



Utilization of Biology Laboratory Teaching Facilities and Equipment in Senior Secondary Schools in Borno State, Nigeria

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ABSTRACT

This study was designed to assess the availability and utilization of biology laboratory teaching facilities and equipment in public secondary schools of Borno State, Nigeria. A descriptive survey research design was used for the study. 75 public secondary schools and 259 biology teachers participated. A purposive sampling technique was used and a sample size of 78 biology teachers was drawn. Laboratory Facilities and Equipment Check List and Questionnaire were used to collect data. Cronbach's Alpha statistics and KR 20 were used to test the reliability of the instruments which were found to $r = 0.94$ and $r = 0.85$ respectively. The findings of the study indicated that biology laboratory teaching facilities and equipment were fairly available in all the sampled schools. The result of the study further indicates that in terms of laboratory reagents most schools have the required ethanol, lime water and Fehling's Solution A&B. Similarly, Laboratory equipment and facilities found to be adequately utilized were microscopes, litmus paper, dissecting set, dissecting board, dissecting pans, dropping pipettes, chemical balance, Petri dishes, beakers, entomological pins, soil test kits, conical flasks, soil sieves, specimen bottle, flask (flat bottom and round bottom), filter funnels, test tubes racks in 12 holes and test tubes holder, prepared slides of typical animal cell and spirogyra. The factors hindering the effective utilization of biology laboratory facilities/equipment includes no separate time allotted for practicals, too many topics to teach by teachers, Inadequacy in quantity and quality of facilities, overpopulated classes in the schools, Lack of fund, and poorly equipped laboratories, were the major factors found affecting the utilization of Laboratory teaching equipment/facilities in the schools. Based on the results, it was recommended that workshops be organized for principals of secondary schools and biology teachers on the need to improvise biology laboratory equipment/facilities in the schools and procure the equipment and supplies. Adequate time should also be allotted to the biology practical instructional programme at the schools time table.

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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. Therefore, the importance of laboratory teaching facilities and

equipment to the successful implementation of the Science curriculum cannot be overemphasized; this is because the use of instructional materials creates a behaviour change in learners (Jimoh, 2009). Okobia (2011) noted that when the students are given the chance to learn through more senses than one, they can learn faster and



easier. Science is doing and involves regular hands – on practical work for learners to develop scientific literacy to face global challenges. Ihejimaizu and Ochui (2016), opined that sound science education is accepted worldwide as bedrock of human development and progress, and also maintained that no educational system can rise above the quality of its teachers, and no nation can rise above the level of its teaching staff. For science teachers to play their roles in teaching science, laboratory facilities must be available and must be used appropriately to improve the performance of students.

Consequently, the methods of teaching science subjects differ more or less from other subject and can be done more effectively by demonstration. According to Ibe and Ukpai (2013) knowledge and skills cannot be distinguished from ability to perform a skill and the ability to handle facts and form concepts often merge into each other.

Practical activity is paramount in developing skills in science education, and this could be achieved with the assistance of laboratory facilities and equipment. The objectives of science education, therefore, can never be realized if a laboratory building cannot be provided or is ill-equipped and underutilized. Hence, a well secured building where facilities and equipment could be stocked must be available in every school for the success of science education programme. (Akanbi and Kolawole 2014)

Availability refers to quality of being able to be used or find in the discharge of certain functions. Longman (2003) asserts that availability refers to resources ready to be used, able to be used or that can easily be found and used. In this regard, Olaitan, Igbo, Ekong, Nwachukwu and Onyemaechi (2002) noted that no meaningful learning or transfer of what has been learned will take place if such learning occurs in a situation devoid of relevant materials and activities as well as concrete experiences. In teaching of biology in secondary school availability of resources is of great importance. The availability of instructional facilities, equipment as well as adequate personnel motivates the learners, increases the teacher's efficiency and promotes the productivity of the teacher.

Hornby, (2004), explained utilization

as to make use of available services at the individual's disposal. Olagunju and Abiona (2008) opined that the process of managing and organizing resources is resource utilization. They added that in a school, the available resources should be utilized in such a way that it enables the students to acquire desirable learning competencies. Utilization of resources in teaching brings about fruitful learning since it stimulates student's senses and motivates them.

Olufunke, (2012), defined teaching as the activities of educating or instructing learners on some specific skills and knowledge in a particular discipline. It involves activities that impart knowledge and skill. In this regard, teaching is the art as well as science of instruction and pedagogy activity. There is the need to provide the background for such pedagogy activity in teaching (with availability of adequate teaching resources). With reference to this study, teaching means the act of giving guidance to learners so as to help them acquire knowledge and skills in Biology. Effective teaching is the instructional techniques which make the teaching appealing to the learners, thereby enhancing easier acquisition of knowledge and skills in biology as subject.

Teaching resources refers to a varieties of material used for teaching and learning purposes. Okeke (2010) assert that they are collection of materials and equipment that can be used effectively for classroom communication, adding that they could as well be described as variety of products of educational technology. In the view of Hornby (2004) resources are what can be used to help achieve an aim such as equipment and supplies which provides information for the teachers and students. According to Inyang, (2006) these are materials the teacher and in fact the entire class utilize for the purpose of making teaching and learning more effective. In other words, teaching resources are information carriers designed specifically to fulfill objectives in a teaching learning situation.

