IJAAR PUBLISHING® DOI: 10.46654

International Journal of Advanced Academic Research | ISSN: **2488-9849**
Vol. 8, Issue 3 (March, 2022) | www.ijaar.org

EFFECTIVENESS OF LABORATORY FACILITIES ON STUDENTS' ACHIEVEMENT IN BIOLOGY IN SECONDARY SCHOOLS

[1]Osita Ugwuoti & [2]Ugochukwu, Mmasi
[1,2]Department of Biology
[1,2]Alvan Ikoku Federal College of Education,
Owerri, Imo State

Abstract
The study investigated the effectiveness of laboratory facilities on secondary school students' achievement in Biology. The study was carried out in secondary schools in Owerri North Local Government Area of Imo State. Based on the objectives of the study, two research questions and two hypotheses guided the study. The quasi-experimental research design was employed in the study adopting the pre-test, post-test non-randomized control group approach. The data required for the study was generated using a researcher made objective test instrument titled "Biology Achievement Test (BAT)". The instrument had reliability coefficient of 0.83 determined using the Kuder Richardson 20 (K-R20) formula. The experiment group was taught Biology concept in the laboratory utilizing laboratory facilities while the control group was taught the same concept in a normal classroom without laboratory facilities. The data generated was analyzed using mean and standard deviation to answer research questions while the hypotheses were tested at 0.05 level of significance using ANCOVA statistical tool. The results of the study revealed that a significant difference existed between the mean achievement scores of students taught Biology using laboratory facilities and those taught without laboratory facilities. Also, there was a significant difference between the mean achievement scores of male and female students taught Biology using laboratory facilities. Based on the result, it was recommended that, Biology teachers at secondary school level should utilize laboratory facilities in teaching and learning process.

Keywords: *Effectiveness, Laboratory Facilities, Biology, Achievement.*

Introduction

Education brings about a desirable change in behaviour in an individual through acquisition of skills, attitudes, competencies, critical and creative thinking. Teaching is a complex and demanding task that requires highly specialized skills, knowledge and resources to impact significantly on students learning. Utilization of resources in an organization is important in achievement of its goals and objectives. Students learning outcome is influenced by appropriate utilization of school resources. Investing in educational resources is the key to ensuring that schools become institutions where students‟ work together, learn from each other and benefit from a supportive school environment, and consequently maximize student learning so that all students achieve their full learning potential (United Nations Scientific and Cultural Organization (UNESCO), 2007).

Biology is the science of life, it studies organisms, their interactions with one another and their environments (Onimisi 2006). All living organisms share several key properties such as order, sensitivity or response to stimuli, reproduction, growth, development, regulation, homeostasis and energy. Biology is related to many things in human's daily life, it is a pre-requisite for certification at the senior secondary school level (SSCE) and for admission into the tertiary institution for most science oriented courses that enables students pursue careers in science related fields such as medicine, nursing, pharmacy, nutrition, medical laboratory etc. Biology pervades literally every field of human endeavour, and plays a fundamental role in educational advancement. Biology as a science subject is practical and experiment based. Its objectives as contained in the National policy on education (FRN, 2013) include among others to equip learners with meaningful and relevant knowledge of Biology (Bajon, Uko, & Ayuba, 2021). Ahmed and Abimbola (2011) argue that because of its numerous importance, Biology is the most popular choice, among science subjects nationwide, offered by candidates sitting for the senior secondary school certificate examinations.

