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ASSESSMENT OF AVAILABILITY AND UTILIZATION OF BIOLOGY LABORATORY MATERIALS IN SENIOR SCHOOLS IN ILORIN, NIGERIA

By

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Abstract

Biology is one of the science subjects where laboratory materials with the use of specimens, apparatus, equipment and safety were taught. These activities were faced with many challenges among which are the availability and effective utilization of the biology laboratory materials. This study investigated the availability and utilization of biology laboratory materials in senior secondary schools in Ilorin, Nigeria, two research questions were raised and two research hypotheses were tested at 0.05 alpha level of significance. The study adopted a quantitative descriptive survey type and 257 Biology teachers were sampled for the study using multistage sampling techniques, data were collected using the Laboratory Activities Rating Scale Questionnaire (LARSQ). Content and construct validity was done by three (3) experts. One (1) from the department of science education, department of plant Biology, University of Ilorin and one (1) experience secondary school Biology teacher respectively. A pilot study was also conducted using (20) Biology Teachers in different schools at the same time that was not participated in the research study. The data obtained was subjected to Cronbach Alpha test using the split half methods at a significant level of 0.05, then, Pearson's Product-Moment Correlation was used to compare the two sets of scores and reliability index of 0.84, 0.81 and 0.87 was obtained respectively which measured the instrument to be reliable. Descriptive statistics such as frequency counts, percentages, means and standard deviations were used to answer the research questions, while inferential statistics (t-test and ANOVA) were employed to test hypotheses at the 0.05 significance level, Findings revealed that while laboratory materials were available to some extent, their utilization rate was low. Significant differences were observed in the teachers' views on laboratory utilization based on gender, teaching experience, and academic qualification. The study concludes that inadequate utilization of laboratory resources continues to hinder effective teaching of biology in Nigerian schools. Study hereby recommends were made for improved provision, training, and monitoring of laboratory practices to enhance students' academic performance.

Keywords: Biology Education; Laboratory Materials; Utilization; Academic Performance; Nigeria

Introduction

The availability of laboratory materials is essential for effective science teaching and learning. Its enables students to understand concepts through practical experience and skills development but inadequate materials may reduce the quality and positive impacts of knowledge.

The utilization of the laboratory materials is vital for meaningful science instructions and effective learning. Proper use of laboratory materials helps students to develop practical skill and deeper understanding of scientific concepts. When laboratory materials are well utilized, the quality of science education is significantly improved.

Science education plays a pivotal role in national development because it equips learners with problem-solving skills, critical thinking abilities, and the capacity to apply knowledge in real-world contexts. Among science subjects, biology is central to understanding life and the environment, and it contributes to health, agriculture, and industry. The teaching of biology in secondary schools therefore requires not only theoretical exposure but also practical engagement through well-equipped laboratories. Practical work allows students to connect abstract concepts with real-life experiences, thereby improving comprehension and retention (Afolabi & Akinbobola, 2021).

In Nigeria, biology consistently records high enrollment among senior secondary students, yet the performance outcomes at the West African Senior School Certificate Examination (WASSCE) have been a source of concern. Reports by the West African Examinations Council (WAEC) between 2015 and 2022 highlight persistent weaknesses in students' practical biology skills such as specimen identification, labeling, and drawing (WAEC, 2022). These shortcomings have been attributed partly to the poor availability and utilization of laboratory facilities. Effective learning in biology depends not only on the provision of these resources but also on how well teachers and students use them during instruction (Ogunleye & Adeyemo, 2020).

Availability of laboratory materials is one side of the challenge, while utilization is another. Studies have shown that in many Nigerian schools, even where laboratories are provided, teachers sometimes underutilize them due to factors such as overcrowded classrooms, lack of time, or inadequate training (Olufunke, 2012; Musah & Umar, 2017). This implies that assessing both the presence and use of laboratory resources is crucial in determining their real impact on learning outcomes. Where utilization is low, laboratory facilities remain underexploited, denying students the benefits of experiential learning (Nsanganwimana, 2021).

The role of teachers is equally critical in this context. Teachers' qualifications, gender, and years of experience may influence how laboratory resources are managed and deployed in classroom settings. For instance, experienced teachers may have better improvisation skills and greater confidence in using limited materials effectively, while novice teachers may require more support and training (Nwagbo & Uzoma, 2016). Understanding these dynamics is necessary for targeted interventions to improve science education in Nigeria.

It is against this background that this study seeks to assess the availability and utilization of biology laboratory materials in senior secondary schools in Ilorin, Nigeria. By examining the adequacy of resources, the extent of their use, and the influence of teacher-related variables, the study aims to provide empirical evidence that can inform education policy, resource allocation, and professional development strategies. The findings are expected to contribute to ongoing efforts to improve the teaching and learning of biology and to enhance students' performance in external examinations.