Secondary education is the form of education children receive after primary education and before the tertiary level (Mgbodile, 2004). In other words, it is referred to as post



primary education. The broad goals of secondary education are to prepare the individual for useful living within the society and higher education (National Policy on Education, NPE, 2014). Viewing, this study in the area of sciences Aka (2005) stated that laboratory has been identified as the most suitable place to acquire the right scientific skills and attitudes. In the laboratory, the student is afforded the opportunity to develop and practice the processes of science such as observations, communication, and formulation of hypotheses, experimentation and classification. Aka then concluded by saying that if one was to achieve any or all of the aims of teaching science in secondary schools one has to take proper stock of laboratories and identify those factors which constitute a draw back to the use of the laboratory for the purpose it was set up and take appropriate step to correct them.

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.

In this regard, the use of instructional materials in teaching is of importance as they help to stimulate student's interest and promote understanding. According to Akoano and Akpokiere (2006) the teaching and learning of science which is practical course requires practical laboratory activities because experiment is the hall mark of science education. Uyoata (2006) also opined that meaningful learning of science requires the use of multisensory approaches where appropriate instructional resources are selected and used. This is necessary because in this kind of learning students make use of more than one sense of modality in learning. Dangbin (2008) also reported that practical activities using sufficient facilities enable learners to acquire cognitive skills such as formulation of hypothesis, making assumptions, designing investigations, understanding variables, observing, recording data and so on. Associated with these activities are scientific attitudes like

curiosity, perseverance etc which are necessary for engaging in fruitful science investigation.

The success of Science education programme depends to a large extent on a number of factors from qualified science teachers, laboratory buildings, and sufficient laboratory facilities to mention but a few. The provision of basic facilities and equipment, and their proper utilization are topical issues in science education in the country (Nwagbo, 2005). Laboratory equipments are functional implements which facilitate learning and not merely display pieces. Laboratories teaching-learning facilities supplement written and spoken words; they also give clarity and concreteness to instruction. In this regard authors such as Uyoata, (2006), highlighted the necessity to provide adequate laboratories as well as sufficient facilities and equipment for the teaching of biology. In the same vein, the Chief Examiner for biology 3 (practical biology) suggested that, schools should endeavour to equip their laboratories as this may enable students to relate the theory they have studied to their practical work (Chief's Examiner Report, 2017).

However, researches were carried out on the laboratory maintenance, management, organization and influence of laboratory facilities on secondary School students' academic performance in biology. Ihejamaizu and Ochui, (2016) in their study revealed that utilization of Biology laboratory equipment significantly influenced students' academic performance in Biology. Most of these researches were carried out in the eastern part of Nigeria. However, studies to determine the availability and the extent of utilization of biology laboratory facilities are scanty if any in Borno State. This study, therefore, ascertains the availability and also determines the extent to which they are being used in the practical lesson in secondary schools of Borno State.

Purpose of the Study

The purpose of the study is to examine the availability and utilization of biology laboratory teaching facilities in public secondary schools in Borno State. Specifically the study determined the following objectives:



- i. The availability of biology laboratory facilities and equipment in public secondary schools of Borno State;
- ii. The extent of utilization of the available biology laboratory facilities in public secondary schools of Borno State;

Research Questions

The following research questions guided the study:

- i. What are the available laboratory facilities and equipment for the teaching and learning of biology?
- ii. What is the extent of utilization of the available laboratory facilities and equipment in teaching and learning biology in public secondary schools in Borno State?

LITERATURE REVIEW

Science teaching has peculiar features and special characteristics which demands special skills. Among its peculiar features is the science laboratory. The laboratory is the work place of the science teacher. It is a place where practical activities are planned and carried out. It contains the resources, equipment and apparatus for science teaching ranging from easily consumable supplies to full range of facilities needed for effective teaching and learning of science. According to Adetero (2009) resources in education include physical facilities, available space for teaching and learning, materials such as laboratory equipment, chemical reagents, libraries, books, furniture and so on.

Assessing the importance of facilities in learning, Egwu, (2008), reported that materials whether standard or improvised are the backbone of experimental work. Dangbin (2008) also argued that practical activities using sufficient facilities enable learners to acquire cognitive skills such as formulation of hypothesis, making assumption designing investigations understanding variable, observing, recording data etc which are necessary for engaging in faithful science investigation. Uyoata (2006) also opined that meaningful learning requires the use of multisensory approach where appropriate instructional recourses are selected and utilized. According to Umeh (2006) material resources are structured facilities that are used to ensure affective teaching

and learning such as the laboratories, the classrooms, equipment, supplies, texture materials, audio-victual aids among others.

Learning resources motivate students and serve as effective ways to explain and illustrate subject content. In a similar vein, Oladipo (2008) asserted that resource materials facilitates understanding of concrete materials, creative motivation and interests for the subject. These biology laboratory resource materials according to Rabi (2017) reinforce learners to retain information for a long period of time. Chukelu (2009) agrees with Okafor (2000) that utilization of material resources for teaching-learning processes has the following positive influence on the learners:

- i. Holds students' interest.
- ii. Retains information.
- iii. Provides concrete and realistic experience.
- iv. Stimulates imagination and self-activity
- v. Helps to clarify abstract ideas.
- vi. Reinforces verbal messages.
- vii. They promote greater acquisition and longer retention of factual knowledge.
- viii. They offer real life experience which stimulates self-activity on the students.

The relevance of the presence of laboratory facilities, equipment and supplies to the smooth running of science education programme in schools has been severally emphasized in the literature (Mgbor; 2005). The level of success of most science education programmes is greatly dependent on the degree of availability and adequacy of equipment and facilities as these form the hub around which such programmes revolve. Longman (2003) explains availability as something that is able to be used or can easily be found and used. In other words they are those resources that are committable or usable upon demand to perform their designated or required function.

