A Survey of Availability, Utilization and Maintenance of Biology Laboratory Equipment and Facilities in Secondary Schools in Sokoto State, Nigeria

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ABSTRACT

The paper, Survey of availability, Utilization and maintenance of Biology laboratory equipment and facilities in secondary schools in Sokoto State examined the availability, use, and extent of maintenance of laboratory facilities in secondary schools in Sokoto State. 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. Four research questions were answered using observation schedule. 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.

1. INTRODUCTION

Among the major goals of man is the desire to live long, to be free from pain and disease and to see that all his children survive him. To serve this goal, the field of medicine has evolved as a result of which average life expectancy has increased, death from diseases has reduced especially among infants and children.

Another basic need of man is food. Technology designed to increase agricultural productivity and minimize cost of production has emerged. Farm machinery of all types have been invented. Various insecticides and pesticides to keep insects and pests in check are being produced.

Comfort and leisure are other goals of man. These include clothing, Shelter, Warmth and other comforts of domestic life such as refrigerators, air conditioners, washing machine etc. In providing these materials, both living and non-living resources serve as raw materials and energy. All these are within the realm of biological sciences which make human problems to be of biological nature.

Therefore, of all the sciences, biology is perhaps the most closely associated with energy life. This gives biology a unique position among the various science subjects offered at the senior school level. Its uniqueness is underscored in the fact that every senior secondary school students must offer biology as a core subjects.

In the teaching and learning of biology the teacher and the learners are expected to adopt inquiry techniques (laboratory method). Inquiry is a process in which learners do something on their own with their own hands and their own minds. It is the art of exploring and experimenting. The emphasis is on

learner experimentation and problem solving activities, the goal of which is to make learners autonomous individuals capable of coping with demands of life. This demands for practical activities at all stages of biology teaching to enable students to acquire and master practical skills and experiences. This is in line with modern education thinking and practices which places great emphasis on the value of experience in the education process.

Experience for the learner means having him/her to see, hear, touch, test, make, try and do. This is because what is seen, heard, touched, tested and smelled forms an experience that leads to permanent learning. Learning achieved through practice could be both mental and physical. Practice requires that relevant facilities are used to perform various activities. According to Bajah (1984), certain basic infrastructure must be available for teachers to teach effectively and for learners to be engaged in useful scientific activities. This underscores the need for appropriate selection, effective use and maintenance of teaching-learning facilities.

2. CONCEPTUAL FRAMEWORK

1) The Science Laboratory

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 etc.

On the importance of facilities in learning, Egwu (2008) reported that materials whether standard or improvised are the backbone of experimental work. Dangbin (2008) also reported 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 etc.

All science laboratories have certain general features and requirements in addition to which each separate science has its own special demand which requires a special laboratory and facilities. For example all modern laboratories need to have a preparation room with storage facilities and shelves for chemicals, tools as well as work benches for the preparation of solutions. They must have sufficient space for free movement. According to Ekundayo (2009) effective learning takes place in environment where learners are free to move around without fear of collapse of building or being injured by broken down facilities. Also there must be adequate ventilation, water, lightening, heating and a good drainage system. On the specific requirements of each laboratory, Inyang (2006) reported that a biology laboratory requires animal rooms and green house for the preservation of special specimens or objects, balance room is necessary in chemistry laboratories for carrying out the weighing of chemicals needed in chemistry practical work, dark rooms in physics laboratories are needed for experiments which could be carried out in the dark while computer rooms are a must for mathematics laboratories.

Facilities for the teaching of biology, exists in different forms and can be obtained in a number of ways. They may be real objects that exists freely within the environment or small plants and animal collected and preserved. They could also be illustrative diagrams, Charts or models. They may be purchased, Produced or constructed by the teacher through impulsion. There are very many commercially produced models of parts of human body and other vital organs such as the heart liver, kidney etc but the teacher should produce his own since such a venture undertaken with the learners would enable them to have a close intimacy with the concept being taught.

2) Availability of Laboratory Facilities

The use of aids in teaching is of importance as they help to stimulate Learners 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 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 date etc and associated with these activities are scientific attitudes like curiosity, perseverance etc which are necessary for engaging in faithful science investigation.

However, Lawal (2006) reported that biology physical structure as well equipment are inadequate. Ajayi (2008) also reported that biology teachers in secondary schools have always lamented that among the various obstacles to effective teaching of biology practicals includes lack of laboratory space and equipment, large class and in adequate time allocation. Oludare Abiodun and Ajayi (2006) also reported that there are no enough classrooms and laboratories. Laboratories have poor facilities and equipment and that, supplies of chemicals and reagents for experiments are quiet low. Also schools lack laboratory assistance resulting in the poor maintenance and obsolete nature of laboratory facilities. Ajayi (1995) in Adepoju (2000) also reported that the quality of the products of the education system is daily depreciating due to obsolete, inadequate or even non-availability of materials.

