1,182,038	25	11.87
2016	1,087,921	31	10.97
2017	1,087,921	31	11.92
2018	1,080,884	30	9.00
2019	1,086,449	31	9.43

Source:

It is commonly expressed that a nation's technological growth depends on the quantity and quality of science education that is taught and learned in schools. This implies that science teaching and learning is sine qua non for

the industrialization process of a nation. Hence laboratory and its facilities cannot be separated from science teaching. A laboratory is a special classroom used by scientist in schools where practical work or experiment is carried out for effective teaching of various science subjects (Pareek & Peter, 2019). Science education is not effective without a quality laboratory work. Hence, science teaching requires the availability of laboratory facilities for experimental work in various science subjects. Laboratory facilities promote quality learning as enhance learners' academic performance in various science subject, develops learners' interest, reasoning skills and attitudes as they manipulate equipment and materials during experiment. Difficult scientific concept becomes easy through experimentation with science kits (Almroth, 2015; Taber & Akpan, 2017). Research has shown that learners find it difficult in achieving the objectives of experiment in the laboratory (Adepoju, 2024, Adeosun, 2021). This may be due to inadequate laboratory facilities to practice with as availability of laboratory facilities help impact practical understanding of theoretical teaching through regular laboratory activities with intent to achieve certain goals. Study shows that the laboratory facilities of most school are not satisfactory (Abidoye, Adebisi, Rihanat & Aliyu, 2022; Osita & Ugochukwu, 2022). Considering the experiences of the researchers as teachers, some schools in Abeokuta Metropolis in Ogun State do not have enough laboratory facilities to back up the theoretical aspect of Biology, since student knowledge will be tested both in theory and practical aspect (Almroth, 2015). It is expected that, practical aspect of Biology should back up theoretical teaching to enable students get full knowledge of biological concepts but however, this is neglected and might not be taught until final examinations like the West African School Certificate Examinations is approaching. This delay in exposing students to practical Biology may be due to non-availability of laboratory facilities in respect of equipment, specimen, and furniture and invariably lead to shallow understanding of concepts taught. In a situation like this, teachers go to extra mile to get these facilities by borrowing from elsewhere or getting it with their personal money at times if not provided by school authority. This condition may contribute to low academic achievement in the subject. The fluctuation observed in Biology achievement is of concern and requires attention from concerned stake holders. To this end, this study researched on Laboratory Facilities and Public Senior Secondary School Students' Academic Achievement in Biology in Abeokuta Metropolis, Ogun State, Nigeria.

Statement of the Problem

Teaching Biology requires students to be able to see, feel and interact with related specimen in order to have clearer understanding of the topic taught and for a lasting memory retention. However, whenever the facilities (equipment, specimen and furniture) needed are not available, the teacher may have to teach theoretically which can lead to shallow understanding of the topics being taught and invariably lead to poor academic achievement of the students in Biology. This notion is being supported with the report from examination bodies like West African Examination Council (WAEC, 2015; 2016; 2017; 2018 & 2019) where students' results revealed fluctuations in yearly reports. Studies have found science laboratories to be central to the teaching of science in secondary schools. Also, studies have shown that useful facilities for successful teaching of Biology may be inadequate or not available in laboratory (Chandana, 2018; Samuel, 2018). However, the state of science laboratories which is crucial to impartation of scientific knowledge seems not to be encouraging as they may be poorly equipped and maintained. Going by the existing literature and to the best knowledge of the researchers, many works have not been carried out on Laboratory Facilities and Public Senior Secondary School Students' Academic Achievement in Biology particularly in Abeokuta Ogun State, for this purpose, this study investigated

Laboratory Facilities and public Senior Secondary School Students' Academic Achievement in Biology in Abeokuta Metropolis, Ogun State.

Aim and Objectives of the Study

The study examined laboratory facilities and public senior secondary school students' academic achievement in Biology in Abeokuta, Ogun state. Specific objective are to:

- i. determine the level of availability of laboratory facilities in senior secondary schools in Abeokuta; ii. Determine the level of usability of laboratory facilities in public senior secondary schools in Abeokuta;
- iii. Determine the extent to which laboratory facilities enhance the teaching of Biology in public senior secondary schools in Abeokuta, Ogun state.
- iv. Investigate the relationship between availability and usability of laboratory facilities in Abeokuta, Ogun State.
- v. Examine the relative influence of laboratory facilities (equipment, specimen, furniture) on senior secondary school students' academic achievement in Biology in Abeokuta, Ogun state.

Research Questions

The following research questions were posited for the study:

1. What is the level of availability of laboratory facilities in senior secondary schools in Abeokuta Ogun state?
2. What is the level of usability of laboratory facilities in public senior secondary schools in Abeokuta Ogun state?
3. To what extent does laboratory facility enhance the teaching of Biology in Abeokuta, Ogun state?

Hypotheses

The following hypotheses were tested:

Ho1: There will be no statistical significant relationship between availability and usability of laboratory facilities in Abeokuta, Ogun state...

Ho2: There will be no significant relative influence of laboratory facilities (Equipment, specimen, and furniture) on Senior Secondary School students' academic achievement in Biology in Abeokuta, Ogun State.