According to Rabi, (2017) facilities, equipment and supplies are very vital in teaching and learning in schools. Similarly Uyoata (2006) asserts that facilities and equipment are programme related in any teaching programme and should be provided in sufficient quantity to meet the needs of the science



education programmes. Writing on availability of school facilities and academic achievement Owweye and Olatunde (2011) opined that availability of school facilities is a potent factor to quantitative education. According to them the importance of provision of instructional facilities for teaching and learning in the education sector cannot be over-emphasized. The authors added; "teaching is inseparable from learning but learning is separable from teaching". According to them this means that teachers do the teaching to make the students learn, but students can learn without the teachers. They added that learning can occur through one's interaction with one's environment. Environment here refers to facilities that are available to facilitate students learning outcome.

Commenting on factors affecting availability and adequacy of laboratory facilities and equipment in Schools Ojoade (2011) asserted that inadequacy of fund to the schools as provided by the government is the main problem of secondary schools in Nigeria. Correspondingly, this situation affects the extent of availability of resources for science programme in the schools.

Utilization of resources according to Crescentia & Amos (2011). is a complex behavioral phenomenon, however it is always related to the availability and quality of such resources or services as the case may be. Utilization of biology laboratory facilities is the frequency with which the available laboratory facilities are used during laboratory experiments. Laboratory facilities can be available, adequate but not utilized during science teaching. The process of managing and organizing resources for teaching and learning is referred to as resource utilization (Ihuarulam, 2008) Resources utilization has to do with the extent to when facilities are provided to schools, these are three possibilities, they are either used effectively or inefficiently or they may remain unused. When item of equipment is maximally used such as equipment is effectively utilized. If the equipment is not maximally used it can be said to be underutilized. When there is so much pressure on the use of equipment this may result to over utilization which could lead to breakdown of such item of equipment.

Teaching leaning facilities improves the quality of teaching and make learning content meaningful. According to Ihiegbulem (2006) resource materials utilization during practices lessons inculcates in the students the spirit of careful observation, manipulative skills, respective thinking and creativity in the learners, Ihuarulam, (2008) however reported that science facilities are only important when they are used. One of the major problems facing the teaching and learning of science is connected with the management of available resources (Ogunleye, 2003)

Horny (2004) explain utilization as to make use of available services at the individual's disposal. Obi (2006) asserts that from the National Policy on Education (NPE; 2004) it could be observed that one of the objectives of education is to make learning permanent. According to him the utilization of instructional materials in teaching is a sure way of achieving this objective. When real objects or their representatives are used in teaching, students see, touch and interact with these materials. Interaction with learning materials will help the students not to forget what they learnt easily. Olagunju and Abiona (2008) explained that the process of managing and organizing resources is resource utilization. Osobonye, (2002), asserted that, one of the reasons available materials are not used by many teachers in schools and colleges is that they lack the necessary skills to operate them. He emphasized that the usefulness of resource materials depends on what the teacher makes out of them.

Researchers have openly reported the positive effects of adequacy and utilizing Laboratory Resources for teaching and learning while non-utilization of such resources has affected students' performance negatively. For instance; Tekalign, (2016), investigate the upshot of availability and utilization of Science laboratory inputs on students' academic achievement in high school Biology, Chemistry and Physics in Ilu Abba Bora Zone, Southwestern Ethiopia. Descriptive survey method was used. Multistage cluster sampling technique was used to select randomly a total of 408 students and 100 teachers from 12 high schools. Questionnaire, science laboratory input checklist and student result data sheet were used to gather data for the study. The



study indicates that, shortage and ineffective use of science laboratories in the high schools correlates with poor achievements of students in standardized Ethiopian General School Leaving Certificate Examination (EGSLCE). The researcher further more stated that the less availability, improper handling of available resources and the improper use of science laboratory items lead to the wastage of resources, less effectiveness of science laboratories and lower academic achievement of students in the high schools of the Ilu Abba Bora Zone, Southwestern Ethiopia.

Mfreke, (2016), conducted a research on Teachers' Utilization of School Facilities and Academic Achievement of Student Nurses in Human Biology in Schools of Nursing in Akwa Ibom State, Nigeria. Ex-post facto survey was adopted for the study. The research population was One Hundred and Seventy Three (173) student nurses in Preliminary Training Session (PTS) in the three (3) accredited Schools of Nursing in Akwa Ibom State. The researcher developed two (2) instruments tagged 'Teachers' Utilization of School Facilities Questionnaire (TUSFQ)' and 'Students' Achievement Test on Human Biology (SATHB)' used in collecting data for the study. The findings of the research revealed that there exists significant positive relationship between teachers' utilization of school facilities (library, laboratory, information and communication technology (ICT) center and recreation center) and academic achievement of student nurses in Human Biology. Based on the findings of the study, it was recommended amongst others that teachers should make good effort in incorporating the available school facilities in their pedagogical practices to develop themselves, and thereby promoting the academic growth of learners.

Pareek, (2019), in his study on Assessment of Availability and Utilization of Laboratory Facilities for Teaching Science at Secondary Level, The study adopted descriptive survey methodology and random sampling. The instruments used for the study were questionnaires for principals, teachers, and students. The study's findings revealed in most participating schools; there were no separate science laboratories. It was also found that many

teachers faced difficulties when conducting science activities due to the large number of students in each class as well as inadequate equipment and materials. The findings highlight that as there was no assessment of science laboratory practical activities, these activities did not contribute directly to the measurement of students' academic performance in science. The study suggested that governments should support laboratory practical activities in science as a part of assessment and specifically for this study's context takes immediate steps to set up science laboratories in all schools for the effective teaching and learning of science.

