# UTILIZATION OF BIOLOGY LABORATORY EQUIPMENT AND STUDENTS' ACADEMIC PERFORMANCE IN CROSS RIVER STATE, NIGERIA

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**ABSTRACT:** *The paper focused on Utilization of biology laboratory equipment and students' academic performance in senior secondary schools in Cross River State, Nigeria. One null hypothesis was formulated. Literature was reviewed accordingly. Ex-post facto research design was adopted and a sample of four hundred and ninety (490) biology students was used for the study. Checklist on utilization of biology laboratory equipment and Bio achievement Test were the instruments used for data collection. To test the hypothesis, one way Analysis of Variance (ANOVA) was employed. The hypothesis was subjected to testing at 0.05 level of significance. The result of the analysis revealed that utilization of Biology laboratory equipment significantly influenced students' academic performance in Biology. Based on the finding of the study, it was recommended among others that Supervisors and inspectors from the Ministry of Education should strictly monitor the frequency of use of laboratory equipment by both teachers and students. This will ensure a hitch free utilization of the available science laboratory equipment in teaching and learning of Biology and such process will encourage students to do science of biology instead of learning about it.*

**KEYWORDS:** Utilization, Laboratory equipment, Student performance

## INTRODUCTION

Modern Science is the firm base upon which modern advances in Technology depends. Many breakthroughs that man has recorded in the quest to improve his life were achieved through the knowledge of science, it therefore became pertinent that science be taught at all levels of education.

At the senior secondary level science is departmentalized into Biology, Chemistry and Physics. Biology which is the study of different forms, their evolution, structures, functions, growth, distribution and taxonomy occupies a unique position in the secondary school science curriculum. It serves as a pre-requisite to the study of other lucrative and challenging professions like; medicine, nursing, pharmacology, biochemistry, agriculture among others. The vital role of the study of this discipline in the economic, industrial and public life of the learners and the general humanity cannot be overstressed (Ibe and Ukpai 2013; Akambi and Kolawole, 2014).

Biology as a science subject is based on practicals and experiment. 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, adequate laboratory and field skills. It is only through utilization of Biology laboratory equipment that the above objectives and goals can be achieved.

Unfortunately, the teaching and learning of biology over decades is yet to adequately meet the expectation of the people in the above areas. This is evident in the overall poor

performance of students in the subject in Nigeria. Table 1 shows the analysis of Biology students' performance in the senior secondary school certificate examination from 2002-2014.

**Table 1.  Percentage distribution of students' performance in May/June Senior Secondary Certificate Examination (SSCE) in Biology in Nigeria, 2002 - 20 14.**

| Years | Total Entry No of Candidates | Total Sat No. of Candidates | Credit passes 1-6 No. of Candidates | Percentage passes % of Candidates |
|---|---|---|---|---|
| 2002 | 1,240,163 | 882,119 | 278,112 | 31.52 |
| 2003 | 1,006,831 | 909,101 | 392,249 | 44.15 |
| 2004 | 1,005,553 | 1,027,938 | 253,487 | 24.69 |
| 2005 | 1,080,162 | 1,072,607 | 379,850 | 35.04 |
| 2006 | 1,170,522 | 1,152,045 | 559,854 | 48.60 |
| 2007 | 1,270,137 | 1,238,163 | 413,211 | 33.37 |
| 2008 | 1,292,910 | 1,259,964 | 427,644 | 33.94 |
| 2009 | 1,372,567 | 1,340,206 | 453,928 | 33.87 |
| 2010 | 1,331,381 | 1,300,418 | 427,544 | 33.90 |
| 2011 | 1,540,141 | 1,505,199 | 579,432 | 38.50 |
| 2012 | 1,695,878 | 1, 672,224 | 649,156 | 38.82 |
| 2013 | 1,782,006 | 1,757,726 | 709,471 | 40.28 |
| 2014 | 1,699,880 | 1,677,849 | 638,998 | 37.59 |

Source: Statistics section, West African Examination Council (WAEC) Nation Office, Onipanu, Lagos, Nigeria.