Methodology

The study employed a descriptive survey research design to investigate and describe the given variables without any manipulation. The population for this study comprised all the 6677 Senior School II students offering Biology in 2020/2021 academic session in the 49 Government owned Senior Secondary Schools in Abeokuta and all the 53 Biology teachers. This includes schools in Abeokuta South, Abeokuta North and Odeda Local Government Areas within Abeokuta Metropolis, Ogun State. Using the Krejci and Morgan standardized sample size table, forty-three (43) schools were randomly selected from the 49 schools in Abeokuta and multi-stage procedure was also used to select 19 schools out of 20 schools in Abeokuta South, 14 schools out of 18 schools in Abeokuta North and 10 schools were selected out of 11 senior secondary schools in Odeda Local Government Areas respectively. With the standardized table, 602 students were selected out of 6677 students and all the 53 Biology teachers making a total of 655 respondents. Two self-developed instruments - Biology Teachers' Questionnaire (BTQ) and Biology Students Achievement Test (BSAT) were used for data collection. BTQ consisted five (5)

sections: Section A was demographic information while Section B comprised the number of laboratory facilities available in the laboratory of schools using five Likert scales of measurement with the following options: Adequately Available (AA); Available (A); Available Not Functioning (ANF); Available Functioning (AF); and Not Available (NA). Section C consisted of items on laboratory facilities usability like chairs, shelves, dissecting set, quadrant and other facilities with the options: Use Regularly (UR); Use Occasionally (UO); and Not in Use (NU). Sections D consisted of 10 items on laboratory facilities which covers equipment, specimen and furniture with the options: Strongly Agreed (SA); Agreed (A); Disagreed (D); and Strongly Disagreed (D). Negative items were reversed and scored. Students Achievement Test (SAT) consisted of 40 questions drafted from past West African Examination Council (WAEC) questions already validated by the WAEC examination body was used to collect data from participating Biology students to test their academic achievement in Biology.

Table 2: Multi-stage Procedure

Local Government Area	Number of Schools	Selected Schools	Average Number of Biology Students per School	Selected Persons	Total
Abeokuta					
South	20	19	14	14*19	260 Abeokuta
North	18	14	14	14*14	196
Odeda	11	10	14	14*10	140
Total	49	43	602+53=655		

Source: Researchers Field work.

The selected schools for the study satisfy the following conditions which qualified them to participated in this study as inclusion criteria for them and any school that did not meet up with the conditions were excluded from partaking in the study: They have evidence of completion of topics considered in this study, they have been presenting student for West African Senior Secondary Certificate Examination (WAEC), they have science laboratory, they have qualified and experienced Biology teachers with a minimum of B.Sc (Ed) Biology, B.Sc Biology plus PGDE or its equivalent. Likewise, selected students are in SS2, they are offering biology and are from government owned schools in the public schools, any student that do not meet this conditions were excluded from partaking in the study. Two self-developed instruments - Biology Teachers' Questionnaire (BTQ) and Biology Students Achievement Test (BSAT) were used for data collection. BTQ consisted five (5) sections: Section A was demographic information while Section B comprised the number of laboratory facilities available in the laboratory of schools using five Likert scales of measurement with the following options: Adequately Available (AA); Available (A); Available Not Functioning (ANF); Available Functioning (AF); and Not Available (NA). Section C consisted of items on laboratory facilities usability like chairs, shelves, dissecting set, quadrant and other facilities with the options: Use Regularly (UR); Use Occasionally (UO); and Not in Use (NU). Sections D consisted of 10 items on laboratory facilities which covers equipment, specimen and furniture with the options: Strongly Agreed (SA); Agreed (A); Disagreed (D); and Strongly Disagreed (D). Negative items were reversed and scored. Students Achievement Test (SAT) consisted of 40 questions drafted from past West African

Examination Council (WAEC) questions already validated by the WAEC examination body was used to collect data from participating Biology students to test their academic achievement in Biology. The instruments were validated by experts in related fields and pilot tested for reliability using Cronbach Alpha formula. The reliability of BTQ (Alpha = 0.85) while that of BSAT was (KR20= 0.92). All corrections and modifications were done before production of final drafts for administration. The researchers and four research assistants administered the instruments to teachers and students after due permission from the principals of the schools concerned. The responses collected were analyzed using frequency counts, mean, percentages and multiple regression analysis.

Results and Discussion of Findings

The results are presented and discussed with respect to the research questions and hypotheses highlighted above.

Research Question One: What is the level of availability of laboratory facilities in senior secondary schools in Abeokuta Ogun State?

Table 3: Availability of Laboratory Facilities in Secondary Schools in Abeokuta Metropolis

S/N	Facilities	AA	A	ANF	AF	NA	$\bar{x}$	Std. D	Rmk
1	Stool/chairs	7(13.2%)	27(50.9%)	5(9.4%)	1(1.9%)	13(24.55)	3.26	1.416	High
2	Students table with drawer	3(5.7%)	11(20.8%)	3(5.7%)	-	36(67.9%)	1.96	1.454	Low
3	Integrated table/students table without drawer	3(5.7%)	13(24.5%)	3(5.7%)	1(1.9%)	33(62.3%)	2.09	1.484	Low
4	Individual shelf	-	4(7.5%)	3(5.7%)	1(1.9%)	45(84.9%)	1.36	.901	Low
5	Integrated shelves	2(3.85%)	17(32.2%)	2(3.8%)	4(7.5%)	28(52.8)	2.26	1.470	Low
6	Preserved animal Specimen	6(11.3%)	30(56.6%)	4(7.5%)	2(3.8%)	11(20.8%)	3.34	1.344	High

Table 3 continues...