In this regard Musah and Umar (2017) conducted a research on Effects of Availability and Utilization of Biology Laboratory Facilities and Students' Academic Achievements in Secondary Schools in Yobe State, Nigeria. The study adopted a Correlational survey research design; a questionnaire containing a checklist (Biology Laboratory Facility) and a Proforma were used for data collection. The findings of their 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.

Similarly, Naisujaki, Jackson and Kirui, (2017), investigated on Perception of teachers on availability of instructional materials and physical facilities in secondary schools of Arusha District, Tanzania. It utilized descriptive case study design and data was collected through questionnaire, interview schedules and documents. Simple random and purposive samplings were used to select a sample of 318 out of about 1049 selected school stakeholder in Arusha District. The study concludes that there is inadequate number of textbooks, reference books, maps and globes in schools under investigation due to increase of students in Community Schools. Further, schools have inadequate physical facilities such as classrooms, desks, chairs and the available classrooms are poorly constructed with inadequate spacing. Researchers recommend that Curriculum developers at Tanzania Institute of Education together with policy makers should come up with a policy guideline that will enhance provision of instructional materials and physical facilities.



The extent of adequacy of laboratory facilities for science teaching depends on the population of students in a particular school. In this regard, Kortam, & Hofstein, (2017) holds that the adequacy of laboratory facilities makes science teaching more concrete and stimulating and hence for better students' academic performance in secondary schools. Academic performance depicts the level of educational attainment of an individual. It differentiates one with high knowledge content from the other with low and less competency in academic performance

Oluwasegun, Ohwofosirai and Emagbetere (2015) examined the impact of physics laboratory equipment on students offering physics in Ethiopia 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, it was that 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 the same vein, Kizito, (2017), investigates the status and barriers of science laboratory activities in Rwandan teacher training colleges (TTCs) towards improvisation practice. In the study, questionnaires and interviews were used to collect data. Observation was indirectly used to support questionnaires and interviews" data collection. Students, teachers, and principals from 13 TTCs served as the population of this study. Findings revealed that Laboratory activities are not fully done because of insufficiency of laboratories, only 5 out of 13 TTCs have science laboratories and teachers encounter many problems including time limitation, scarcity of some materials and lack of skills.

Rabi (2017), Survey of Availability, Utilization and Maintenance of Biology Laboratory Equipment and Facilities in Secondary Schools in Sokoto State, Nigeria. Descriptive survey design was adopted for the study. A sample of 30 Senior Secondary Schools and 30 biology teachers was selected from the population of secondary schools in the state using stratified sampling technique. Findings of the study indicated that most senior secondary schools in Sokoto State have no laboratories. Where they exist, they are poorly

equipped. Teachers indicated reluctance and inability in conducting practical works using the few available laboratory facilities. Poor maintenance culture was also discovered among biology teachers in Sokoto state. It was recommended among others that science laboratories should be well equipped with relevant and modern facilities for effective teaching. Teachers should try to improvise using local materials; they should also develop maintenance culture to ensure longer life span of the few available facilities.

Bhimsen and Megha, (2017), conducted a research on Utilization of Available Facilities of Computer Aided Teaching in Secondary Level School of Nepal. The study measured the utilization practice of available facilities of computer aided teaching in secondary level school. The study was conducted in Dang and Pyuthan district of Nepal India. In total 578 students were selected from the different schools of two district by using the simple random sampling. The findings shows that Private schools have slightly better facility of computer aided teaching than the public school but there was no significant effect of location. The use of computer practice is slightly better in Dang district than the Pyuthan but use of computer in leisure time and facility of soft copy of reading materials provided by school was similar in both districts. It was recommended among others that school management should increase the accessibility of computer for students to develop the technical skill in student.

Similarly in a survey conducted by Matilda and Emmanuel, (2013) The research work surveys the resources and use of the libraries of three selected Secondary Schools in Owerri metropolis with a view to ascertaining the availability, level of adequacy of the resources and use vis – a –vis the standards. Questionnaire, interview and personal observation methods were employed in data collection. Respondents were made up of 30 teachers and 270 students from the three schools. The findings revealed an ineffective use of the libraries due to gross inadequacy of the resources of the libraries and other problems hampering the effective use of the libraries and their resources. A specific amount of library grant should be included in the annual



school budget. The study strongly makes the following recommendations: A percentage of this grant should be used for the acquisition of basic library resources such as – current books and periodicals, audio-visual materials and teaching aids. The use of the library should also be incorporated into the school timetable. Longer duration for the expiration of borrowed books should be instituted. From the foregoing, previous studies were carried out in the eastern part and northwest of Nigeria. However, studies to determine the availability and the extent of utilization of biology laboratory facilities are scanty if any in Borno State. Recognizing the great importance accorded to utilization of these essential equipments and facilities as a means of improving the quality of science (biology) teaching-learning, gave the impetus for this study.

METHODOLOGY

Descriptive survey research design was used in this study. Abdel – Khalek and Al-Kandari (2006), asserted that this design describes situations of what is being investigated as they exist in their natural setting. Abbaszadeh, (2008), also supported this by stating that this design finds out current status of the phenomenon and therefore permits the study sample from the population for the purpose of drawing generalization to the entire population. Ugwoke, (2010), Owoeye and Olatunde, (2011), had successfully used this design in similar studies. The descriptive design is therefore considered appropriate to produce rich and strong description and understanding of the availability, adequacy and use of laboratories in the secondary schools of Borno State.

The population for the study comprised all the public secondary schools of Borno state and all the biology teachers in secondary schools of Borno State. The state has four education zones with a total number of 259 Biology teachers both Male and Female in 75 secondary schools in the State. Most of the teachers come from the five major tribes in the state as follows; Kanuri, Bura, Margi, Chibok and Gwaza with few others that are not indigene of Borno state.