Statement of the Problem

Despite the Nigerian government's efforts to promote sciences through laboratory activities in the country through the procurement of different materials, a numbers of factors including teachers' misconceptions and view of scientific terms seems challenging (Aypay, 2011). However, proper laboratory safety rules, availability and the utilizations of the laboratory, inadequacy of laboratory equipment, procurement knowledge of the laboratory materials among others which are used in different laboratory activities stands to be a challenge. This was also demonstrated by the candidates' unsatisfactory performance in the practical and in

biology as seen on the West African Senior School Certificate Examinations (WASSCE) results from year 2014-2022.

West African Chief Examiner's reports (2021) revealed that there had been inconsistent decline in the performance of students in biology in public examinations conducted by the West African Examination Council (WAEC) but recently weakness in the area of technicality such as identifications, observation, labeling, titles, measurement e.t.c which are part of practical laboratory activities were recently identified in biology across the country over the years (WAEC, 2014-2022). This implies that adequate proper laboratory materials which cover teaching and learning materials used in the laboratory, knowledge of the availability, optimal utilization and safety of the laboratory equipment and the laboratory users, students' performance in biology may continue to fall short. The teachers' view of laboratory materials and the students' performance can be significantly improved through laboratory activities.

Table 1: Students' Performance in WASSCE Biology (2014–2022)

Year	Total Sat	Credit Pass	% Pass
2014	1,365,384	766,971	56.17%
2022	1,057,577	699,430	66.69%

Source: WAEC National Office (2022)

Purpose of the Study

The main purpose of this study was to assess the availability and utilization of biology laboratory materials in senior schools in Ilorin, Nigeria. Specifically, this study assessed the;

1. safety use of laboratory apparatus for laboratory the activities.
2. availability rate of laboratory specimens for laboratory activities.

Research Questions

The following research questions guided the study;

i. What are the safeties used rate of the laboratory apparatus for laboratory activities by the biology teachers?
ii. What are the availability rates of the laboratory specimens for laboratory activities?

Research Hypothesis

There was no statistically difference on the views of male and female biology teachers on the safety use of laboratory apparatus for laboratory activities.

Review of Related Literature

The study was anchored on the Constructivist Learning Theory, which posits that learners build knowledge through experiences and interactions. Laboratory practicals provide learners with hands-on opportunities to construct scientific knowledge.

Empirical studies (Musah & Umar, 2017; Olufunke, 2012; Nsanganwimana, 2021) reveal that laboratory resources significantly influence students' achievement. However, in Nigerian schools, inadequate resources, poor maintenance, and underutilization remain key challenges. The WAEC Chief Examiners' reports (2014–2022) consistently highlight persistent weaknesses in biology practicals, particularly in technical areas such as labeling, measurements, and diagrammatic skills. However, no specific study had been examined, on the availability and utilization of laboratory materials in senior schools in Ilorin, Nigeria so as to fill the methodologica, sample, and population gaps identified in the reviewed literatures, the current study combined both descriptive and the inferential statistics such as mean and standard deviations and inferential such as t test and then analysis of variance (ANOVA). In the Same vein, this study fills the populations' gap, identified in the literature, through the participation of 257 biology teachers who were selected across various schools.