7	Slides Of Invertebrate Animals	2(3.8%)	15(28.3%)	8(15.1%)	2(3.8%)	26(49.1%)	2.34	1.437	Low
8	Slides of plant materials/parts		9(17.0%)	3(5.7%)	2(3.8%)	39(73.6%)	1.66	1.176	Low

9	Plants album	-	10(18.9%)	1(1.9%)	42(79.2%)	-	1.60	1.198	Low	
10	Dissecting set		17(32.1%)	1(1.9%)	1(1.9%)		33(62.3%)	2.09	1.458	Low
			1(1.9%)							
11	Auxanometer		9(17.0%)	2(3.8%)	-		41(77.4%)	1.66	1.255	Low
			1(1.9%)							
12	Aquarium	-	7(13.2%)	1(1.9%)	45(84.9%)	-	1.43	1.047	Low	
13	PH Meter	-	8(15.1%)	2(3.8%)	-		43(81.15)	1.53	1.120	Low
	Clinostat	-	9(17.0%)	1(1.9%)	43(81.1%)	-	1.55	1.153	Low	
15	Barometer	-	14(26.4%)	1(1.9%)	1(1.9%)	37(69.8%)	1.85	1.336	Low	
16	Thistle funnel		25(47.2%)	-	4(7.5%)	22(41.5%)	2.64	1.508	Low	
			2(3.8%)							
17	Secchi disc		11(20.8%)	1(1.9%)	2(3.8%)	38(71.7%)	1.77	1.310	Low	
			1(1.9%)							
18	Photometer		11(20.8%)	1(1.9%)	3(5.7%)	36(67.9%)	1.87	1.373	Low	
			2(3.8%)							
19	Quadrant		25(47.2%)	1(1.9%)	7(13.2%)	19(35.8%)	2.66	1.427	Low	
			1(1.9%)							
20	Inoculating		20(37.7%)	4(7.5%)	1(1.9%)	27(50.9%)	2.38	1.471	Low	needles
										1(1.9%)
21	Microscope		25(47.2%)	5(9.4%)	4(7.5%)	14(26.4%)	3.06	1.420	High	
			5(9.4%)							
22	Capillary tube		23(43.4%)	3(5.7%)	2(3.8%)	22(41.5%)	2.68	1.516	Low	
			3(5.7%)							
23	Cobalt Chloride		19(35.8%)	4(7.5%)	1(1.9%)	24(45.3%)	2.62	1.572	Low	
			5(9.4%)							
			2(3.8%)							

Table 3 Continues...

S/N	Facilities	AA	A	ANF	AF	NA	$\bar{x}$	Std.D	Rmk
25	Preservative Chemicals	7(13.2%)	24(45.3%)	4(7.5%)	4(7.5%)	14(26.4%)	3.11	1.463	High
26	Potassium	17(32.1%)	24(45.3%)	3(5.7%)	4(7.5%)	7(5.4%)	3.13	1.492	High

24	Agar medium	11(20.8%)	1 (1.9%)	3(5.7%)	36(67.9%)	1.87	1.373	Low
	Permanganate							
27	Osmic acid	4(7.5%)	14(26.4%)	1(1.9%)	1(1.9%)	33(62.3%)	2.15	1.549 Low
28	Sudan 111	5(9.4%)	22(41.5%)	1(1.9%)	2(3.8%)	23(43.4%)	2.70	1.588 Low
	Solution							
29	Eosin	1(1.9%)	14(26.4%)	4(7.5%)	3(5.7%)	31(58.5%)	2.08	1.385 Low solution
30	Acetic acid	1(1.9%)	11(20.8%)	3(5.7%)	1(1.9%)	37(69.8%)	1.83	1.326 Low

Grand mean = 63.12

Weighted mean = 2.104

Expected mean = 3.00

Source: Researchers Field work.

Threshold: Adequately Available (AA), Available (A), Available, Not Functioning (ANF), Available, Functioning (AF), Not Available (NA)