The situation of fluctuating, yet persistent under-average performance of biology students in WAEC/SSCE which never recorded an average of 50 percent pass in public examinations is not different in Cross River State. The problem has continued to generate several research concern among stakeholders on the underlying force responsible for, as well as possible ways to combat this poor trend of performance. Several reasons have been adduced for the problem. Akinolu (2006) hinged it on poor pedagogical skills. Neji (2011) blamed it on learners' personal characteristics. Several other research attribute it to inadequate, inappropriate and perhaps non-utilization of the available laboratory equipment in teaching and learning biology, These authors lament that teaching the subject in secondary schools in conventional classrooms can be defective (Olufunke 2012; Omosewo 2011; Igboabuchi 2010; Olajide 2011; Oludipe 2011).

Apparently, the poor or non-use of laboratory equipment can be responsible for the poor performance observed in Table 1 above. In view of this, though several studies were carried out in different areas to delve into the problem of poor performance in biology. Yet, much is left to carry out further research on the otherwise protracted issue of poor performance in biology with particular reference to the present research area.

Bio laboratory equipment have been identified as part of the teaching-learning facilities teachers and students use to express ideas without difficulties, thus making the lesson interesting, motivating and easy to understand. Utilization of laboratory equipment defines the extent or how often the available science laboratory equipment are used during classes or laboratory sessions. According to Lawal (2013), such materials promote learning by doing, make the classroom lively, real, and meaningful and have the potential to make the content

permanent thereby increase students' performance. To Lawal, utilization of these equipment enable learners to focus their attention to important issues and acquire practical skills. In effect, acquisition of such skills is capable of helping students combat unemployment and poverty. Hence, the need for maximum use of such equipment cannot be overemphasized.

Oluwasegun, Ohwofosirai and Emagbetere (2015) examined the impact of physics laboratory equipment on students offering physics in Ethiope West local government area. They found that the use of Physics laboratory equipment facilitate the teaching and learning of Physics, inculcate scientific reasoning and enhances academic performance in the subject. Olufunke's (2012) study found that schools with highest frequency of utilization of these equipment had highest mean score followed by schools with average and low frequency of utilization respectively.

In another study by Nwagbo and Uzoma (2014) on the effects of practical activities on secondary school students' process skill acquisition in Abuja municipal council, 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. Whereas several other research on influence of laboratory equipment found significant relationship between utilization of these facilities and students' academic performance (Nsugbe and Igboabuchi 2010; Chukwuemeka 2008; Chinwoke 2010). Neji (2011) in contrast, found no significant correlation between utilization of science laboratory facilities and students' academic performance in chemistry.

Yet, inappropriate, inadequate and non-utilization of laboratory facilities have been identified by some authors as some of the possible causes of students' poor performance. For instance, Aderonmu (2006) found that students often complain of non-familiarization with biology laboratory equipment until a few weeks to the external examination, and in most cases, even the teachers of this subject did not know the use of laboratory equipment and chemicals until the practical examination.

The literature reviewed in the respective areas established evidence that the use of laboratory equipment exerts a significant influence on students' academic performance. In spite of the extensive report in these areas, there was no report on biology laboratory equipment utilization and students' performance in the subject being documented in the Northern Education Zone of Cross River State where the present research is centred. Recognizing the great importance accorded utilization of these essential equipment as a means of improving the quality of science teaching/learning, gave the impetus for this paper.

**Research Question**

The investigation addressed the question; to what extent does utilization of the available Biology laboratory equipment influence students' academic performance in the subject in Northern Education Zone of Cross River State?

**Research Hypothesis**

There is no significant influence of biology laboratory equipment on students' academic performance

## RESEARCH METHODOLOGY

The research area was Northern Education Zone of Cross River State. Ex-post facto research design was used for the study. The sample consisted of 490 SS3 biology students of the 2015/2016 academic session. This set of students were considered appropriate for the study being that they were preparing for the standardized WAEC examination. They might have covered most of the biology curriculum. To select the sample, stratified sampling technique based on local government areas was first used. Simple random sampling technique (balloting method) was used to select 14 schools in the zone. The method was again used to select 35 students each from the 14 sampled schools, giving a total of 490 SS 3 biology students who participated in the study.

