



Impacts of Availability and Utilization of Biology/Chemistry Laboratory Facilities and Students Academic Achievements in Secondary Schools in Yobe State, Nigeria

¹Musah, Aminu & ²Bah Ladi Fatima

¹Department of Integrated Science Education

²Department of Chemistry Education

Federal College of Education (Tech) Potiskum, Yobe State, Nigeria

¹Email. Musahaminu16@gmail.com & ²Phone: 08061356111

ABSTRACT

The study investigated the effects of availability and utilization of biology/chemistry laboratory facilities and students' academic achievement in secondary schools in Yobe state of Nigeria. The study adopted a Correlational 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/Chemistry 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/chemistry 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/chemistry 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/chemistry in external examinations and beyond.

Keywords: Academic Achievement, Laboratory Facilities, Availability, Adequacy, Utilization

INTRODUCTION

Science is doing and involves regular hands – on practical work for learners to develop scientific literacy to face global challenges. Biology and chemistry being natural sciences 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/chemistry 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 and chemistry as key science subjects are offered by most senior secondary students (Adodo & Oyeniya, 2013). They are core subjects 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 chemistry 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 are poor when compared with other subjects (see page 7), (Adodo& Sunday, 2013). A review of student's performance in Biology and chemistry 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 and chemistry, efforts should be directed towards improving teaching and learning of the subjects.

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/chemistry 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 10,231 students 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/chemistry Laboratory Facilities Checklist (BCLFC) extracted by the researcher 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 was 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 one, 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/chemistry 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.

Table 1: Mean Responses and Standard Deviations (SD) of Respondents on Availability of Biology/chemistry 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
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

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/chemistry laboratory facility availability and utilization and student academic achievement, therefore the null hypothesis (H_{04}) 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 and chemistry laboratories

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/chemistry 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
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/chemistry 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, adequacy and utilization and students achievement.

CONCLUSION AND RECOMMENDATION

Based on the findings of this study, it was concluded that:

Biology/chemistry 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/chemistry 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 exists 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/chemistry 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 and chemistry 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.

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

REFERENCES

- Achimagu, L. (2006). Resource materials for teaching primary science. *Proceedings of the 47th Annual conference STAN*. PP.134.
- Adesoji, F.A., & Olatunbosun, S.M. (2008). Student, Teacher and School Environment Factors as Determinants of Achievement in Senior Secondary School Chemistry in Oyo State. *The Journal of International Social Research*. 1(2), 44-51.
- Adeyemi, T.O, (2008). Science laboratory and the quality of output from secondary schools in Ondo state Nigeria. *Asian Journal of information management* 2(3), 23-30
- Adodo, S.O and Oyeniyi J.D, (2013). Student variables as correlates of secondary school student performance in Biology. *International journal of science and research*. 2(7)34-42. Retrieved Online from <http://www.ijsr.net> on 10th April 2014
- Akpan, O. (2006). *Laboratory facilities for Chemistry teaching*. Unpublished seminar paper, University of Calabar, Nigeria.
- Asiyai, R. I. (2012). Assessing school facilities in public secondary schools in Delta state Nigeria. *International Multidisciplinary Journal*. 6(2), 192-205
- Barrow, L.H. (1991). *Evaluation of Science Laboratories in the Middle Schools of four Educational Districts in Saudi Arabia*. PhD Thesis, University of Missouri, Columbia.
- Crescentia, S.O, & Amos, A.O, (2011). 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
- 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
- Federal Ministry of Education, (2008). *Senior Secondary Schools Curriculum: Biology for senior secondary schools*. Abuja-Nigeria: NERDC press.
- Federal Republic of Nigeria, (2008). *National Policy on Education* (4th Ed) Lagos: NERDC Press
- Ifeakor, A.C, Okoli, J.N & Nwafor, O, (2010). An appraisal of the availability and utilization of new technological resources for science curriculum delivery in Nigerian universities. *African research review*. 4(2), 370-383.
- Ihuarulam, A. I. (2008). *Chemistry teachers' perception of availability and utilization of resources for curriculum development in Kano State*. Published M.Ed. thesis, University of Kano, Nigeria.
- 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*.
- Inyang, N.E.U. (2006). The Status of Science and Maths Laboratories in Selected Secondary Schools in Akwa-Ibom State of Nigeria. *47th STAN Annual Conference Proceedings*, 33-37.
- Kennedy, E.U. (2009). Teachers utilization of Instructional resources in teaching Basic Electricity in rural and urban Technical colleges. *International Journal of scientific research in Education*. 2(2), 51-63
- Lavrenz, F. (2006). The Relationship between Science Teacher Characteristics and Student Achievement and Attitudes, *Journal in Research in Science Teaching*, 12(3), 433-437.
- Leeper, et. al. (1968). *Good schools for young children: A guide for working with three, four and five year old children*. London: The Macmillan Company.
- Lyons, J. (2012). *Workers of Tomorrow, Education in progress*, Ministry of Education and Scientific research. Forth Fortis. Fiji.

- Okeke, R. J. (2010). *Principles of development selection, utilization, evaluation, storage and retrieval of instructional materials*. In F. A. Okwo and G. A. Ike (Eds.), *Educational technology: Basic concepts of issues*. Nsukka: University Trust Publishers, 45-76.
- Oladare, O.T.; Abiodun, O.S. & Bajulaiye, B.A. (2006). The Status of resources in Secondary School; Teaching and Learning in Lagos State, Nigeria. *47th STAN Conference Proceedings*, Pp 14-21
- Onipede, H. (2004). National Development Hinges on Quality Education. *The Comet*, January 2, pp: 21.
- Onyeji, J. N. (2004). Status of Instructional Readiness for Integrated Science Teaching in the Universal Basic Education Era. *Journal of Science and Technical Education for Sustainable Universal Basic Education in Nigeria*. 170-172 Open University Press.
- Udo, E. U. (2006). Availability, selection and utilization of instructional resources for teaching primary science in Uyo Local Government Education Authority, Akwa Ibom State. *47th annual conference of Science Teachers' Association of Nigeria*, Calabar, August 3-7
- West African Examinations Council. (2008). *Regulations and syllabuses for the senior school certificate examination (Nigeria)-2008-2012*, Lagos: Author
- Wikipedia (2013). *System theory: Wikipedia, the free dictionary*: Retrieved 11th February 2013 from <http://en.wikipedia.org/wiki/sysemstheory>,.
- Yobe state TSB/STSB, (2014). Senior Secondary Student Enrolment, *Government gazette*