



Availability and Utilization of Biology Laboratory Equipment in Senior Secondary Schools in Zaria Educational Zone, Kaduna State, Nigeria

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ABSTRACT

This study investigated the availability and utilization of Biology Laboratory Equipment in senior secondary schools in Zaria Educational Zone, Kaduna State, Nigeria. The study was guided by two objectives and two corresponding research questions. A survey research design was employed. The population of the study consisted of 13,634 which include 33 quality assurance personnel, 1256 teacher and 12345 students respectively. The sample size of 374 was used based on research advisors' (2006) table for sample selection at 95 percent confidence level and margin error of 5 percent. Disproportionate sampling technique was used to allocate respondents to the existing strata; thus 30 quality assurance staff, 174 Biology teachers and 167 Biology students respectively were disproportionately selected. In addition, stratified simple random sampling was used to choose respondents from each strata. A questionnaire was adapted from the work of Auwal (2016). The questionnaire contained check list of Biology equipment was used in the data collection, the reliability of the instrument was 0.62. The study used mean and standard deviation to obtain overall average scores. The findings revealed that Biology equipment are available in senior secondary school, Educational Zone, but proper utilization in teaching and learning Biology is not frequent. The study made some recommendations among which are is the need for quality assurance unit of Zaria Educational Zone, Kaduna State to put more effort in executing their primary responsibilities of ensuring quality teaching through effective monitoring and on-the-spot assessment of biology teachers and facilities.

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INTRODUCTION

Many research has been carried out in relation to utilization of biology have revealed that essential biology equipment are insufficient. This is obvious and general issue in our system of education. Insufficient materials of teaching resources have been of serious issue to educators (Kennedy, 2009). Lyons (2012), see learning as a complex activity that comprised interplay of students' motivation, physical equipment, teaching resources, skills of teaching and curriculum demands. The process of managing and organizing resources is term resource utilization. The utilization laboratory facilities in education bring about good expected learning outcomes since resources stimulate students learning as well as motivation. We know biology is a science subject which comprised practical and experiment in laboratories. Similarly, laboratory equipment needs an experience science teacher who is capable in operation, utilizing as well as maintaining of these equipment.

According to Imogie, (2010) science teachers have roles to play in teaching science in secondary schools, laboratory equipment availability, and management and used appropriately to improve students' performance. However, students' academic poor performance in Biology especially at Senior School Certificate Examinations (SSCE) has reached a level concern to all stakeholders in education generally in the country. The major reason for this problem is lack or inappropriate utilization of laboratory equipment in the teaching of science schools by secondary school Science teachers (Asiyai, 2012). Biology can be regarded key science subject studied senior secondary students (Adodo & Oyeniyi, 2013).

Institutions in Nigeria charged with the responsibility of science teachers training are increasing making teachers without laboratory practice experience es. This usually leads to lack of necessary competence and confidence in handling practical classes. So even when materials are

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available using them is a big challenge, they may neglect to use them. The process of managing and organizing resources for teaching and learning is referred to as resource utilization. Resources utilization deals with the extent to when facilities are provided to schools, there are three assumptions, it is possible they are either used effectively or inefficiently or they are remaining unused. When item of equipment is maximally used such equipment its utilization will be affective. If the equipment is not maximally used it can be referring to under-utilized. It is against this backdrop that this study examines the availability and utilization of laboratory equipment in secondary schools in Zaria Educational Zone, Kaduna state, Nigeria.

The underutilization of material resources had impacted negatively on performance in biology in Zaria Educational Zone. This study addressed the extent to which utilization of resources influenced the academic achievement of students in biology in the study area. The poor performance in biology especially at senior secondary certificate examination (SSCE) in Zaria Educational Zone is a big challenge to the planners, policy- makers and teachers. It was observed that academic performance in biology had been declining in the zone over recent years. The main concern of the study is that these students are being locked out of major careers like medicine, pharmacy, nursing, science laboratory and biochemistry among others due to poor performance in biology.