Threshold: Low-0.00 - 2.99; Moderate-up -3.00; High-3.01 and above

Decision: Low level

Table 3 showed the level of availability of laboratory facilities in public senior secondary schools in Abeokuta. The results from the table revealed that the level of availability differed from one facility to the other. For instance, most of the schools indicated high availability of stool/chairs, as reflected by a mean of 3.26 (SD=1.492) indicating (64.1%). Also, 67.9% of the respondents affirmed that there was high availability of preserved animal specimens which were functioning as indicated, while 28.3% affirmed that preserved animal specimens were not available. The mean value of $\bar{x}=3.34$ further confirmed the adequate availability of preserved animal specimen. In the same vein, it was observed that there was high availability of microscope in the laboratory as 56.6% indicated the availability of microscope while 33.9% declined that microscope is not available in their school laboratories. In addition, majority of the respondents confirmed high availability of Preservative Chemicals and Potassium per manganite in the laboratory with mean value of $\bar{x}=3.11$ and 3.13 respectively which indicated the adequate availability of the facility in the laboratory. However, the result from the table further revealed that the following laboratory facilities indicated low level of availability items 2,3,4,5,7,8,9,10,11,12,13,14,15,16,17,18,19,20,22,23,24,27,28,29 and 30 had mean scores below the weighted mean ($\bar{x}=3.00$). This implies that the level of availability of laboratory facilities in public senior secondary schools in Abeokuta was low except items 1, 6, 21, 25 and 26 which the respondents indicated that there was high level of those items. However, 62.3% of the respondents confirmed that integrated table/table without drawer were not available with mean $\bar{x}=2.09$ which further confirmed that the facility was not available in the laboratory. 84.9% further said that individual shelves were not available. In the same vein, the result revealed non availability of integrated shelf in the laboratory. More importantly, it was indicated that slides of invertebrate animals (2.34), slides of plant/parts (1.66), dissecting set (2.09), auxanometer (1.66) aquarium (1.43), clinostat (1.85) and barometer (2.64) were not available. Likewise, plant album (1.60), Secchi disc (1.77), Photometer (1.87), Osmic Acid (2.15), Eosin solution (2.08) and Acetic acid (1.83) all indicated low level of availability

having mean threshold below 3.00 respectively. Based on the weighted mean value of $\bar{x}=2.104$ which is less than the criterion value of $\bar{x}=3.00$, one can conclude that the above listed facilities were not available as learning supporting facilities in Biology laboratory in the study area. Hence, there is low level of availability of laboratory facilities in public senior secondary schools in Abeokuta. This is a strong indication that basic laboratory facilities needed in the teaching of Biology were not available in most of the public Senior Secondary Schools in the study area.

Research Question Two: What is the level of usability of laboratory facilities in senior secondary schools in Abeokuta, Ogun State?

Table 4: Table showing level of usability of laboratory facilities in senior secondary schools

S/N	Facilities	UR	UO	NU	$\bar{x}$	Std. D	Remark
1	Stool/chairs	36(67.9%)	10(18.9%)	7(13.2%)	2.55	0.722	High
2	Students table with drawer	6(11.3%)	10(18.9%)	37(69.8%)	1.42	0.692	Low
3	Integrated table/students table without drawer	14(26.4%)	10(18.9%)	29(54.7%)	1.72	0.863	Low
4	Individual shelf	1(1.9%)	8(15.1%)	44(83.0%)	1.19	0.441	Low
5	Integrated shelves	6(11.3%)	10(18.9%)	37(69.8%)	1.42	0.692	Low
6	Preserved animals specimen	22(41.5%)	19(35.8%)	12(22.6%)	2.19	0.786	High
7	Slides of invertebrate animals	10(18.9%)	15(28.3%)	28(52.8%)	1.68	0.827	Low
8	Slides of plant materials/parts	6(11.3%)	16(30.2%)	31(58.5%)	1.53	0.696	Low
9	Plants album	6(11.3%)	14(26.4%)	33(62.3%)	1.49	0.697	Low
10	Dissecting set	7(13.2%)	17(32.1%)	29(79.2%)	1.58	0.719	Low
11	Auxanometer	2(3.8%)	3(5.7%)	42(79.2%)	1.26	0.560	Low

12	Aquarium	2(3.8%)	3(5.7%)	48(90.6%)	1.13	0.440	Low
13	PH Meter	3(5.7%)	5(9.4%)	45(84.9%)	1.21	0.532	Low
14	Clinostat	2(3.8%)	10(18.9%)	41(77.4%)	1.25	0.519	Low
15	Barometer	2(3.8%)	15(28.3%)	36(67.9%)	1.36	0.558	Low

in Abeokuta Metropolis

Table 4 continues...

S/N	Facilities	UR	UO	NU	$\bar{x}$	Std. D	Remark
16	Thistle	8(15.1%)	20(37.7%)	25(47.2%)	1.68	0.728	Low
17	Secchi disc	3(5.7%)	10(18.9%)	40(75.5%)	1.30	0.575	Low
18	Photometer	1(1.9%)	12(22.6%)	40(75.5%)	1.26	0.486	Low
19	Quadrant	11(20.8%)	19(35.8%)	23(43.4%)	1.77	0.776	Low
20	Inoculating Needles	9(17.0%)	13(24.5%)	31(58.5%)	1.58	0.770	Low
21	Microscope	20(37.7%)	15(28.3%)	18(34.0%)	2.04	0.854	High
22	Capillary tube	15(28.3%)	9(17.0%)	29(54.7%)	1.74	0.880	Low
23	Cobalt Chloride paper	7(13.2%)	16(30.2%)	30(56.6%)	1.57	0.721	Low
24	Agar Medium	7(13.2%)	12(22.6%)	34(64.25)	1.49	0.724	Low
25	Preservative Chemicals	17(32.1%)	24(45.3%)	12(22.6%)	2.51	0.741	High
26	Potassium	per 21(39.6%)	17(32.1%)	15(28.4%)	2.06	0.824	High manganite
27	Osmic acid	5(9.4%)	6(11.3%)	42(79.2%)	1.30	0.638	Low
28	Sudan III Solution	11(20.8%)	11(20.8%)	31(58.5%)	1.62	0.814	Low

29 Eosin solution 6(11.3%) 10(18.9%) 37(69.8%) 1.42 0.692 Low

30 Acetic acid 6(11.3%) 13(24.5%) 34(64.2%) 1.47 0.696 Low

Grand Mean= 49.5

Weighted = 1.65

Expected Mean = 2.00

Source: Researchers Field work.