However, this very important subject has witnessed high level of poor performance among students in both internal and external examinations. The poor performance of students in Biology especially at Senior School Certificate Examinations (SSCE) level has become a source of concern to all stakeholders in education in the country (Imogie, 2010). Daluba (2012) stated that the review of student's performance in Biology in the West African Senior Secondary Certificate Examination (WASSCE) from 2005 to 2013 in Nigeria, revealed that there was a fluctuation and downward trend in the students' performance. One of the major reasons for this is the unavailability of or in appropriate utilization of laboratory facilities in the teaching of Biology by secondary school teachers (Orji & Ebele in Asiyai, 2012). Olufunke (2012), Igboabuchi (2010) and Oludipe (2011) attributed the poor state of Biology performance to inadequate, inappropriate and perhaps non-utilization of the available laboratory equipment in teaching and learning biology, some authors lament that teaching the subject in secondary schools in conventional classrooms can be defective. Abdulrahaman as cited in Bathsheba, Damak, Wajim and Akwayamai (2020) opined that the problem of non-availability of laboratory facilities for effective teaching of Biology in our secondary schools persists thereby giving rise to poor academic performances, as discussion and lecture methods of teaching have been dominating the teaching and learning activities where students need to do practical work. Agwagah (2008) viewed that the traditional methods are guilty of imposing poor concept formation and reducing the interest and retention and thereby leading to poor achievement among science students. This then calls for the use of the laboratory teaching method which is one of the contemporary teaching methods that could help to increase students' achievement and promotes retention of psychomotor skills in Biology.

Ogunkola and Olatoye (2004) stated that practical work is the back-bone of effective science teaching and learning. It has been repeatedly emphasized that scientific enterprise is an activity packed one, involving continuous exploration and verification of facts. Science is learnt by doing, so the different school curricula should adequately provide facilities for practical work at every stage of learning experiences. Nworgu as cited in Bathsheba, et al (2020) said that teaching of biology involves three major domains of educational objectives namely cognitive, affective and psychomotor. It was further indicated that, teachers of biology mostly emphasize on cognitive domain at the expense of the other two domains. The development of psychomotor domain involves practical activities which require laboratory facilities and equipments.

Laboratory has been conceptualized as a room or a building specially built for teaching by demonstration of theoretical phenomenon into practical terms. The laboratory is the work place of the science teacher. It is a place where practical activities are planned and carried out. It contains the resources, equipment and apparatus for science teaching ranging from easily consumable supplies to full range of facilities needed for effective teaching and learning of science (Muhammad & Ubendu, 2021).

The provision of adequate laboratory facilities makes science learning easier because students can actually learn through practical and interactive approaches. Laboratory works stimulates learners' interests as they are made to personally engage in useful scientific activities and experimentation; promotes the idea that science is not only products or process; affords the learner the basic skills and scientific method of problem solving (Muhammad & Ubendu, 2021). The laboratory experience enables students to translate what seems to be abstract into practical realities, thereby enhancing their understanding of the learning process. Musah and Umaru (2017) noted that the availability of laboratory facilities is essential for effective teaching and learning of Science and consequently a good performance in students. Okoli and Osuafor (2010) pointed out that the method offers students the opportunity to develop scientific skills and attitude such as objectivity, communication, questioning, formulating hypothesis, analyzing data, critical thinking, carefulness, open-mindedness, making inference and analyze data. Scientific skills can only be effectively developed if biology laboratory resources are effectively utilized. Lawal (2013) opined that the use of laboratory materials promote learning by doing, makes the classroom lively, real, and meaningful and have the potential to make the content permanent thereby increase students' performance. Oluwasegun, Ohwofosirai and Emagbetere (2015) indicated that the use of Physics laboratory equipment facilitate the teaching and learning of Physics, inculcate scientific reasoning and enhances academic performance in the subject. Nwagbo and Uzoma (2014) stated that practical activity method of teaching and learning was found to be more effective in fostering students acquisition of science process skills which may eventually improve students' performance. It also enables the students to understand complex abstract ideas involved in science and allows them have an opportunity of taking part in the process of learning.

Statement of the Problem

Evidences abound that students find it difficult in comprehending some biological concepts in the classroom. This is evident in their rate of failure in local and external examination in Biology in recent times. This is suspected to result from the methodology applied by the teachers in teaching and learning process which leaves the students with poor foundations in Biology. The teacher centered approach allows students to result to memorization without having a practical skill and proper understanding of the Biology concepts taught and the consequence of this approach is mass failure among the students. This study was therefore

carried out to investigate the effectiveness of laboratory facilities on students' achievement in Biology in secondary schools.