The findings by researchers and leading educators showed that for better performance in biology several factors should be considered such as qualification of teaching staff, availability of instructional resources that include textbooks, laboratories, apparatus etc and also availability of laboratory technicians and utilization by teachers and students. Hence this study was set to find out how use of laboratory equipment influence student academic achievement in biology in senior secondary schools in Zaria Educational Zone, Kaduna State, Nigeria.

Objectives of the Study

The main objective of the study is to assess the utilization of laboratory equipment and their

impact on students' academic achievement in secondary schools in Zaria Educational Zone, Kaduna State, Nigeria. The study shall be guided by the following specific objective. These are to:

1. Determine the availability of laboratory equipment in secondary schools in Zaria educational zone, Kaduna State, Nigeria;
2. determine the extent to which teachers utilize laboratory equipment in secondary schools in Zaria educational zone, Kaduna State, Nigeria;

Research Questions

In the light of the objectives set, the following research questions are formulated to guide the study:

1. To what extent are laboratory equipment available in secondary schools in Zaria educational zone, Kaduna State, Nigeria?
2. What is the extent of teachers' utilization of laboratory equipment in secondary schools in Zaria educational zone, Kaduna State, Nigeria?

METHODOLOGY

The design of the study is survey. "It is usually employed by collecting data and describing in systematic manner the characteristic features or facts about a given population from a few people or items considered to be representative of the entire group" (Salihu and Adamu 2016:1470). Specifically, cross-sectional type of survey will be used. Cross-sectional surveys according to Salihu, Muhammed and Bayero (2016:467) "are studies in which samples are selected from a defined population and contacted at a single point in time.

The population of this study comprises of all biology teachers in 53 senior secondary schools in Zaria Educational Zone, Kaduna State, Nigeria. It also included quality assurance officers' in Zaria Inspectorate Zone and students. There are 1256 biology teachers, consisting of 876 males and 380 females based on the official data obtained from Zaria Educational Zonal Office, Zaria. There are 33 quality assurance officers (27 males and 6 females). There are also 12, 345 science students spread across the schools (7,756 males and 4,589 females). Table 1 shows the population distribution of respondents according to their respective gender.

Table 1: Population Distribution of Respondents by Gender

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S/N	Respondents	Population		Total
		Male	Female	
1	Quality assurance personnel	27	6	33
2	Teachers	876	380	1256
3	Students	7756	4589	12345
4	Total	8659	4975	13634

Source: Zaria Educational Zone

The sample of this study is 374 consisting of quality assurance personnel, Biology teachers and science students in the study area. The decision to use the sample size at 95 percent confidence level and margin error of 5 percent is based on the Research Advisors' (2006) table for sample specification. Two sampling techniques were used in the study. Disproportional stratified sampling was used in selecting the number of respondents for the study from the three strata. Disproportional sampling is where the number of respondents in each stratum (in this case quality assurance officers, teachers and students) does not reflect proportion in population. According to Garson (2012:13) "disproportionate

stratified sampling occurs when disproportionate numbers of subjects are drawn from some strata compared to others." This is necessitated by the fact that the numbers of respondents are not evenly distributed. The stratified simple random sampling was used to select respondents from each stratum. According to Garson (2012:12) "stratified simple random sampling is simple random sampling of individuals from each stratum of the population." This technique was used because it serves the dual purposes of providing samples that are representative of major subgroups of the population and of improving the precision of the estimators.

Table 2: Sample of the Study according to the category of respondents

S/N	Institutions	Total	Sample size
1	Quality assurance personnel	33	30
2	Teachers	1,256	174
3	Students	12,345	167
4	Total	13,634	374

The data collection instrument for this study is the structured questionnaire called "Availability and Utilization of Laboratory Equipment Questionnaire" (AULEQ). Muhammed (2017:115) define questionnaire as "a method of gathering information from respondents about attitudes, knowledge, beliefs and feelings". Section "A" of the instrument deals with the personal information of the respondents, section 'B' and 'C' deal with availability of laboratory equipment which was adopted from the work of Auwal (2016).

