# Effects of Availability and Utilization of Biology Laboratory Facilities and Students Academic Achievements in Secondary Schools in Yobe State, Nigeria

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**A b s t r a c t**

The study investigated the effects of availability and utilization of biology laboratory facilities and students academic achievement in secondary schools in Yobe state of Nigeria. The study adopted a Correletional survey research design and was guided by two research questions and one null hypothesis tested at 0.05 level of significance. The population of the study comprised all the 42 biology teachers and 370 biology students across all the senior secondary schools in Yobe state. Stratified random sampling technique was used to select the student sample (370). A questionnaire containing a checklist (Biology Laboratory Facility) and a Proforma were used for data collection. Data for research questions were analyzed using Mean and Standard Deviation while Pearson Product Moment Correlation Coefficient and Multiple Correlation analysis were used for the null hypotheses. The reliability coefficient of the instrument was obtained to be 0.84 using Cronbach Alpha. The findings of the study revealed that biology laboratory facilities are either not available entirely, or where they are available they are inadequate and therefore they are not utilized by the high number of students population. There was a significant relationship between biology laboratory facility availability and utilization, and student's academic achievement $r=.614$, $n=42$, $p<0.05$, $r=.572$ and $r=.590$, $n=370$, $p<0.05$. To this end, it was recommended that Government at state level through Ministry of Education and Science and Technical schools Board should as a matter of priority provide and equip the laboratories with relevant, enough and usable facilities to improve student's performance in biology in external examinations and beyond.

**Background to the Study**

Science is doing and involves regular hands – on practical work for learners to develop scientific literacy to face global challenges. Biology being a natural science can be studied both indoor and outdoor as most biological specimen are plants and animals which abounds in the environment. However some laboratory facilities may not be found outside the laboratories such as reagents, hence the need to have a well stocked laboratory with available and adequate facilities. For science teachers to play their roles in teaching science, laboratory facilities should be available and used appropriately to improve the performance of students. Students poor performance 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).One of the major reasons for this anomaly is the lack of or in appropriate application of laboratory facilities in the teaching of science by secondary school science teachers (Orji & Ebele in Asiyai, 2012). Biology as a key science subject is offered by most senior secondary students (Adodo & Oyeniyi, 2013). It is a core subject required for medical sciences, biotechnology, pharmacy, microbiology, agriculture, oceanography to mention but a few.

One would be tempted to assume that the high enrolment in Biology and the fact that it deals with familiar objects like living things in general and the human body in particular, would imply high performance. From observations, performance in sciences is poor when compared with other subjects (see page 7), (Adodo& Sunday, 2013). A review of student's performance in Biology in the West African Senior Secondary Certificate Examination (WASSCE) from 2005 to 2013 in Nigeria revealed fluctuation and downward trend in the students' performance (Daluba, 2012). This has attracted a lot of concern among science educators. In order to achieve the objectives and the aspiration of the government, and to improve students performance in Biology efforts should be directed towards improving teaching and learning of the subject.

Achimagu (2006) classified resource materials into classroom/laboratories equipment/chemicals and textual/audio visual materials. Resources or facilities according to Umeh (2006) refers to facilities that can be used to enhance or improve educational programmes and promote teaching and learning. Science laboratory resources/facilities can be human or material. The human resources have to do with personnel such as lecturers/teachers, laboratory technologist/assistants and students. The science laboratory material resources are those materials available to the science teacher for teaching and learning. They include textbooks, computers, thermometers, fire extinguishers, first aid kits, oven, incubators, chalkboards, model/mock-ups, television, radio and other electronic devices.

Although some facilities may be available and adequate but may not be put to use by the teachers. Umeh (2006) is of the view that audio visual aids such as computers and projectors are not utilized in schools due to lack of knowledge on the proper use of such resources for teaching. Onyeji (2004) had earlier reported that none of these new media (electronics) is available, accessible or used in communicating Science, Technology and Mathematics (STM) in secondary schools. Physical laboratory facilities are the

fundamental factors in better learning and achievements of the students. All facilities should be provided to the schools for the students' better, concrete, and real experiences. Leeper, (1968), stated that the child learns through concrete rather than abstract experiences as there are learners who use different cognitive skills for learning, such as seeing, hearing feeling and touching skills.