Purpose of the Study

The present study was carried out to investigate the effectiveness of laboratory facilities on students' achievement in Biology. Specifically, the study determined whether;

i. Students taught Biology using laboratory facilities had better achievement than those taught without laboratory facilities.

ii. Male and female students taught Biology using laboratory facilities differed in their achievements.

Research Question

The following research questions guided the study,

1. What is the difference between the mean achievement scores of students taught Biology using laboratory facilities and those taught without laboratory facilities?
2. What is the difference between the mean achievement scores of male and female students taught Biology using laboratory facilities?

Hypotheses

The following hypotheses were formulated to guide the study:

H_{O1}: There is no significant difference between the mean achievement scores of students taught Biology using laboratory facilities and those taught without laboratory facilities.

H_{O2}: There is no significant difference between the mean achievement scores of male and female students taught Biology using laboratory facilities.

Methodology

The study was a quasi-experimental research design which applied the pre-test, post-test, non-randomized control type. This design was adopted since it was not possible to alter the academic programme of the schools used through randomization process. The population of the study consisted of all senior secondary school II (SS 11) Biology students in the 15 public secondary schools in Owerri North Local Government Area of Imo State. Through random sampling, two co-educational schools were selected for the study. In each of the two schools selected, two intact classes were randomly assigned to control and experiment groups and this gave a sample total of one hundred and eighty Biology students (180) for the study. The sample comprised of ninety nine (99) females and eighty one (81) males. The control group had ninety six (96) students with fifty one (51) females and forty five (45) males, while the experiment group had eighty (84) students with thirty six (36) males and forty eight (48) females. The instrument for data collection was a researcher made 30–multiple choice questions titled "Biology Achievement Test (BAT)" it was constructed based on the topics treated with the students from the syllabus. The construction of the instrument was guided by a table of specification. To determine the face and content validity of the instrument, it was handed over to two experts in Biology education and a Measurement and Evaluation expert. Their expert judgment guided the restructuring of the instrument where necessary. To determine the reliability of the instrument, 30 copies were administered to students outside the study group with the same characteristics. The data generated was analyzed using Kuder Richardson 20 (K-R20) formula, this gave a reliability coefficient of 0.83 which was adequate for the study. The two groups (control & experiment) were administered with a pre-test to determine their placement before the treatment. The control groups were taught a Biology concept in a normal classroom according to a regular lesson plan without laboratory facilities by their regular teachers. The experiment groups were taught the same Biology

concept in a laboratory utilizing laboratory facilities. The entire lessons lasted for two weeks after which a post-test was administered to both groups using a re-arranged version of the pre-test and marked over 100 percent. The data generated was analyzed using mean and standard deviation to answer research questions while analysis of covariance (ANCOVA) was used to test hypotheses at 0.05 level of significance

Result

Research question 1: What is the difference between the mean achievement scores of students taught Biology using laboratory facilities and those taught without laboratory facilities?

Table 1: summary of students' achievement

Group	**N**	**mean**	**SD**	**Mean difference**
Experiment	84	50.02	6.21	
Control	96	33.30	5.14	16.72

Table 1 shows that, the experiment group had a mean achievement score of 50.02 with a standard deviation of 6.21. The control group had a mean achievement score of 33.30 with standard deviation of 5.14. These gave a difference in mean of 16.72 in favour of the experiment group.

Research question 2: What is the difference between the mean achievement scores of male and female students taught Biology using laboratory facilities?