The instrument was duly validated by experts in the Department of Science and Educational Technology, Bayero University, Kano. However, useful input such as reframing of the items, deleting of irrelevant items and simplifying some ambiguous items made were incorporated to arrive at the final certified copy of the instrument. The consistency of the instrument (questionnaire) was ascertained using Cronbach alpha method for determining reliability coefficient. The outcome of the pilot study at Giwa Educational Zone was used to determine the

reliability coefficient of sections B and C i.e. (0.77 and 0.69). The study used the 0.64 as the minimum threshold for accepting the consistency of the instrument as set by Danjuma and Muhammad (2011).

Introductory letters were presented to the schools in the study area and Zaria Educational Zone. This enabled the researchers to obtain the data needed for the study. The letter is also aimed at introducing the researchers and the study motives and as a means of soliciting official permission and co-operation to use quality assurance personnel, teachers and students as respondents for the study. The researchers administered the questionnaires to the respondents under study by physically visiting them. The process lasted for five working days.

In order to effectively analyze responses, nominal values were assigned to the response categories in the scale with weighted value of 4 to 1 in terms of scoring, ranging from the highest to the least and computation were carried out. The research questions were analyzed using arithmetic mean and

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standard deviation to obtain overall average scores. The decision on the cut-off point for the item means was based on the Gregory and Ward's (1978) formula for determining the lower and upper limits in mean.

This formula is applied as follows;

0.01 – 2.00: Unavailable (UN), Never (N)
2.01- 3.00: Inadequate (IN), Monthly (M)
3.01-3.50: Available (AV), Weekly (W)
3.51 - 4.00: Daily (D)

RESULTS AND DISCUSSIONS

Table 3: Mean scores of availability of biology laboratory equipment

S/N	Items	AV	IN	UN	Mean	SDev	Remark
1	Biology laboratory	159	46	41	3.15	1.04	Available
2	Teachers preparatory office	84	24	22	3.66	1.17	Available
3	Electricity source	94	128	24	3.53	1.00	Available
4	Water supply	55	60	15	3.34	1.31	Available
5	Laboratory tables, shelves and stools	144	36	66	3.70	1.49	Available
6	Graphic materials	87	13	30	2.85	1.11	Inadequate
7	Dissection tools/kits	139	74	33	3.54	1.20	Available
8	Microscope	80	35	18	3.08	1.18	Available
9	Autoclaves	172	48	26	3.27	1.38	Available
10	Conical flask	91	24	15	3.84	1.46	Available
11	Test tubes	143	65	38	3.09	1.04	Available
12	Beaker	80	31	19	3.70	1.17	Available
13	Reagents bottles	148	48	50	3.81	1.00	Available
14	Hand lense	70	29	31	2.91	1.36	Inadequate
15	Dissection microscope	159	68	19	3.73	1.49	Available
16	Weighing Scale/Weighing Balance and Ruler	85	31	14	2.85	1.11	Inadequate
17	Bunsen burner	177	43	26	3.56	1.20	Available
18	Gauze wire	95	20	15	3.16	1.15	Available
19	Wash bottle brush	234	7	5	3.27	1.38	Available
20	Reagent/Chemicals	121	6	3	3.80	1.46	Available
21	Thermometers	161	44	41	2.41	1.02	Inadequate
22	Preserve Animals	86	22	22	3.6	1.19	Available
23	Photometer	94	128	24	3.35	1.01	Available
24	Cotton wool	55	60	15	3.01	1.37	Available
25	Filter paper	144	36	66	3.77	1.46	Available
26	Sand bucket	85	31	14	2.83	1.08	Inadequate
27	Fire extinguisher Co ₂	177	43	26	3.49	1.22	Available
28	Safety goggles and gloves	95	20	15	3.08	1.17	Available
29	Insect net	234	7	5	3.36	1.38	Available
30	First aid box	121	6	3	2.83	1.45	Inadequate

Details in Table 3 shows the mean response scores of respondents (quality assurance officers, biology teachers and students) on the availability of laboratory equipment in senior secondary schools in Zaria Educational Zone, Kaduna State, Nigeria. Using Gregory and Ward (1978) formula for determining

the lower and upper limits in mean as indicated above, it is clear that almost all biology equipment as identified are available with the exception of items 6, 26 and 30 (graphical materials, sand bucket and first aid box) which are inadequate.