Twenty eight (28) secondary schools and seventy eight (78) biology teachers from Biu and Maiduguri central education zones were

selected as sample for the study using purposive sampling technique. According to Kombo & Tromp (2006), purposive sampling is the procedure where the researcher purposively targets groups of people believed to be reliable for the study. This technique is appropriate due to difficult to reach communities in the research area and only biology laboratories and biology teachers in the sampled schools were involved. The sample size amounts to 37% of the population of the public secondary schools in the State. Also a sample size of 78 biology teachers was also drawn from the entire population of biology teachers in the state. This represents 30% of the total population of biology teachers in the state. The 78 teachers that were chosen as sample cut across all the biology teachers in the 28 schools that were selected for this study.

The instrument for data collection were availability and of biology laboratory Equipment and Facilities checklist (ABLEFC) and Utilization of biology laboratory Equipment and Facilities Questionnaire (UBLEFQ) were used in eliciting information in this study. The observation checklists method tends to eliminate subjectivity and bias in data collection and gives accurate information related to what is actually seen in time and place. Observation increases the chance of researcher to obtain valid and credible picture of phenomena being studied (Kothari, 2008). The UBLFEQ is of four-point rating scale adapted by the researcher. Respondents ticked whether they utilize the biology laboratory facility and equipment Very often (VO = 4), Often (O = 3), Rarely (R = 2) and Never (N = 1). Section B2 of the UBLFEQ elicits information on factors affecting the utilization of the biology laboratory facility and equipment in the Schools. The reliability of the adapted instruments was established using Cronbach's Alpha statistics for section B1 and Kuder and Richardson formula 20 (RK-20) for section B2. Section A of the instrument seeks demographic of the respondents; Section B1 of the instrument elicits information on extent of utilization of biology laboratory teaching equipment/facilities in schools, had reliability coefficient of $r=0.94$, while section B2 elicits information on factors affecting the utilization of biology laboratory teaching equipment/facilities in schools, and had reliability co-efficient of $r = 0.85$.



Mohsen (2011) provide the following rules of thumb: “ $\geq .9$ – Excellent, $\geq .8$ – Good, $\geq .7$ – Acceptable, $\geq .6$ – Questionable, $\geq .5$ – Poor and $\leq .5$ – Unacceptable”

Data collected for the study were analyzed using frequency counts, percentages Mean and standard deviation. In answering the research questions the Benchmark/Mean cut off point for the items are on 4 point rating scale. Only statements with a Mean of 2.50 and above were regarded as utilized, below 2.50 were regarded as underutilized and less than 2.00 were regarded as never utilized (Omiko, 2015).

RESULTS

Research question 1: What are the available laboratory facilities and equipment for the teaching and learning of biology in public secondary schools in Borno State?

To answer this research question, data on the availability of laboratory facilities and equipment generated via availability and adequacy of biology laboratory Equipment and Facilities checklist (AABLEFC) were analysed using frequency count. Summary of the results are shown in Table 1. Results as shown in Table 1 indicate that out of all the biology equipment and facilities, only Models of heart, eye, skeleton,

microscope and dissecting sets were available up to required numbers in all the sampled schools. Eight Schools have the minimum required beakers, 19 schools have the minimum required boiling tubes, 12 schools have the minimum required bunsen burner, 7 schools have the minimum required boiling tubes and chemical balance. 15 schools have the minimum required conical flasks and dissecting pans (wire bottom), while only 1 school has the minimum required clinostats (clock work). 17 school have the minimum required clamps (for retort stands), 26 school have the minimum required dissecting board, 9 school have the minimum required dropping pipettes with rubber bulb, 5 school have the minimum required filter funnels, 3 school have the minimum required flasks (distilling) and 13 school have the minimum required flasks (flat bottom and round bottom) and plant pots.

Table 1 below also indicate that none of the schools has the minimum required number of bell jars, crucible, cylinder, cork (assorted), corks borers machine, crucibles tongs, evaporating dishes, glass rod and tripod stands. However, only models of heart, eye, skeleton and microscope were available in all the schools according to the number required.

Table 1: Summary of Availability of Laboratory Facilities and Equipment for the of Biology in Borno State Secondary Schools

SN	Biology laboratory Facilities/equipment	Minimum NO. required per school	Number of school With minimum Requirement	NO. of schools without minimum requirement
1.	Beakers – 100ml -200ml	100	8	20
2.	Bell jars	2	0	28
3.	Bunsen burners (adjustable)	50	12	16
4.	Boiling tubes	144	19	9
5.	Crucibles (porcelain with cover)	30	0	28
6.	Conical flasks: a-250ml	5	15	13
	b-500ml	5	4	24
7.	Cylinders (measuring): a-10ml and b-100ml	30	0	28
8.	Chemical balance	2	7	21
9.	Corks (assorted)	A park of 330	0	28
10.	Cork borers machine (a set)	1	0	28
11.	Crucible tongs	30	0	28
12.	Clamps (for retort stands)	15	17	11