School facilities have been observed as a potent factor to quantitative education. The availability of laboratory facilities is essential for effective teaching and learning of Science and consequently a good performance in students. Ifeakor (2006) is of the opinion that learning can occur through one's environment – facilities that are available to facilitate students learning outcome. Students can master better the basic concepts of Biology /chemistry when they learn by doing. This implies that practical should function as the primary learning experience.

Researchers such as Oladare, Abiodun, and Bajulaiye (2006). Lavrenz (2006); Akpan (2006), Inyang (2006), Adesoji (2008); and Ihuarulam (2008) stated that there are inadequate resources for teaching and learning of science subjects in public secondary schools in Nigeria. They further stated that where there are little resources at all, they are not in good condition, while the few ones that are in good condition are not enough to go round and also the few available material are dysfunctional.

Empirical studies conducted in relation to resource utilization in education have revealed that essential facilities are not always available in schools. This inadequacy of teaching resources has been of serious concern to educators (Kennedy, 2009). Lyons (2012), states that learning is a complex activity that involves interplay of students" motivation, physical facilities, teaching resources, skills of teaching and curriculum demands. The process of managing and organizing resources is called resource utilization. The utilization of resources (laboratory facilities) in education brings about fruitful learning outcomes since resources stimulate students learning as well as motivating them.

**Research Questions**
The following research questions were posed and answered in this study.
1.      What is the extent of availability of biology laboratory facilities in secondary schools in Yobe state?
2.      What is the extent of utilization of biology laboratory facilities in secondary schools in Yobe state?

**Hypothesis**
The null hypothesis was formulated and tested at 0.05 level of Significance to guide the study
**Ho₁.** There is no significant relationship between the extent of availability and utilization of biology laboratory facilities and students academic achievement.

**Research Methodology**
The study was conducted using a Correlation Survey research design.. A direct observation of secondary schools biology laboratory inventory and what is available in

the schools science laboratory was carried out during the study using a questionnaire checklist. The study was carried out in Yobe state. The state capital is Damaturu. Yobe state has 17 local government areas and 42 senior secondary schools. The state is divided into three educational zones namely: Gashua zone with 20 senior secondary schools, Potiskum zone with 17 senior secondary schools, and Damaturu zone has 11 senior secondary schools (Yobe State Teaching Service Board and Science and Technical Schools Board, 2014).

The target population of the study was all Senior Secondary Two (SS2) students offering biology and 42 Heads of department of biology in the public secondary schools in Yobe state. A total of 10,231students in senior secondary schools in Yobe state constituted the population of the study. Most schools in Yobe state are single sex schools. (Yobe state Teaching Service Board, Science and Technical Schools Board, 2014)

The entire population of the 42 out of 48 Heads of department of biology (4 schools had their laboratories destroyed during the insurgency, while the rest 2 schools had no laboratories at all) in the study area was used because of small size while 370 SS2 biology students drawn from the senior secondary schools across the three educational zones in Yobe state was used. Stratified random sampling technique was used to obtain the sample of SS2 students offering biology in the public secondary schools. Six schools were randomly chosen from the three educational zones in Yobe state.

The instruments that were used in the study were a questionnaire of Biology Laboratory Facilities Checklist (BLFC) extracted by the researchers from the WAEC syllabus, and a Proforma (WASSCE Result Sheet). The instrument was face and content validated. The instrument (checklist) was validated by three experts (biology lecturers). The reliability of the instrument was determined using the Cronbach Alpha (α) with the reliability coefficient of 0.84 that was obtained. The data for the study was generated using a questionnaire (BLF) checklist.

The data generated for the study were analyzed using the Statistical Package for Social Science (SPSS) version 22. The Research Questions were answered using descriptive Statistic (Mean and Standard Deviation) while the hypothesis was tested at 0.05 level of significance using Multiple Correlation.