Table 4: Mean score on the utilization of biology laboratory equipment in secondary schools

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S/N	Items	Daily	Weekly	Monthly	Never	Mean	SDev	Remark
1	Biology laboratory	89	138	70	77	2.8402	1.0901	Monthly
2	Preparatory office	35	146	112	81	2.7969	1.0674	Monthly
3	Electricity source	183	80	53	58	2.5041	.9493	Monthly
4	Water supply	88	138	70	77	2.5469	.9949	Monthly
5	Laboratory tables, shelves and stools	35	146	112	81	2.5574	1.1334	Monthly
6	Graphic materials	183	80	53	58	2.9219	1.2398	Monthly
7	Dissection tools/kits	88	138	70	77	2.9262	1.1523	Monthly
8	Microscope	35	146	112	81	2.9688	1.1700	Monthly
9	Autoclaves	183	80	53	58	3.0164	1.0262	Weekly
10	Conical flask	88	138	70	77	3.0234	1.0534	Weekly
11	Test tubes	35	146	112	81	2.6474	.9973	Monthly
12	Beaker	183	80	53	58	2.6875	.9861	Monthly
13	Reagents bottles	88	138	70	77	2.6516	1.0761	Monthly
14	Hand lenses	35	146	112	81	2.5000	1.0795	Monthly
15	Dissection microscope	184	81	53	58	3.0574	1.0407	Weekly
16	Weighing Scale/Weighing Balance and Ruler	88	138	70	77	3.0313	1.0863	Weekly
17	Bunsen burner	88	138	70	77	3.0041	.9999	Monthly
18	Gauze wire	35	146	112	81	3.0391	1.0302	Weekly
19	Wash bottle brush	183	80	53	58	3.8566	.5517	Daily
20	Reagent/Chemicals	88	138	70	77	3.8125	.6243	Daily
21	Thermometers	35	146	112	81	3.3033	.9884	Weekly
22	Preserve Animals	183	80	53	58	3.2969	.9749	Weekly
23	Photometer	88	138	70	77	2.7828	1.0010	Monthly
24	Cotton wool	37	146	110	81	2.8203	1.0073	Monthly
25	Filter paper	183	80	53	58	2.6475	.9333	Monthly
26	Sand bucket	88	138	70	77	2.6094	.9156	Monthly
27	Fire extinguisher Co ₂	35	146	112	81	2.8402	1.0901	Monthly
28	Safety goggles and gloves	88	138	70	77	2.7969	1.0674	Monthly
29	Insect net	36	146	111	81	2.5041	.9493	Monthly
30	First aid box	184	80	52	58	2.5469	.9949	Monthly

Details in Table 4 shows the mean response of respondents (quality assurance officers, biology teachers and students) on the utilization of laboratory equipment in senior secondary schools in Zaria Educational Zone, Kaduna State, Nigeria. Using Gregory and Ward (1978) formula for determining the lower and upper limits in mean as indicated above, it is observed that majority of biology equipment as identified are utilized on monthly basis with the exception of items 9, 10, 15, 16, 18, 19, 20, 21, and 22 (Autoclaves, Conical flask, Dissection microscope, Weighing Scale/Weighing Balance and Ruler, Gauze wire, Wash bottle brush, Reagent/Chemicals, Thermometers and Preserve Animals) that are utilized on weekly basis.

DISCUSSIONS

The study discovered that biology equipment are largely available in senior secondary

schools in Zaria Educational, Kaduna State, Nigeria but their effective utilization in teaching and learning process in biology classroom has not been frequent. Resources according to Njeri (1990) enhance interest, comprehension, retention and concreteness to any learning situation. According to Maeke (2003), poor learning resources and facilities have been classified under the causes of dropout rate and withdrawal. Bakhda (2004) points out that those available facilities should be adapted and utilized to suit the school curriculum and good performance. Some of the reasons hindering regular utilization of biology equipment in the study area is lack of apparatus and textbooks which makes it difficult in the teaching of the subject and lack of laboratories where experiments can be done and the apparatus can be kept safely. Also lack of motivation may be a contributory factor. This is in agreement with

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Ajaja.(2008) who believed that teaching and learning activities, which result in effective teaching and improved academic performance. The school climate is determined by the resources such as laboratories, libraries with equipment and facilities which the teachers and students use and which influences attitude in teaching and learning. Unconducive environment create stress on teachers and students thus resulting in negative attitude and poor performance by students. Facilities which are below approved standards could also lead to producing wrong results and dilute the quality of teaching and learning producing poor academic performance Adeyemi. (2008).