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13	Dissecting sets	5	28	0
14	Dissecting board	50	26	2
15	Dissecting pans (wared bottom)	50	15	13
16	Dropping pipettes with rubber bulb	100	9	19
17	Evaporating dishes 100ml	150	0	28
18	Filter funnels (2 sizes)	100	5	23
19	Flasks (distilling) (Kjedahl)	20	3	25
20	Flask a-flat bottom and b- round bottom	5	13	15
21	Flask vacuum	2	8	20
22	Filter paper 12cm, 15cm, 50cm	15pkts of each	23	5
23	Glass sheets	2	3	25
24	Graduated pipettes	5-50	27	1
25	Hand lenses	50	11	17
26	Hygrometer (net and dry bulb)	2	9	19
27	Insect nets	20	3	25
28	Insects or entomological pins	2 boxes	7	21
29	Litmus paper	50 parks	2	26
30	Microscopes	5	28	0
31	Microscopes slides	5 pkts 100	22	6
32	Petri dishes	160	16	12
33	Pipe clay (triangular for tripod stand)	40	8	20
34	Potometers	2	7	21
35	Potometers Ganongs	2	7	21
36	Plant Pots	40	13	15
37	plastic models:			
	a- Heart	1	28	0
	b- Eye	1	28	0
	c- Ear	1	23	5
	d- Skeleton	1	28	0
38	Rain Gauge	1	10	22
39	Retort stand	30	17	11
40	Soil Sieves (Grader)	6 sets	19	8
41	Spatula/plastic spoon	20	2	26
42	Soil Test Kits	2	4	24
43	Stop Clocks	10	2	26
44	Specimen Bottles	50	21	7
45	Separating Funnels	20	7	21
46	Test tubes: 150×15mm and 125×16mm	300	2	26
47	Test holder	50	4	24
48	Test rank in 12 hole	50	6	22
49	Thermometers (10°c-100°c)	20	3	25
50	Tripod stand	50	0	28
51	Wire gauze	50	18	10
52	Wind vane	1	12	16
53	Aspirator	1	5	23
54	Blotting paper	10 pkts	6	22
55	Barometer	2	9	21



Results from Table 1 below indicate that 16 schools have the minimum required ammonium hydroxide in liquid, potassium permanganate and starch soluble while 11 schools have minimum required calcium sulphate pure and sodium bicarbonate, and 6 schools have the minimum required paraffin wax/oil or Vaseline, charcoal powder and commercial yeast.

Furthermore, 23 schools have the required ethanol; 25 schools each have lime water and Fehling's Solution A&B, 9 schools each have Millions reagent; while none of the school the minimum required Glycogen Crystals. Finally, the results show that none of the biology laboratory reagents is available up to minimum required quantity in all the schools.

Table 2: Summary of Available Biology Laboratory Reagents in Secondary Schools in Borno State

SN	Reagents	Minimum NO. required per school	Number of school with minimum Requirement	Number of schools without minimum requirement
1.	Acid nitric pure	2 ½ L	7	21
2.	Acid sulphuric pure	50L	5	23
3.	Agar powder	500g	1	27
4.	Alkahol methylated spirit	5L	8	20
5.	Alum (iron) pure	100g	3	25
6.	Ammonium hydroxide in liquid	2 ½ L	16	12
7.	Calcium sulphate pure	500g	11	19
8.	Charcoal powder pure	1kg	6	22
9.	Chloroform 1 Esther	1L	3	25
10.	D-Fructose	500gm	1	27
11.	Ethanol	2 ½ L	23	5
12.	Formaldehyde	3 × 2 ¹ / ₂	9	19
13.	Glycogen Crystals	100gm	0	28
14.	Oil of cloves	100ml		
15.	Paraffin wax/oil or Vaseline	5 bottles	6	22
16.	Lead acetate	1 L	8	20
17.	Potassium bicarbonate	500g	4	24
18.	Potassium permanganate	25g	16	12
19.	Sodium bicarbonate	500g	11	17
20.	Sodium hydroxide	250g	12	16
21.	Starch soluble	250g	16	12
22.	Trypsin	25g	2	26
23.	Commercial Yeast	200g	6	22
24.	Zinc Chloride	250g	5	23
25.	Methylene Blue	25g	7	21
26.	Fehling's Solution A&B	2 ½ L	25	3
27.	Millions reagent	1L	9	19
28.	Lime water	1L	25	3
29.	Disinfectant	500ml	17	11
30.	Renin powder	25g	0	28

Results from Table 3 below indicate that 9 schools have the minimum required number of

blood cells and T.S of Dicotyledonous stem. 3 schools have the minimum required number of



typical plant cell, T.S of Monocotyledonous stem and euglena, 8 schools have the minimum required number of T.S of Monocotyledonous root

while 12 schools have minimum required number of T.S of Dicotyledonous root.

Table 3: Summary of the Available Prepared Slides for use with Bio-viewers in Borno State Secondary Schools

SN	Prepared slides for use with bio-viewers	Minimum requirement per school	Number of school with minimum requirement	Number of schools without minimum requirement
1.	Typical plant cell	50	3	25
2.	Typical animal cell	50	7	22
3.	T.S of Monocotyledonous root	50	8	20
4.	T.S of Dicotyledonous root	50	12	16
	T.S of Dicotyledonous stem	50	9	19
5.	T.S of Monocotyledonous stem	50	3	25
6.	Paramecium	50	6	22
7.	Blood cells	50	9	19
8.	Spirogyra	50	6	22
9.	Euglena	50	3	25

Results from Table 4 below shows that all the 28 sampled schools have minimum required number of Ascaris and Fish specimen.

However, only 9 schools have minimum required number tapeworm specimen

Table 4: Summary of Available Biology Specimen in the Schools

SN	Specimen	Minimum requirement Per School	Number of school with minimum Requirement	Number of schools Without requirement
1	Ascaris	10	28	0
2	Tapeworm	10	9	19
3	Fish	10	28	0

Research question two: What is the extent of utilization of the available laboratory facilities and equipment in teaching and learning biology in public secondary schools in Borno State?

From the Table 5 below above it is shown that the available bio-viewers in the schools that were utilized up to the Mean 2.50 and above include typical animal cell (2.50) and spirogyra (2.56).