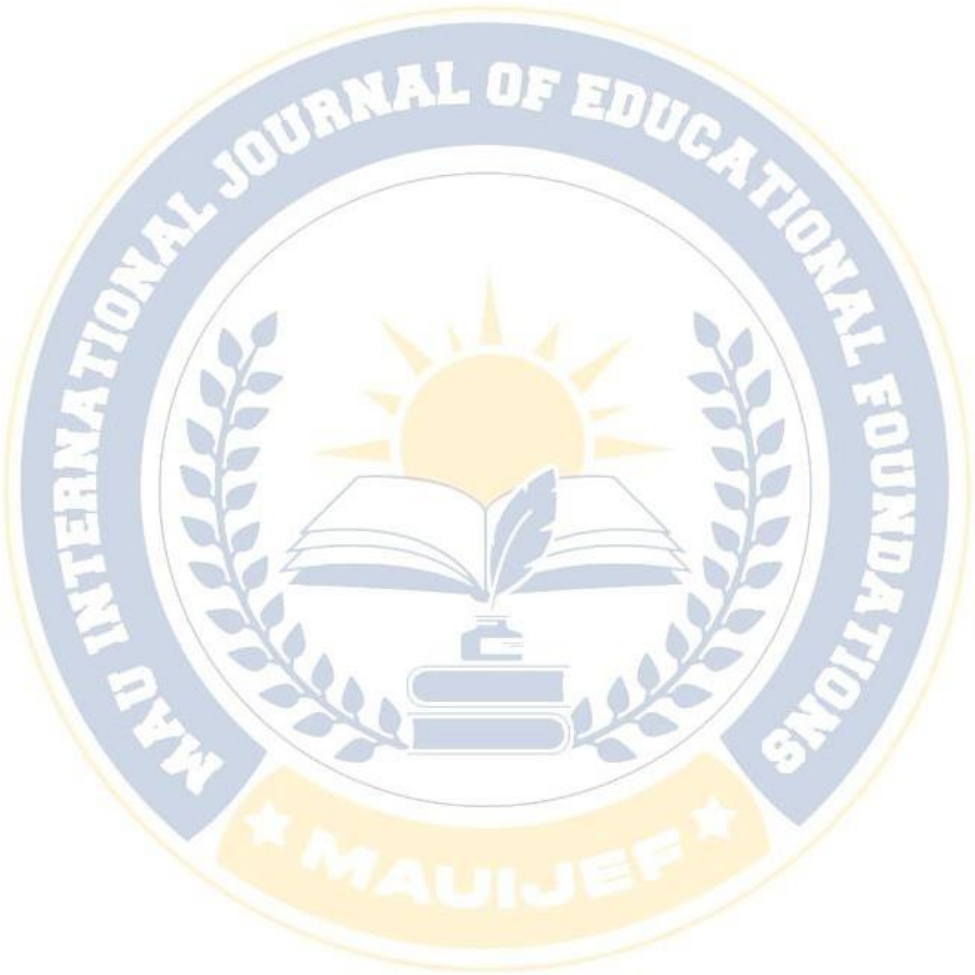
Methodology

The study adopted a descriptive survey design. The population for this study comprised of all senior secondary school biology teachers in ilorin, Nigeria with SSS III Biology teachers as target populations. A multi-stage random sampling technique was used to select participants. Data were collected using the Laboratory Activities Rating Scale Questionnaire (LARSQ). Content and construct validity was ensured by 3 experts in the department of science education, university of illorin and one experienced biology teacher. Reliability was established using Cronbach Alpha with a coefficient index of 0.82. Descriptive statistics (mean, SD, percentages) were used to answer research questions, while inferential statistics (independent t-test and one-way ANOVA) tested hypotheses at a 0.05 significance level.

Results

Findings revealed that biology laboratory materials were moderately available but grossly underutilized. Teachers acknowledged challenges such as inadequate specimens, outdated apparatus, and poor maintenance culture.

Inferential analysis showed significant differences in teachers' perceptions of laboratory utilization based on gender, teaching experience, and academic qualifications. For example, experienced teachers expressed more favorable views towards laboratory utilization compared to less experienced teachers.



Mean Rating and Standard Deviation of Teachers View on Safety Use of Laboratory Apparatus

S/N	Statements	Mean	SD	Rank
1.	I know how to use first aid kits in the laboratory.	4.68	0.67	6th
2.	I work with inventory that has the identifications of all chemicals, equipment and apparatus in the laboratory.	4.48	0.8	9th
3.	I am aware of the precautions to be taken in case of fire outbreak in the laboratory.	4.68	0.66	6th
4.	I always ensure that the laboratory is clean and tidy.	4.79	0.55	1st
5.	I always take care about to ensure that laboratory materials/apparatus are in the right places after usage.	4.75	0.51	3rd
6.	I never leave the laboratory but ensure proper checking of all electrical devices.	4.75	0.62	3rd
7.	I know which of the emergency kits that has to be in a laboratory for using in case of any emergency situations.	4.71	0.56	5th
8.	I tell students to wash their hands and faces with water after the practical laboratory activities.	4.76	0.54	2nd
9.	I know how to use bucket of sand in case of fire outbreak in the laboratory.	4.62	0.69	8th
10.	I know how to use fire extinguisher in case of fire accident in the laboratory.	4.44	1.09	10th
	Average Mean and Standard Deviation	**4.67**	**0.91**	

Discussion

The findings of this study corroborate earlier reports (Ibe, 2015; Nwagbo & Uzoma, 2016) which identified poor laboratory practices as a major cause of low student performance. The significant differences observed across gender, teaching experience, and qualifications suggest the need for differentiated professional development for teachers.

Laboratory utilization is not merely a function of resource availability but also depends on teachers' competence, creativity, and willingness to improvise. Thus, even where resources exist, poor usage results in limited student engagement and unsatisfactory performance.

Conclusion

The study concludes that inadequate utilization of biology laboratory materials persists in Ilorin senior secondary schools, despite moderate availability. Effective use of laboratory resources is key to improving students' performance in Biology. Without addressing utilization gaps, provision of resources alone may not yield improved outcomes.

Recommendations

1. The government should increase funding for the provision of modern laboratory facilities.
2. School authorities should ensure regular maintenance of laboratory materials.
3. Teachers should undergo periodic training on laboratory management and improvisation.
4. Curriculum planners should emphasise practical activities in biology teaching.
5. Parents and stakeholders should support schools in providing additional resources.

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