### Research Instrument

A well validated instrument titled Utilization of Biology Laboratory Equipment Checklist (UBLEC) and Biology Achievement Test (BAT) were used for data collection. Section A of the UBLEC elicited information on the respondents' personal data. Section B was a 30 item checklist adapted from the West African Examination Council (WAEC) minimum standard for the establishment of secondary school biology laboratory with four point scale. Respondents were required to tick against the option they deemed correct. The checklist was designed to elicit responses on the usage of the available laboratory equipment. . The BAT was a 10 item multiple choice questions extracted from past WAEC questions; had five options with one correct answer and four distractors.

Subjects were properly guided on how to complete the checklist. Four Likert's point was used for scoring items on UBLEC. Each item had the lowest score of 1 and highest score 4. The lowest total score was 30, while the highest score was 120. Scores of students were categorized as high, average and low. For biology achievement test, each correct answer attracted one mark, wrong answers attracted a zero mark. Summation of the marks constituted the respondents' academic performance rating. Data collected were analyzed using one-way analysis of variance (ANOVA). The hypothesis were subjected to testing at 0.05 level of significance.

## PRESENTATION OF RESULT

The null hypothesis stated that there is no significant influence of utilization of Biology laboratory equipment on students' academic performance in Biology. This hypothesis was tested with ANOVA.The results in Table 2 showed that 189 students studied in schools with high utilization of Biology laboratory equipment, 160 students in schools with average level of utilization and 141 students in schools with low utilization of Biology laboratory equipment. The means and standard deviation of students' academic performance in Biology were computed based on the utilization of Biology laboratory equipment and statistically compared using one-way analysis of variance. The analysis showed that the calculated f-ratio of 1,841.199 was greater than the critical f-value of 9.68 at 0.05 level of significance and 2 and 487 degrees of freedom. This implies that the result is significant, indicating that there is a significant influence of utilization of Biology laboratory equipment on students' academic performance. It can also be seen from the result that high utilization of Biology laboratory equipment had the most significant effect on students' academic performance (X~= 9.41).

This was followed by average utilization (X= 8.93) and low utilization (X~= 6.19) being the least significant. (See Table 2)

Consequent upon this result, a post hoc analysis using Bonferroni correction to adjust for multiple comparison was used to determine the differences between the groups. Table 3 revealed no significant influence between high utilization and average utilization (t=0.736), no significant influence between high utilization and low utilization (t=1.409) and no significant influence between low utilization and average utilization (t=0.6730) on students' academic performance.

**Table 2.** **One way analysis of variance to determine the influence of Biology laboratory equipment on students' academic performance in Biology**

| Level of utilization | N | X | SD |
|---|---|---|---|
| HU | 189 | 108.44 | 9.41 |
| AU | 160 | 79.82 | 8.91 |
| LU | 141 | 51.67 | 6.19 |

HU = High Utilization, AU = Average Utilization, LU = low Utilization

| Source of variation | Sum of square | Degree of Freedom | Mean Square | F |
|---|---|---|---|---|
| Between group | 262,310.291 | 2 | 131,155.146 | 1,841.99* |
| Within group' | 34,690.736 | 487 | 71.234 | |
| Total | 297,001.027 | 489 | | |

Significant at 0.05; df 2 and 487; critical f. 9.68

**Table 3.** **Bonferroni correction to adjust for multiple comparison analysis of utilization of Biology laboratory equipment on students' academic performance in Biology.**

**Confidence intervals**

| Comparison | Mean 1 − Mean 2 | 95% CI of difference |
|---|---|---|
| 1. HU vs AU | +28.62 | -64.84 to + 122.08 |
| 2. HU vs LU | +56.77 | -40.04 to + 153.58 |
| 3. LU vs AU | -28.15 | -128.64 to + 72.34 |

Statistical significance

| Comparison | Significant? (P= 0.05?) | T |
|---|---|---|
| 1. HU vs AU | No | 0.736 |
| 2. HU vs LU | No | 1.409 |
| 3. LU vs AU | No | 0.673 |