Table 5: Extent of Utilization of Available bio-viewers (slice)

SN	Utilization of prepared Bio-viewers	N	\bar{X}	SD	Decision
1.	Typical plant cell	78	2.49	0.55	Underutilized
2.	Typical animal cell	78	2.50	0.60	Utilized
3.	T.S of Monocotyledonous root	78	2.47	0.70	Underutilized
4.	T.S of Dicotyledonous root	78	2.41	0.67	Underutilized
5.	T.S of Dicotyledonous stem	78	2.44	0.75	Underutilized



6.	T.S of Monocotyledonous stem	78	2.49	0.89	Underutilized
7.	Paramecium	78	2.47	0.60	Underutilized
8.	Blood cells	78	2.46	0.60	Underutilized
9.	Spirogyra	78	2.56	0.59	Utilized
10.	Euglena	78	2.46	0.75	Underutilized

(2.50 and above= utilized, below 2.50=underutilized and less than 2.00 never utilized)

From the Table 6 below it is shown that none of the available biology Laboratory reagents Mean score that is up to the Mean 2.50. Therefore,

all the reagents were not adequately utilized by biology teachers in all the sampled public secondary schools in Borno state.

Table 6: Extent of Utilization of Available biology Laboratory reagents

SN	Utilization of biology Laboratory reagents	N	\bar{X}	SD	Decision
1.	Acid nitric pure	78	1.69	0.59	Never utilized
2.	Acid sulphuric pure	78	1.78	0.70	Never utilized
3.	Agar powder	78	1.68	0.57	Never utilized
4.	Alkahol methylated spirit	78	1.81	0.51	Never utilized
5.	Alum (iron) pure	78	1.85	0.54	Never utilized
6.	Ammonium hydroxide in liquid	78	1.96	0.80	Never utilized
7.	Calcium sulphate pure	78	1.82	0.55	Never utilized
8.	Charcoal powder pure	78	2.09	0.69	Underutilized
9.	Chloroform 1 Esther	78	1.67	0.95	Never utilized
10.	D-Fructose	78	1.71	0.85	Never utilized
11.	Ethanol	78	2.27	0.92	Underutilized
12.	Formaldehyde	78	1.94	0.78	Never utilized
13.	Glycogen Crystals	78	2.13	0.76	Underutilized
14.	Oil of cloves	78	2.13	0.81	Underutilized
15.	Paraffin wax/oil or Vaseline	78	2.09	0.93	Underutilized
16.	Lead acetate	78	1.78	0.68	Never utilized
17.	Potassium bicarbonate	78	2.01	0.55	Underutilized
18.	Potassium permanganate	78	2.09	0.75	Underutilized
19.	Sodium bicarbonate	78	2.03	0.72	Underutilized
20.	Sodium hydroxide	78	2.14	0.89	Underutilized
21.	Starch soluble	78	2.24	0.78	Underutilized
22.	Trypsin	78	1.81	0.94	Never utilized
23.	Commercial Yeast	78	1.96	0.84	Never utilized
24.	Zinc Chloride	78	1.62	0.59	Never utilized
25.	Methylene Blue	78	1.65	0.73	Never utilized
26.	Fehling's Solution A&B	78	2.06	1.11	Underutilized
27.	Millions reagent	78	1.92	1.01	Never utilized
28.	Lime water	78	2.14	0.98	Underutilized
29.	Disinfectant	78	2.24	1.14	Underutilized
30.	Renin powder	78	1.78	0.92	Never utilized

(2.50 and above= utilized, below 2.50=underutilized and less than 2.00 never utilized)

From the Table 7 below, it is shown that all of the available biology specimen extent of utilization Mean scores was less than 2.00 in the

sampled schools. This indicates that all the biology teachers in the sampled schools never utilized available biology specimen.



Table 7: Extent of Utilization of Available biology specimen

SN	Utilization of Biology Specimen	N	\bar{X}	SD	Decision
1.	Ascaris	78	1.99	0.76	Never utilized
2.	Tapeworm	78	1.81	0.72	Never utilized
3.	Fish	78	1.79	0.83	Never utilized

Table 8 shows the mean score of the extent of utilization of the different biology Laboratory equipment and Facilities in the

schools. Items that are utilized in the sampled school are those with Mean 2.50 and above

Table 8: Extent of Utilization of Available Biology Laboratory Equipment/Facilities

SN	Utilization of biology Laboratory facilities	N	\bar{X}	SD	Decision
1.	Beakers – 100ml -200ml	78	2.65	0.88	Utilized
2.	Bell jars	78	2.19	0.72	Underutilized
3.	Bunsen burners (adjustable)	78	2.41	0.78	Underutilized
4.	Boiling tubes	78	2.53	0.70	Utilized
5.	Crucibles (porcelain with cover)	78	2.18	0.79	Underutilized
6.	Conical flasks: a-250ml b-500ml	78	2.60	0.73	Utilized
7.	Cylinders (measuring): a-10ml b-100ml	78	2.47	0.70	Underutilized
8.	Chemical balance	78	2.82	0.62	Utilized
9.	Corks (assorted)	78	2.29	0.82	Underutilized
10.	Cork borers machine (a set)	78	1.79	0.89	Never utilized
11.	Crucible tongs	78	2.08	0.66	Underutilized
12.	Clamps (for retort stands)	78	2.26	0.75	Underutilized
13.	Dissecting sets	78	2.87	0.84	Utilized
14.	Dissecting board	78	2.86	0.62	Utilized
15.	Dissecting pans (wared bottom)	78	2.67	0.71	Utilized
16.	Dropping pipettes with rubber bulb	78	2.72	0.80	Utilized
17.	Evaporating dishes 100ml	78	2.44	0.62	Underutilized
18.	Filter funnels (2 sizes)	78	2.53	0.73	Utilized
19.	Flasks (distilling) (Kjedahl)	78	2.45	0.70	Underutilized
20.	Flask a-flat bottomb- round bottom	78	2.54	0.62	Utilized
21.	Flask vacuum	78	2.44	0.82	Underutilized
22.	Filter paper 12cm, 15cm, 50cm	78	2.04	0.84	Underutilized
23.	Glass sheets	78	2.23	0.80	Underutilized
24.	Graduated pipettes	78	1.87	1.02	Never utilized
25.	Hand lenses	78	2.03	0.87	Underutilized
26.	Hygrometer (net and dry bulb)	78	2.44	0.77	Underutilized
27.	Insect nets	78	2.37	0.90	Underutilized
28.	Insects or entomological pins	78	2.64	1.03	Utilized
29.	Litmus paper	78	2.99	0.90	Utilized
30.	Microscopes	78	2.94	0.73	Utilized
31.	Microscopes slides	78	2.10	0.93	Underutilized
32.	Petri dishes	78	2.69	0.87	Utilized
33.	Pipe clay (triangular for tripod stand)	78	2.56	0.50	Utilized
34.	Potometers	78	2.36	0.93	Underutilized
35.	Potometers Ganongs	78	2.35	0.83	Underutilized