Note: UR = Used Regularly; UO = Used Occasionally; NU = Not in use

Threshold: Low= 0.00 -1.99; Moderate = 2.00; High= 2.01 and above

Research Question three: To what extent does laboratory facility enhance the teaching of Biology?

S/N	Items	SA	A	D	SD	$\bar{x}$	Std. D	Rmk
Table 5: Laboratory Facilities used in Teaching Biology								
1	The use of apparatus during biology lesson increases learner performance.	41(77.4%)	12(22.6%)	-	-	3.77	0.423	H
2	Learners' interest, reasoning skills attitude for science is developed as they manipulate equipment during experiment.	22(41.5%)	29(54.7%)	2(3.8%)	-	3.38	0.562	H
3	Provision of adequate facilities determines how best and frequency laboratory activities will be done to boost Biology academic achievement.	25(47.2%)	25(47.2%)	1(1.9%)	2(3.8%)	3.38	0.713	H
4	Inadequate provision of biological reagents is a barrier to Biology teaching	28(52.8%)	23(43.4%)	2(3.8%)	-	3.49	0.576	H
5	Provision of chemicals and reagents lead to early exposure of students to practical Biology, thereby increasing Biology achievement.	34(64.2%)	13(24.5%)	6(11.3%)	-	3.53	0.696	H
6	Teaching with specimen gives learners opportunity to observe and detect their environment.	28(52.8%)	25(47.2%)	-	-	3.53	0.504	H

7	Use of specimen during Biology lessons promotes quality teaching and learning and enhances learners' performance in Biology.	24(45.3%)	26(49.1%)	3(5.7%)	-	3.4	0.599	H
8	Sufficient quantity of stools, chairs and tables dictates the regular performance of practical activities in the laboratory.	17(32.1%)	26(49.1%)	7(13.2%)	3(5.7%)	3.0	0.829	H
9	Dissection of animal in Biology lead to low achievement in concepts like transport, digestion and respiratory systems	2(3.8%)	6(11.3%)	32(60.4%)	13(24.5%)	1.9	0.718	L
10	Observation of plant parts with an electron microscope leads to good Retention which is an indicator of good performance.	21(39.6%)	27(50.9%)	3(5.7%)	2(3.8%)	3.2	0.738	H

Weighted Mean =3.276

Note: SA =Strongly Agree, A=Agree, D=Disagree, SD=Strongly Disagree, H=High, M=Medium, L= Low

Threshold: Low Extent: 0.00-2.49; Moderate Extent: 2.50; High Extent: 2.51 - 3.99, Decision: High Extent

Table 5 showed the extent to which laboratory facilities enhanced teaching of Biology among secondary schools. From the table, it was observed that all the respondents strongly indicated that the laboratory facilities are very essential to improve the teaching of Biology. Also, the result further revealed the degree of the agreement on the items, all the items with mean value of $\bar{x} = 3.77, 3.38, 3.38, 3.49, 3.53, 3.53, 3.40, 3.08$ and 3.26 indicates that the respondents' views on the importance of laboratory to enhance the teaching of Biology among secondary schools was high since the weighted mean value of all the items are above the criterion mean value of $\bar{x} = 2.50$. However, the respondent strongly disagreed on the item that Dissection of animal in Biology lead to low achievement in concepts like transport, digestion and respiratory systems with $\bar{x} = 1.94$. This implies that dissection of animal in Biology does not lead to low achievement in concepts like transport, digestion and respiratory systems. Majority (99.8%) of the respondents indicated that the use of apparatus during Biology lesson increases learner performance and 96.2% strongly agree that learners' interest, reasoning skills attitude for science is developed as they manipulate equipment during experiment. More importantly, provision of adequate facilities determines how best and frequency laboratory activities will be done to boost Biology academic achievement as 94.4% indicated their opinion while 5.7% disagree on the statement. In addition, 96.52% of the respondents was on the opinion that the inadequate provision of biological reagents is a barrier to Biology teaching while 3.8% revealed that the inadequate provision of biological reagents is a barrier to Biology teaching 88% further revealed that provision of chemicals and reagents lead to early exposure of students to practical Biology, thereby increasing Biology achievement and teaching with specimen gives learners opportunity to observe and detect their environment. In the same vein majority of the respondents strongly agree that observation of plant parts with an

electron microscope leads to good retention which is an indicator of good performance. Hence, it can be deduced from the result that to a high extent laboratory facilities enhanced teaching of Biology among secondary schools in Abeokuta.

Test of Hypotheses

Hypothesis One: There is no significant relationship between availability and usability of laboratory facilities in Abeokuta, Ogun State.