**Results and Discussion**
The findings of the study related to research question one in table 1 revealed that biology laboratory facilities in Yobe state secondary schools are not available enough to be used by the students. Of the fifty five (55) items on the checklist as stipulated by WAEC, only twenty three (23) of these items are said to be available while the rest items including microscopes, overhead projectors and slides among others are not available. This anomaly greatly affects the comprehension and subsequently the performance of the students. This is in agreement with Onipede, (2004) who reported that many schools in Nigeria do not have laboratory with minimum standard facilities. This finding is consistent with Barrow`s (1991), Onipede (2004) and Ihuarulam (2008), who in their

separate studies reported that science education is faced with the problem of lack of resources with half the schools having no real laboratory talk less of fully equipped ones. Akpan (2006) strongly believed that shortages of laboratory facilities could have serious implications on the quality of schools` output.

Findings related to research question two in table 2 revealed that the few and inadequate biology laboratory facilities in Yobe state secondary schools are utilized by the students, as of the fifty five items on the list, thirty one (31) were observed to be utilized by the students which could impact positively on their performance in public external examinations. This agrees with Lyons (2012), who stated that learning is a complex activity that involves interplay of students‟ motivation, physical facilities, teaching resources, skills of teaching and curriculum demands. Findings related to hypothesis 1 in Table 3 revealed that there was a positively strong correlation between the variables i.e. biology laboratory facility availability and utilization and student academic achievement, therefore the null hypothesis ($H_{O4}$) was rejected. This implied that there was a significant strong relationship between facility availability and utilization and student's academic achievement. The result of the finding supported the positions of Crescentia and Amos (2011), Adesoji and Olatunbosun (2008) and Okeke, (2010) who reported that laboratory facilities availability and utilization were found to enhance achievement through the manipulation and use of same in the biology laboratories.

**Table 1: Mean Responses and Standard Deviations (SD) of Respondents on Availability of Biology Laboratory Facilities in Yobe State Secondary Schools.**

| S/N | Item | Mean | SD | Remark |
|-----|------|------|------|--------|
| 1 | Agar | 3.52 | 1.15 | A |
| 2 | Benedict Solution | 4.02 | 1.13 | A |
| 3 | Iodine Solution | 4.66 | .57 | A |
| 4 | Common Salt | 3.66 | 1.00 | A |
| 5 | Starch Powder | 2.80 | .50 | NA |
| 6 | Vegetable Oil | 1.80 | .74 | NA |
| 7 | Milk | 1.04 | .21 | NA |
| 8 | Yeast | 2.52 | 1.01 | NA |
| 9 | Formaldehyde | 2.33 | 1.05 | NA |
| 10 | Reducing sugar | 1.71 | .89 | NA |
| 11 | Formaldehyde | 2.38 | 1.05 | NA |
| 12 | Basins | 2.42 | .85 | NA |
| 13 | Bunsen Burner | 2.47 | 1.19 | NA |
| 14 | Disposable Gloves | 1.42 | .80 | NA |
| 15 | Dissecting Board | 2.80 | .74 | NA |
| 16 | Dissecting Kits | 2.28 | .94 | NA |
| 17 | Tripod stand | 4.09 | 1.07 | A |
| 18 | Cotton Wool | 2.19 | .50 | NA |
| 19 | Jugs | 2.80 | .74 | NA |
| 20 | Fire Extinguisher | 2.71 | .55 | NA |
| 21 | Monocular/binocular Microscope | 1.47 | .80 | NA |
| 22 | Nets(Swoop) | 2.47 | .96 | NA |