## DISCUSSION OF FINDINGS

The finding of this study agrees with Olufunke (2012) whose finding revealed a significant relationship between high frequency of utilization of physics laboratory equipment and students' academic performance. This implies 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 present finding is also in line with Oluwasegun, Ohwofosirai and Emaghetere (2015) whose result showed that the use of physics laboratory equipment facilitates the teaching and learning of physics, inculcate scientific reasoning and enhance academic performance in the subject. This is true because the involvement of learner with laboratory equipment will eliminate abstraction of the concept learned. As learners are involved in the laboratory activities, they manipulate the equipment, conduct experiments, record scientific observation, this way basic scientific skills and attitudes are acquired that will help them both in performance and in future application of concepts in everyday life. Hence the finding corroborates that of Nwagbo and Uzoma (2014) in Abuja whose findings revealed that practical activities enhance the acquisition of science process skills. This implies that an instructor who utilizes laboratory equipment in biology instruction tends to produce graduates that will be relevant to the contemporary society as the skills acquired can translate into wealth creation and combat unemployment and poverty among citizens. However, the present research finding has debunked that of Neji (2011) whose finding showed no significant correlation between utilization of science laboratory facilities and students' academic performance in chemistry. It could be that laboratory equipment were either rarely used by teachers and students in those schools or they could not be used appropriately as opined by (Onasanya and Omosewo 2011; Oludipe 2011; Olajide 2011; Nsugbe and Igboabuchi 2010). Research is replete that the use of laboratory equipment makes science learning so real to learmers. Biology teaching and learning cannot be effective under conditions in which these equipment are either not utilized or under-utilized.

## CONCLUSION

It is evident from the finding of this research that the use of biology laboratory equipment is directly linked to students' improved performance. When students are exposed to the use of these equipment, they tend to perform better than they would have done without these facilities.

## RECOMMENDATIONS

Based on the finding of this research and the conclusion drawn, the following recommendations were made;

1) Supervisors and inspectors from the Ministry of Education should strictly monitor the frequency of use of laboratory equipment by both teachers and students. This will ensure a hitch free utilization of the available science laboratory equipment in teaching and learning of Biology and such process will encourage students to do science of biology instead of learning about it.

2) Secondary Education board should ensure that laboratory technicians as well as laboratory technologists are employed and posted to all public secondary schools in the State. They will complement the effort of the subject teachers especially where such teachers may not be knowledgeable on the operations of modern equipment.

3) Secondary Education Board, professional bodies like STAN should organize seminars, workshops and refresher courses for biology teachers. In such fora, specialists like educational and laboratory technologists, laboratory technicians, computer experts and so on should be invited to train Biology teachers on how modern laboratory facilities can be used to improve classroom instruction

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**APPENDIX**

**UTILIZATION OF BIOLOGY LABORATORY EQUIPMENT CHECCKLIST
(UBLEC)**

| S/NO | SUB-SECTION A: CHECKLIST ON BIOLOGY LABORATORY EQUIPMENT | Utilization | | | |
|---|---|---|---|---|---|
| | | HU | U | SU | NU |
| 1 | Biology laboratory | | | | |
| 2 | Biology laboratory attendant | | | | |
| 3 | Test tube | | | | |
| 4 | Forceps | | | | |
| 5 | Dissecting set | | | | |
| 6 | Dissecting pins | | | | |
| 7 | Dissecting board | | | | |
| 8 | Dissecting dishes | | | | |
| 9 | Glass rod | | | | |
| 10 | Petri dishes | | | | |
| 11 | Prepared slides | | | | |
| 12 | Iodine solution | | | | |
| 13 | Million's reagent | | | | |
| 14 | Sudan III solution | | | | |
| 15 | Thermometer | | | | |
| 16 | Fehling solution | | | | |
| 17 | Insect nets | | | | |
| 18 | Quadrates | | | | |
| 19 | Microscope | | | | |
| 20 | Beakers | | | | |
| 21 | Measuring cylinder | | | | |
| 22 | Storage bottle | | | | |
| 23 | Tripod stand | | | | |
| 24 | Slides | | | | |
| 25 | Stop watches | | | | |
| 26 | Hand lens | | | | |
| 27 | Round bottom flask | | | | |
| 28 | Photometer | | | | |
| 29 | Dropping bottle | | | | |
| 30 | Desiccators | | | | |