CONCLUSIONS

Based on the foregoing, it is concluded that laboratory equipment are largely available in secondary schools in Zaria Educational Zone, Kaduna State, Nigeria but their utilization is largely on monthly basis which is not healthy for effective teaching and learning especially in practice-based course like biology.

RECOMMENDATIONS

In the light of the above, it is recommended thus:

1. The quality assurance unit of Zaria Educational Zone, Kaduna State should put more effort in executing their primary responsibilities of ensuring quality teaching through effective monitoring and on-the-spot assessment of biology teachers and facilities. This will assist in making teachers to utilize these resources during teaching and learning sessions.
2. The school principals should also make funds available and other necessary facilities that make effective resource utilization possible;
3. There is the need for seminars and workshops to be organized for biology teachers especially in the aspect of effective utilization and maintenance of laboratory equipment in order to enhance effective service delivery.

REFERENCES

- 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. [Http://www.ijsr.net](http://www.ijsr.net) retrieved on 10th April 2018.
- 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.
- Asiyai, R. I. (2012). Assessing school facilities in public secondary schools in Delta state Nigeria. *International Multidisciplinary Journal*. 6(2), 192-205
- Ajaja O. P. (2008) Science Teaching Evaluation in Nigerian Secondary Schools. The State of Resource Materials. *International Journal of Education* 5(1) 190-201
- Auwal H.M. (2016) *Assessment of Resource Availability and Utilization for Biology Instruction in Secondary Schools in Birnin Gwari Local Government Area, Kaduna State*. Post Graduate Diploma in Education Project Research, Directorate of Postgraduate Diploma in Education, Federal College of Education, Zaria.
- Bakhda, S. (2004). *Management Education of Schools*, Oxford University Press Nairobi.
- Garson, G.D. (2012), *Testing Statistical Assumptions*. Asheboro, NC: Statistical Associates Publishing.
- 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. Associates Publishing.
- Gregory G.S. & Ward D.C. (1978). *Statistical methods in educational psychology*. New Jersey: Prentice-Hall.
- Kennedy, E.U. (2009). Teacher's utilization of Instructional resources in teaching Basic Electricity in rural and urban Technical colleges. *International Journal of scientific research in Education*. 2(2), 5163
- Lyons, J. (2012). *Workers of Tomorrow, Education in progress*, Ministry of Education and Scientific research. Forth Fortis. Fiji.
- Maeke, E. M. (2003). *Secondary School Dropout in Kolome Division, Makueni District Kenya*. Unpublished M.Ed. Thesis, Kenyatta University.
- Muhammed, A. (2017). *Evaluation of Availability, Organization and Utilization of Multimedia Resources for Teaching Social Studies in Colleges of Education in North-Central Nigeria*. Doctoral thesis, Department of Arts and Social Science Education, Ahmadu Bello University, Zaria.



- Njeri, J. G. (1990). *A Study of the Utilization of Learning Resources in the Teaching of Christian Religious Education in Embu Kenya*. Unpublished M.Ed. Thesis, Kenyatta University, Nairobi.
- Salihu, J. J. & Adamu, S. (2016). *A Survey on Social Studies Teachers' Opinion on Factors Inhibiting Successful Implementation of Millennium Development Goals in Nigeria*.
- Ebohon, O. J., Ayeni, D. A, Egbu, C. O, and Omole, F. K. Procs. of the Joint International Conference (JIC) on 21st Century Human Habitat: Issues, Sustainability and Development, 21-24 March 2016, Akure, Nigeria, page number 1469-1475.
- Salihu, J. J., Muhammed, A. & Bayero, H.I. (2016). *Teachers' Perspective on Strategies to Mitigate Graduate Unemployment in Nigeria. Proceedings of Nigeria's Economic Development Conference (NEDCO)*. Pp 463-478.