| S/N | Item | Mean | SD | Remark |
|-----|------|------|-----|--------|
| 23 | Petri Dishes | 2.66 | 1.30 | NA |
| 24 | PH meters | 1.61 | 1.14 | NA |
| 25 | Quadrates | 2.59 | .66 | NA |
| 26 | Scissors | 2.83 | 1.08 | NA |
| 27 | Sharp Knives | 3.80 | .50 | A |
| 28 | Sieves | 2.85 | .84 | NA |
| 29 | Buckets | 4.40 | .70 | NA |
| 30 | Spaces/Trowels | 2.42 | .80 | NA |
| 31 | Spatulas | 4.19 | .99 | A |
| 32 | Test tube Rack | 4.42 | .59 | A |
| 33 | Test tube Holder | 3.54 | 1.46 | A |
| 34 | Wash Bottles | 3.50 | 1.03 | A |
| 35 | Absorbent paper | 1.47 | .91 | NA |
| 36 | Soil test box for minerals | 1.50 | .63 | NA |
| 37 | Computer and software | 1.78 | 1.11 | NA |
| 38 | Fridge/freezers | 1.92 | 1.27 | NA |
| 39 | Overhead projector | 1.71 | .59 | NA |
| 41 | Medical Specimen B | 1.71 | .83 | NA |
| 42 | Microscope slide | 2.61 | 1.30 | NA |
| 43 | Thermometer | 4.23 | .90 | A |
| 44 | Wash bottles | 3.76 | 1.18 | A |
| 45 | Beakers | 4.19 | .99 | A |
| 46 | Conical flask | 4.19 | .96 | A |
| 47 | Cover slips | 2.42 | .96 | NA |
| 48 | Dropper | 2.78 | 1.15 | NA |
| 49 | Funnels | 3.53 | 1.26 | A |
| 50 | Hand lens | 3.73 | 1.21 | A |
| 51 | Skeleton | 3.52 | 1.12 | A |
| 52 | Wall charts/posters | 3.53 | 1.26 | A |
| 53 | Shelves/benches | 4.64 | .61 | A |
| 54 | Chairs/Stools | 4.00 | 1.24 | A |
| 55 | Black Curtains | 4.14 | .64 | A |

**Key: NA =Not Available,  A= Available**

The result presented in Table 1 indicates that 23 items have mean scores of 3.50 and above which implies that the items are available in the school biology laboratories, while the rest 32 items have means scores below the cut-off mark of 3.50 and are therefore classified to be un available in the biology laboratories of secondary schools in Yobe state in relation to WAEC minimum benchmark

**Table 2: Mean Responses and Standard Deviations (SD) of Respondents on the Utilization of Biology Laboratory Facilities in Yobe State Secondary Schools.**

| S/N | Item | Mean | SD | Remark |
| --- | --- | --- | --- | --- |
| 1 | Agar | 2.54 | .88 | NU |
| 2 | Benedict's reagent | 3.54 | .91 | U |
| 3 | Iodine solution | 3.53 | 1.09 | U |
| 4 | Common salt | 2.54 | 1.03 | NU |
| 5 | Starch powder | 2.34 | .88 | NU |
| 6 | Vegetable oil | 1.29 | .45 | NU |
| 7 | Milk | 1.45 | .55 | NU |
| 8 | Yeast | 1.56 | .59 | NU |
| 9 | Formaldehyde | 3.52 | 1.08 | U |
| 10 | Reducing sugar | 2.91 | 1.11 | NU |
| 11 | Formalin | 3.50 | 1.10 | U |
| 12 | Basins | 3.52 | 1.01 | U |
| 13 | Bunsen burner | 4.02 | .94 | U |
| 14 | Disposable gloves | 2.83 | .97 | NU |
| 15 | Dissecting boards | 2.20 | 1.10 | NU |
| 16 | Dissecting kits | 2.66 | 1.00 | NU |
| 17 | Tripod stand | 3.58 | 1.17 | U |
| 18 | Cotton wool | 3.56 | 1.02 | U |
| 19 | Jugs | 3.74 | 1.14 | U |
| 20 | Fire Extinguisher | 2.71 | .55 | NU |
| 21 | Monocular/binocular M | 1.47 | .80 | NU |
| 23 | Petri dish | 3.52 | 1.35 | U |
| 24 | Ph meter | 2.63 | 1.12 | NU |
| 25 | Quadrants | 2.67 | 1.16 | NU |
| 26 | Scissors | 3.51 | 1.08 | U |
| 28 | Sieves | 3.62 | 1.17 | U |
| 29 | Buckets | 3.94 | 1.06 | U |
| 31 | Spatulas | 4.02 | .94 | U |
| 32 | Test tube rack | 4.13 | .70 | U |
| 33 | Test tube holders | 3.91 | .90 | U |
| 34 | Wash bottles | 4.15 | .83 | U |
| 35 | Absorbent papers | 2.48 | .64 | NU |
| 36 | Soil test box for minerals | 1.54 | .49 | NU |
| 37 | Computer and softwares | 1.94 | 1.09 | NU |
| 38 | Overhead projector | 2.12 | 1.11 | NU |
| 39 | Fridge/freezers | 3.55 | .95 | U |
| 40 | Graduated cylinders | 4.01 | 1.02 | U |
| 41 | Medical specimen bottle | 2.05 | 1.06 | NU |
| 42 | Microscope slide | 2.64 | 1.30 | NU |
| 43 | Thermometer | 3.57 | 1.08 | U |
| 44 | Water bottles | 3.65 | 1.05 | U |
| 45 | Beakers | 4.13 | 1.09 | U |
| 46 | Conical flask | 3.70 | 1.20 | U |
| 47 | Cover slips | 2.84 | 1.20 | NU |