Table 2: Summary of gender achievement

Gender	**N**	**Mean**	**SD**	**Mean difference**
Male	36	46.28	5.08	
Female	48	49.02	5.41	1.74

Table 2 shows that, male students in the experiment group had mean achievement score of 46.28 with a standard deviation of 5.08 while their female counterparts had mean achievement score of 49.02 with a standard deviation of 5.41. These gave a difference in mean of 1.74 in favour of the females.

H_{O1}: There is no significant difference between the mean achievement scores of students taught Biology using laboratory facilities and those taught without laboratory facilities.

Table 3: Summary of ANCOVA analysis

Source	**Type 111 sum of squares**	**df**	**Mean Square**	**F**	**Sig**
Corrected model	9165.452	4	2291.363	22.736	.000
intercept	16853.173	1	16853.173	167.225	.000
covariate	15.258	1	15.258	.151	.698
method	7572.142	1	7572.142	75.134	.000
Gender	1022.873	1	1022.873	10.149	.002
Method*gender	.117	1	.117	.001	.973
Error	17636.793	175	100.782		
Total	312726.000	180			
Corrected total	26802.244	179			

Table 3 shows that the p-value (0.000) is less than 0.05. Based on the result, the null hypothesis is rejected and alternative accepted. This implies that there is a significant

difference between the mean achievement scores of students taught Biology using laboratory facilities and those taught without laboratory facilities.

H_{O2}: There is no significant difference between the mean achievement scores of male and female students taught Biology using laboratory facilities.

Table 3 shows that the p-value (0.002) is less than 0.05. Based on the result, the null hypothesis is rejected and the alternative accepted. This implies that there is a significant difference between the mean achievement scores of male and female students taught Biology using laboratory facilities**.**

Discussion of findings

The result of the study revealed that, utilization of laboratory facilities in teaching and learning of biology is effective in improving students' achievement. The students taught Biology using laboratory facilities had higher mean achievement scores than those without laboratory facilities. Further statistical analysis showed a significant difference between the mean achievement scores of students taught Biology using laboratory facilities and those taught without laboratory facilities. This effectiveness may have stemmed from the practical and activity based nature of learning Biology with laboratory facilities. This result is in agreement with the findings of Ihejiamaizu and Ochui (2016) which revealed that utilization of biology laboratory equipment is effective in the teaching and learning of biology. Students who utilize these equipment achieve higher than their counterparts academically. The results is also in line with Nwabo and uzoma (2014) who stated that practical activities enhances the acquisition of science process skill.

The result of the study also revealed that female students had higher mean achievement scores in Biology than their male counterparts when taught with laboratory facilities. Further probe on the result of the study indicated that a statistical significant difference exists between the mean achievement scores of male and female students taught Biology using laboratory facilities. This results is in disagreement with the findings of Chibabi, Umoru, Onah, Itodo, (2018) which showed that male students performed well than the female students, although, the difference was not statistically significant. The result is also in parallel with Iwuji as cited in Chibabi et al. (2018) who stated that males students appear to be higher in achievement than the females and also reported that boys are better at activities requiring manipulation (psychomotor skills) than girls, and that boys are more aggressive towards laboratory and project work.

Conclusion

The study investigated the effectiveness of laboratory facilities on students' achievement in Biology in secondary schools. The result revealed that the use of laboratory facilities in teaching and learning Biology is effective in enhancing students' achievement.

Recommendation

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

1) Teachers should use laboratory facilities in teaching Biology to enhance students' achievement at secondary school level.

2) Government and Non-Governmental organizations should organize conferences and workshops to train Biology teachers on innovative approaches of teaching Biology.

3) The Government and school managers should establish laboratories at secondary schools to enable teachers utilize them in teaching.

References

Ahmed, M.A. & Abimbola, I.O (2011). Influence of teaching experience and school location on biology teachers' rating of the difficult levels of nutrition concepts in Ilorin, Nigeria. *JOSTMED*, 7(2), 52-61.

Agwagah, U.N.V. (2008). Mathematics is beyond calculation: aesthetic values. *Abacus: The Journal of Mathematical Association of Nigerian*. 33(1),70-79.