36.	Plant Pots	78	2.31	0.76	Underutilized
37.	plastic models:	78	2.33	0.88	Underutilized
	a- Heart				
	b- Eye				
	c- Ear				
	d- Skeleton				
38.	Rain Gauge	78	2.29	0.93	Underutilized
39.	Retort stand	78	2.40	0.98	Underutilized
40.	Soil Sieves (Grader)	78	2.60	0.89	Utilized
41.	Spatula/plastic spoon	78	2.47	0.68	Underutilized
42.	Soil Test Kits	78	2.64	0.48	Utilized
43.	Stop Clocks	78	2.22	0.92	Underutilized
44.	Specimen Bottles	78	2.58	0.59	Utilized
45.	Separating Funnels	78	2.31	0.65	Underutilized
46.	test tubes:150×15mm and 125× 16mm	78	2.42	0.64	Underutilized
47.	Test holder	78	2.51	0.73	Utilized
48.	Test rank in 12 hole	78	2.56	0.59	Utilized
49.	Thermometers (10°C-100°C)	78	2.49	0.68	Underutilized
50.	Tripod stand	78	2.29	0.77	Underutilized
51.	Wire gauze	78	2.41	0.69	Underutilized
52.	Wind vane	78	2.44	0.83	Underutilized
53.	Aspirator	78	2.22	1.03	Underutilized
54.	Blotting paper	78	1.79	0.74	Never utilized
55.	Barometer	78	1.60	0.65	Never utilized

(2.50 and above= utilized, below 2.50=underutilized and less than 2.00 never utilized)

DISCUSSION

The findings of the study are hereby discussed as follows; the result of the study in Table 1, 2, 3 and 4 indicates that biology laboratory teaching equipment and facilities were not available in the schools as required by the schools in relation to WAEC minimum benchmark. This is similar to the findings of Ugwuanyi, (2013), the study indicated that of most of the physical education teaching facilities are unavailable in all the schools. In the same vein Musah and Umar (2017) findings, 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. Tekalign, (2016) reported that, the unavailability and shortage of science laboratory inputs in the schools create problems to cover portions related to practical activities that results in non-attainment of the curriculum objectives. Facilities are an important factor for the healthy functioning teaching learning process and their availability, adequacy and relevance influence academic achievement of students.

The result of the study showed that the laboratory equipment and facilities that were being utilized adequately include microscope, litmus paper, dissecting sets, dissecting pans, Petri dishes, beakers, boiling tubes, test tube holder, conical flask, chemical balance, pipettes, filter funnels, insects pins, soil test kits, prepared slide of animal cell and prepared slide of spirogyra. Although the items or facilities in result found to be utilized in tables was not a surprise to the researcher since most of elementary practical in biology in secondary school used such facilities. The present finding is 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 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. Research is replete that the use of laboratory equipment makes science learning so real to learners. Biology teaching and learning cannot be effective under conditions in which these equipment are either not utilized or under-utilized.

Consequently, the finding is also in line with Pareek (2019) in India whose study's findings revealed in most participating schools; there were no separate science laboratories. It was also found that many teachers faced difficulties when conducting science activities due to the large number of students in each class as well as inadequate equipment and materials. The findings highlight that as there was no assessment of science laboratory practical activities, these activities did not contribute directly to the measurement of students' academic performance in science. The study suggested that governments should support laboratory practical activities in science as a part of assessment and specifically for this study's context takes immediate steps to set up science laboratories in all schools for the effective teaching and learning of science

CONCLUSION

This study investigated the availability and utilization of biology laboratory teaching equipment and facilities in Borno state. In conclusion from the research findings of this study, it is clear that biology laboratory teaching equipment and facilities in Borno state are fairly available hence those available are underutilized in the schools. Based on the findings of this study, the following recommendations were made by the researcher:

- i. Borno State Government to make frantic and sincere effort towards provision of

modern biology laboratory equipment and facilities in secondary schools, construct more class rooms and recruit more biology teacher to reduce issues of over populated classes

- ii. Biology teachers and students in public secondary schools in Borno state to be sensitized by professional bodies like STAN on the need to improvise Biology laboratory equipment and facilities. It could be achieved through class project in Biology.
- iii. School 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 biology laboratory equipment in teaching and learning of Biology and such process will encourage students to do science of biology instead of learning about it.

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