| S/N | Item | Mean | SD | Remark |
|-----|------|------|-----|--------|
| 48 | Dropper | 2.78 | 1.19 | NU |
| 49 | Funnels | 4.06 | .89 | U |
| 50 | Hand lens | 3.66 | 1.09 | U |
| 52 | Wall charts/posters | 3.66 | 1.10 | U |
| 53 | Shelves/benches | 3.91 | .88 | U |
| 54 | Chairs/stools | 3.83 | 1.07 | U |
| 55 | Black curtains | 3.66 | 1.16 | U |

**KEY: U= Utilized, NU= Not utilized**

The result presented in Table 2 shows that 31 items have mean rating of 3.50 and above which is above the cut-off mark implies that the items are utilized in the secondary schools in Yobe state, while 24 items whose means are below the cut-off point of 3.50 are therefore described to be unutilized in the schools biology laboratory in Yobe state in relation to WAEC minimum requirement.

**Table 3: Multiple Correlation's Analysis of Availability and Utilization of Laboratory Facilities and Student Achievement (p<0.05)**

|  |  | Academic Achievement | Availability | Utilization |
|--|--|----------------------|--------------|-------------|
| Correlation | Achievement | 1.00 | .614 | .590 |
|  | Availability | .614 | 1.00 | .590 |
|  | Utilization | .590 | .614 | 1.00 |
|  |  |  |  |  |
| Sig (1.tailed) | Achievement |  | .000 | .000 |
|  | Availability |  |  |  |
|  | Utilization | .000 | .000 | .000 |
| N | Achievement |  |  |  |
|  | Availability | 42 | 370 | 42 |
|  | Utilization | 370 | 42 | 370 |

**Correlation is Significant at 0.05 Level (1-tailed)**

Result presented in Table 3 shows the relationship between availability and utilization of biology laboratory facilities and students' academic achievement which was investigated using Multiple correlation, there was a positive correlation among the three variables,, r=.614, n=42, p<0.05 and r=.590, n=370, p<0.05.

The null hypothesis was rejected that there is a significant relationship between laboratory facilities availability and utilization and students achievement.

**Conclusion and Recommendations**
Based on the findings of this study, it was concluded that:
Biology laboratory facilities which enhance and improve student's performances were not available in most of the secondary schools in Yobe State.

Adequately furnished laboratories which improve students learning outcomes in sciences were observed to be inadequate in most of the Yobe state secondary schools.

Biology laboratory facilities which were mostly unavailable and inadequate were not maximally utilized in most of the secondary schools in Yobe state.

That a significantly positive relationship exist between availability of biology laboratory facilities and student's academic performance..

That a significantly positive relationship exist between utilization of biology laboratory facilities and student's academic performance.

**Recommendations**

From the result of the study, the following recommendations are made:

1. It is evident that availability of biology laboratory facilities promote learning of the subjects. Therefore Yobe state government and all other stakeholders of education should as a matter of priority make available these facilities in the schools.

2. Teachers of sciences should be encouraged to practically teach biology through the use of the few available facilities in their schools to enhance understanding.

3. Science teachers should also be motivated and encouraged to improvise where materials are not available in order to supplement the few available facilities in the school laboratories.

3. Science and Technical Schools Board should provide adequate laboratory facilities for the teaching and learning of Biology in schools in Yobe state

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