Asiyai, R. I. (2012).Assessing school facilities in public secondary schools in Delta State, Nigeria. *International Multidisciplinary Journal* 6(2), 192-205.

Bajon, H. R, Uko, I. B.& Ayuba A.(2021). Availability and utilization of biology laboratory facilities as a correlate of academic achievement among secondary school students in Takum Education Zone, Taraba State, Nigeria. *Journal of Research & Method in Education (IOSR-JRME).* 11(2), 26-31.

Bathsheba, A. J., Damak, J. D., Wajim D.I. & Akwayamai, P.J (2020). Influence ofthe 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)* 19(8), 67-78.

Chibabi, A. A., Umoru, S. E., Onah, D. O. & Itodo, E. E. (2018). Effect of laboratory method on students' achievement and retention in senior secondary schools biology in Kogi East Senatorial Zone. *Journal of Research & Method in Education (IOSR-JRME)* 8(6), 31-39.

Daluba, N.E, (2012). An evaluation of resource available for science teaching in secondary schools: implications for 20:2020. *Journal of emerging trends in educational research and policy studies.* 3(3), 363-367.

Etobro, B.A & Emmanuel F. F. O (2017).Students' perceptions of difficult concepts in biology in senior secondary schools in Lagos state. *Global journal of educational research* 16, 2017: 139-147.

FRN (2013). *National policy on education*. Abuja: NERDC Press.

Igboabuchi, A. (2010). Biology laboratory facilities for salvaging dividing economy. *Journal of Science Teachers Association of Nigeria*, 42, 251-254.

Ihejiamaizu, 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.

Imogie, A. I. (2010). A new paradigm for teacher preparation in the 21st century Nigeria. *A paper presentation at the annual national conference organized by the Institute of Education, University of Nigeria,* Nsukka.

Lawal, F. K. (2013). Resource utilization for teaching biology towards achieving millennium development goal's objective in selected secondary schools in Zaria Metropolis. *54th Annual Conference Proceedings of Science Teachers Association of Nigeria.* 197-202.

Muhamad, L.H. & Ubendu, N. (2021). Assessment on influence of school mapping on allocation of science laboratories in secondary schools in Kaduna state, Nigeria. *Al-hikmah journal of education*, 8(1), 306-314.

Musah, A.& Umaru, A.A.(2017). Effects of availability and utilization of biology laboratory facilities and students' academic achievements in secondary schools in Yobe State, Nigeria. *International Journal of Innovative Social & Science Education Research* 5(2), 1-8.

Nwagbo, E.O & Uzoma, A. B (2014). Effects of practical activities on secondary students process skill acquisition in Abuja Municipal Council. Nigeria.

Ogunkola, B.J. & Olatoye, R.A. (2004). Student gender self-concept and attitude towards science as predictors of performance in practical biology tasks. *Sokoto Educational Review* 7:124-125.

Okoli, J. N. & Osuafor, A. M. (2010). Status of human and material resources for teaching the basic sciences in senior secondary schools in Anambra State. *Institute of Education Journal*, 21 (2), 162-174.

Olufunke, B. T (2012). Effect of availability and utilization of physics laboratory equipment on students' academic achievement in senior secondary school physics. *World Journal of Education* 2(5) 1-7.

Oludipe, D. I. (2011). The influence of teacher preparation and use of instructional materials on primary school pupil's performance in Integrated Science. *Journal of Soil Science and Environment*, 2(8), 134-145.

Oluwasegun, G. Ohwofosirai, A. & Emagbetere, J. (2015). The impact of physics laboratory on students' offering physics in Ethiope West local Government Area of Delta State. *Journal of Educational Research and Review* 10(7), 961-956.

Onimisi, J. A. (2006). *Impact of type of teacher training on students achievement and attitude towards integrated science*. Unpublished P.HD Thesis. University of Nigeria, Nsukka