Table 6: Pearson Product Moment Correlation showing Relationship between availability of laboratory facility and Utilization

Variables	N	R	P	Remark
Availability of laboratory facility	53			Significant
Utilization of laboratory facility	53	0.146**	0.001	

Sources: Researchers Field work

Table 6 showed that there was a statistically positive correlation ($r=.146$, $n=53$, $p=.001$) between availability and utilization of laboratory facilities among secondary schools in Abeokuta. The relationship indicates that the coefficient of the availability and utilization of laboratory facilities is significant at $p < 0.05$. A general overview show that availability of laboratory facilities correlates positively with teachers' utilization. Given that the relationship was statistically significant, the hypothesis that says "there is no statistically significant relationship between availability of laboratory facility and Utilization among Secondary Schools was rejected. Therefore, it was concluded that there was a statistically positive relationship between availability of laboratory facility and Utilization among Secondary School in Abeokuta

Hypothesis Two: There is no significant relative influence of laboratory facilities (Equipment, specimen, and furniture) on Senior Secondary School students' academic achievement in Biology in Abeokuta, Ogun State.

Table 7: Coefficients of the Multiple Regression Analysis for the Relative Contribution of laboratory facilities (Equipment, specimen, and furniture)) to the Prediction of Academic Achievement Biology

Model	Unstandardized Coefficients	Standardized T	Sig.
	B	Std. Error	Beta
(Constant)	16.780	3.087	5.436
Equipment	0.130	0.220	0.191
Specimen	0.199	0.067	0.173
Furniture	0.096	0.075	0.065

Source: Researchers Field work,

Table 7 showed the relative contribution of each of the independent variables to the dependent variable. The null hypothesis which stated that there is no significant relative contribution of laboratory facilities (Equipment, specimen, and furniture) on academic achievement in Biology among Senior Secondary Schools was therefore rejected and the alternative hypothesis was upheld leading to the conclusion that there is a significant relative influence of laboratory facilities (Equipment, specimen, and furniture) on academic achievement in Biology

among Senior Secondary Schools. This means that there is association between laboratory facilities (Equipment, specimen, and furniture) Also, it was observed that laboratory equipment ($\beta = 0.191$; $t = 2.547$, $p < 0.05$); Laboratory specimen ($\beta = 0.173$; $t = 2.971$, $p < 0.05$) are significant and can be used to predict academic achievement in Biology among Senior Secondary Schools in Abeokuta.

Discussion of Findings

From the research questions the findings revealed that basic Biology laboratory facilities are generally not adequate as rated by Biology teachers. This was reflected by an overall mean availability of 2.104 to one access to basic Biology laboratory equipment during their Biology lessons. Based on the weighted mean value of $\bar{x} = 2.104$ which less than criterion value of $\bar{x} = 3.00$ s, it was concluded that the above listed facilities are not available as learning supporting facilities in Biology laboratory in the study area. Hence, there is low level of availability of laboratory facilities in public senior secondary schools. This is a strong indication that basic laboratory facilities needed in the teaching of Biology were not available in most of the public senior secondary schools in the study area. The finding was in line with the findings of some scholars who were of the opinion that inadequate laboratory facilities and utilization have significant impact on students' manipulative skills (Crescentia & Amos, 2016; Adesoji & Olatunbosun, 2018). The findings of this study contradict the outcomes of a group of researchers who were of the opinion that essential facilities required for teaching of business education are moderately supplied to the department and presently the provision of such facilities is affected by so many problems (Pareek & Peter, 2019). It was also, in consonance with another study which revealed that most of the facilities are not available in the study area. From the opinion of the respondents' wall chart, percentage of available facilities is more in some of the secondary schools. In addition, the respondent opined that some Biology laboratory facilities and laboratory assistant are not available. Hence, laboratory activities depend on the amount of laboratory equipment available for teaching and the teachers' ability to use them well (Bathsheba et al., 2020). However, this study disagreed with the finding of another scholar which revealed that laboratory facilities for teaching practical chemistry are well supplied and replaced as when due, hence poor performance of student in practical chemistry may be due to other factors (Samuel, 2016). On the other hand, this study is in agreement with the research conducted by a study which shows that the percentage of insufficiency of laboratory equipment for teaching chemistry was more than adequacy, as the percentage of schools with available apparatus was too low, while in some schools, apparatus and equipment are not available at all, however, chemistry laboratory facilities of most schools were inadequate (Chandana, 2018). Moreover, the study revealed that majority of the schools did not utilize the basic Biology laboratory facilities available in schools. Observation from the result shows that only 67.9% of the respondent indicated that they regularly utilized stool/chairs in the laboratory. This shows that quite a sizeable proportion of the schools make use of stool/chairs in regards to basic Biology laboratory facility based on the threshold laboratory stool was ranked high with the mean 2.55. Likewise, items 6, 21, 25 and 26 were highly utilized. That means that only 6 items were regularly used to enhance Biology teaching. On specific facilities, microscope, preservative chemicals and potassium per manganate are utilized Biology laboratory facilities used by Biology teachers. This was reflected by the results of the survey which established that very few of the respondents regularly make use of the available facilities to enhance students' performance during Biology teachings. However, Students table with drawer, individual shelf, integrated shelves, slides of invertebrate animal plant album, Aquarium, PH Meter, Clinostat, Barometer, Thistle funnel, Secchi disc,

Potometer Agar medium, Osmic acid, Eosin solution and Acetic acid are ranked low according to the threshold as majority indicated that they never make use of them During Biology lessons. This implies that majority of the respondents do not use aforementioned facilities. The teaching of Biology without adequate utilization of laboratory facilities may have significant influence on student achievement in Biology. This implies that effective utilization of Biology laboratory facilities enhanced the teaching and learning of Biology. On the average Biology laboratory facilities usability was found low. The findings of this present study is in line with the research conducted by some researchers whose result showed that the use of physics laboratory equipment enhances teaching and learning of physics, promote scientific reasoning and enhance academic performance in the subject. Furthermore, the findings agree with another investigation on utilization of Biology laboratory equipment and students' academic performance in senior secondary schools in cross river state. The result revealed that utilization of Biology laboratory equipment influenced students' academic performance in Biology significantly (Ihejiamaizu & Ochui, 2016) it is also in agreement with a study on availability of chemistry laboratory facilities and its utilization which revealed that laboratory facilities utilization was very low (Chandana, 2018). In addition, the finding of the study revealed the extent to which laboratory facilities enhanced teaching of biology among secondary schools. From result, it was observed that all the respondents strongly indicated that the laboratory facilities are very essential to improve the teaching of Biology in that majority of the respondents strongly agree of all the items. The level of agreement on the items indicated that the respondents' views on the importance of laboratory to enhance the teaching of Biology among secondary schools were statistically significant since the weighted mean value of all the items are above the criterion mean value of $\bar{x} = 2.50$. However, the respondent strongly disagree on the item that Dissection of animal in Biology lead to low achievement in concepts like transport, digestion and respiratory systems with $\bar{x} = 1.94$. This implies that dissection of animal in Biology does not lead to low achievement in concepts like transport, digestion and respiratory systems. The finding support the study of a scholar by noting that, students' skills and abilities are improved through effective utilization of science laboratories equipment in the teaching and learning (Arokuyu & Chimuaya 2016). A recent study conducted somewhere was in consonance with the findings of this study particularly on the influence of science laboratory equipment on students' academic achievement (Tekalign 2016). However, the present research finding has debunked that of a group of researcher whose finding showed no significant difference between high, low and medium utilization of laboratory facilities in influencing academic performance of students (Jones, Sugalan, and Mundy & Fedynic 2019). More importantly, the finding shows that there was a statistically significant positive correlation between availability and utilization of laboratory facilities among Biology teachers with a high level of availability laboratory facilities associated to higher utilization among the teachers and vice versa. A general overview shows that availability of laboratory facilities correlate positively with teachers' utilization. Given that the relationship was statistically significant, the hypothesis that, "there was no statistically significant relationship between availability of laboratory facility and Utilization among Secondary Schools was rejected... Findings from the study showed that there is significant relative contribution of laboratory facilities (Equipments, specimen, and furniture) on academic achievement in Biology among senior secondary schools. This implies that laboratory facilities (Equipment and specimen) are potent factors that predict students' achievement in Biology in the study area. The findings of this study concur with one of the recent scholars who investigated the relationship between school resources such as laboratory and students' academic achievement. The results showed that there exists a

positive relationship between availability and utilization of school learning materials like laboratories and students' academic achievement (Arop, Umanah, & Effiong 2019). Generally it can be seen from the findings above that availability and utilization of laboratory equipment had a statistically significant relationship with students' academic achievement in Biology among senior secondary schools.

Conclusion

The study investigated Laboratory facilities and public senior secondary school Students' Academic Achievement in Biology in Abeokuta Metropolis Ogun State. Laboratory has been identified as crucial workshop for science teaching while laboratory facilities are important for impartation knowledge in Biology in schools. The study adopted descriptive survey research design for investigation and description of the give variables without any manipulation. The findings from this study confirmed the fact that certain factors have enhanced students' academic achievement in Biology. The result of the findings has showed that availability and utilization of laboratory facilities remains relevant to the teaching and learning of Biology in order to enhance the practical skills and performance of students in Biology. There was low level of availability of laboratory facilities (weighted mean= 2. 104) in public senior secondary schools in Abeokuta metropolis. Usability level of laboratory facilities was low (Weighted mean=1.65). This could be a possible contributing factor in the low students' academic achievement in Biology among senior secondary schools in the study area. The teaching of Biology concepts without adequate utilization of laboratory facilities may have significant influence on student achievement in Biology. Furthermore, findings showed that laboratory facilities are very essential to improve the teaching of Biology as the extent to which laboratory facilities enhanced biology teaching was high (weighted mean =3,28).Positive correlation was recorded between availability and usability of laboratory facilities among Biology teachers. Laboratory facilities (Equipment and specimen) are potent factors that can predict student achievement in Biology in the study.

Recommendations

Based on the findings of this study the following recommendations were made:

- i. Laboratory facilities should be made available to schools to enhance teaching and learning of Biology;
- ii. Teachers should regularly use laboratory facilities during Biology lesson to expose learner to practical aspect of Biology long before the commencement of external examinations;
- iii. Teachers should ensure that they use the available facilities during Biology lesson to contribute positively to learners' academic achievement in biology;
- iv. All stakeholders should ensure that necessary laboratory facilities are provided to use for utilization during teaching; and Student should be involved in collection of specimen and improvisation of equipment since they are potent factors that can be used to predict academic achievement in Biology

References

Abidoye, F. O., Adebisi, A. M., Rihanat, A. A. & Aliyu, M. Z. (2022). Availability of

Laboratory Facilities on Students' Performance in Upper Basic Schools in Kwara State, Nigeria. *International Journal of Educational Research Review*, 7(2), 262-267 www.ijere.com

- Adeosun M. I. (2021). Laboratory Facilities, Teaching Methods and Public Senior Secondary School Students' Academic Achievement in Biology in Abeokuta, Ogun State, An Unpublished Master Thesis, Department of Science Education Lead City University Ibadan, Nigeria.
- Adepoju, T. M. (2024). Effect of Predict – Observe – Explain and Virtual Laboratory Strategies on Secondary School Physics Student Attitude Achievement in Simple Harmonic Motion in Ogun state. An Unpublished PhD Thesis, Department of Science Education Lead City University Ibadan, Nigeria.
- Adesoji, F. A & Olatubosun, S. M. (2018). Student, Teacher and School Environmental Factors as Determinants of Achievement in Senior Secondary School Chemistry in Oyo State. *Journal of International Social Research*, 1(2), 44-51.
- Agbogboroma, T. E. & Oyovwi, E. O. (2015). Evaluating the Effect of Students' Academic Achievement on Identified Difficult Concepts in Senior Secondary School Biology in Delta State. *Journal of education and practice*, 6(30), ISSN2222-1735, ISSN 2222-288X (Online).
- Almroth, B. C. (2015). The Importance of Laboratory Exercises in Biology Teaching: A Case Study in an Exotoxicology Course. University of Gothenburg.
- Arop B.A, Umanah F.I& Effiong (2015). Effect of Instructional Materials on the Teaching and Learning of Basic Science Junior Secondary Schools in Cross River State, Nigeria, *Global Journal of Educational Research* 14(1), 67-73
- Bathsheba, A. J. Damak, J. D., Wajim, D. I & Akwayamai, P. J. (2020). Influence of the Availability of Laboratory Facilities on Academic Performance of Students in Biology in Senior Secondary School of Jalingo Local Government Area of Taraba State, Nigeria. *African Scholars Journal of Contemporary Education Research (JCER-8)*, 29(8), 68-78.
- Biology Explorer (2020). Six Reasons that Emphasizes the Importance of Biology. 25/06/2021
- Chandana, D. (2018). A Study of Availability of Chemistry Laboratory Facilities and its Utilization in the Higher Secondary Schools of Guwahati City, Assam. *International Journal of Innovative Science and Research Technology*, 3(9), 377-382.
- Crescentia, S. O. & Amos, A. O. (2016). Availability and Utilization of Biology Laboratory Facilities in Secondary Schools to Aid Learning in Ethiopie West LGA Delta state. *European Journal of Scientific Research*. 2(5) 46-53
- Etebu, E. & Amatari, V. O. (2020). Impact of Teachers' Educational Qualification on Senior Secondary Schools Students' Academic Achievement in Biology in Bayelsa State. *IOSR Journal of Humanities and Social Science*, 25(4), 13-28.
- Ihejiamazu, C. C. & Ochui, I. O. (2016). Utilization of Biology Laboratory Equipment and Students' Academic Performance in Cross River State, Nigeria. *British Journal of Education*, 4(9), 55-63.

- Jones. S.D. Sugalan S., Mundy M., & Fedynich. B. (2018). Examining the Relationship between Textbooks and Laboratory Experiences on Student Achievement in Eighth Grade Science, *Administrative Issues Journal*, 8(2)
- Osita, U. & Ugochukwu, M. (2022). Effectiveness of Laboratory Facilities on Student Achievement in Biology in Secondary Schools; *International Journal of Advance Academic Research*, 8(3), ISSN: 2488-9849.DOI.10.46654, www.ijaar.org
- Pereek, M. & Peter, B. (2019). Availability of Instructional Facilities in Teaching and Learning of Business Education Department in River State University, *International Journal of Innovative Education Research*, 7(2), 1-11.
- Salisu, I., Bilikisu, B. & Sani, Y. (2018). Biology Education a Panacea for Sustaining National Development. *Frontiers in Environmental Micro Biology*. 4(2), 71-74
- Samuel, C. N. N. (2018). Effects of Laboratory Facilities on Students Performance in Practical Chemistry in Anambra State, Nigeria, *South Eastern Journal of Research and Sustainable Development*, 1-7
- Samuel, G. S. (2016). Student Academic Performance in Physics, Chemistry and Biology: A Case Study of Some Selected Senior Secondary Schools in Faggel Local government Area of Kano State, Nigeria.
- Taber, K. S & Akpan, B. (2017). The Role of Laboratory in Science Teaching and Learning, Retrieved online on 24/05/2020
- Umar, M. Yagana, A. & Aliyu, H. (2018). Prediction of Academic Performances in Biology among Public Senior Secondary School Students in kwara state, Nigeria. *International Journal of Education and Research*, 6 (12), 45-53.
- The West African Examination Council (2015). WAEC Chief Examiner Report 2019, online.org
- The West African Examination Council (2016). WAEC Chief Examiner Report 2019,
- The West African Examination Council (2017). WAEC Chief Examiner Report 2019,
- The West African Examination Council (2018). WAEC Chief Examiner Report 2019,
- The West African Examination Council (2019). WAEC Chief Examiner Report 2019,
- Ziyadulla, M. (2019). The importance of biological education at school, *European journal of research and reflection in educational science*, 7(12), 222-231.