There is a general consensus among science educators that science teaching in schools has continued to be theoretical and not practically oriented (Ihieglulem 2006, Oludare Abiodun and Emmanuel 2009) As a result of this learners do not think practically and they are not able to apply the knowledge acquired. Little encouragement is given to learners to find out things for themselves instead they are being fed with fact and dogmas. As a result of this many science classrooms are characterized by for the purpose of passing examination.(Balogun, 1985) Supporting this view Ogu (2008) reported that in most schools emphasis is more on the memorization of facts with a view to passing examination and less on the method of finding out the facts and learning to apply them. That the practice is to defer practice to few weeks to the external examination. This practice prepare the students for the examination but does not give room for any meaningful learning.

Resources are aids to learning rather than teaching, sourcing them however, is the responsibility of the teacher. Sourcing for resources makes the teachers work cumbersome as a result of which few teachers would like using them (Dangbin, 2008) That some teachers may not want to use facilities simply because they are too lazy to go for them even when they are available. Also some teachers may not want to use teaching facilities because they have been trained in the use of excessive verbalization of ideas and they are reluctant to shed the old practice. According to Lewin (2000) high institutions in Nigeria charged with the responsibility of training science teachers are increasingly turning out teachers without requisite experiences in laboratory practices. Such trained teachers usually lack the necessary competence and confidence to

conduct practical classes. Thus even when materials are within easy reach they may refuse to use them.

The condition under which many teachers functions does not engender any enthusiasm for practical work. The class size especially in urban school is getting larger. According to Chika (2010) there is a general increase in the environment of students who study biology without a corresponding increase in school facilities. Adebayo (2000) had earlier reported that the population of student has continue to grow every year at the expense of available physical facilities for their use that government has failed to expand or put in place new facilities thereby making the exciting facilities to be over-utilized because of the pressure on them. Supporting this view Lewin (2000) reported that the importance attached to laboratory activities does not match government provision of laboratory materials and equipment possibly due to the condition of the national economy which continue to deteriorate. Justifying this Clain Lewin (2000) noted that in most states governments have given up the hope of adequate equipping all schools with science facilities. Instead they have resorted to designating selected schools as "science schools" which they equip with their mega resources. Another related problem is the practice in which teachers are not involved in the planning and procurement of relevant instructional facilities for use in schools. According to Uyoata (2006) truckloads of items some of which are so strange and not related to the contents of the science cumculum are imposed on the teachers. Such materials are packed away where they collect dust for years which leads to malfunctioning of such facilities. They may lie waste because the teacher does not know how to use. And when they are faulty the replacement parts are hardly available.

3) The Science Teacher

The teacher is the most important resource in the teaching-learning process. This is because it is the teacher who harnest all other resources and put them to use. The teacher does not only disseminate knowledge but also create and generate new knowledge. The teacher does not only manage physical environment for teaching and learners but also sees to the management of the psychological environment of the learners. Redi and Watternberg (1951) in Adeyinka (1981) summarized the role of teachers thus:

The classroom teacher is among other things the representatives of the society inculcating moral concepts, the judge giving marks and rating; a resource centre processing knowledge and skills, a helper providing guidance for pupils activities, a referee settling disputes among his pupils, a detective discovering rule-breakers, an object of identification processing traits which children imitates; a group leader establishing the climate of the group; a parent giving [f] attention to the younger ones as a parent would normally do; a friend and confident , establishing and sharing confidences with them and an object of affection meeting the psychological needs of the children.

The science teacher needs to possess all these traits, in addition he should be resourceful and creative for efficient execution of his task. He must master a vast arrays of skills which include practical, minds-on, hands-on skills. He must be thoughtful in

the selection and use of teaching- learning facilities. According to Ajaja (2008) effective teaching and learning of science require a lot of resources among which are well trained science teachers, science facilities such as laboratories, reagents, chemicals, equipments, models and teaching aids among others. Azare (2007) also reported that teachers are the most vital tool via which school can transform students. That the success at attainment of pre-planned educational goals and objectives depends to a great extent on how sufficient and qualitative the resources sourced are supplied. Adepoju (2000) have earlier reported that the most effective ways to bring about curriculum change, teaching improvement, quality instruction and efficient internal and external operations of the school system is through adequate and highly competent and qualified teachers.

However, Eze (2006) has identified scarcity of qualified science teachers and incompetence on the part of the few available science teachers as among the reasons for poor performance of students in external examinations in Nigeria. Combs (1965) in Adepoju (2000) also reported that the most acute shortage of well qualified teachers have cropped up in the science, mathematics and various technical fields where overall manpower shortages also have been greatest.

Science teaching is getting more complex, sophisticated and challenging. In this regard there is the need for more competent and effective teachers who can make appropriate choice of effective teaching methods and effective use of available instructional materials to develop in the learners the mental attributes of the scientist, technologists and technician. While the procurement and distribution of equipment and facilities may not be the sole responsibility of the science teacher, ensuring that such facilities are available in the required number, maintaining them against destruction and dilapidation by keeping them always in good condition so that they can be put to use when required is within the direct control of the science teacher. Thus the science teacher needs to be not only creative and resourceful but also maintenance of science teaching-learning facilities, Utilization of laboratory facilities.

4) Utilization of Laboratory Facilities

The process of managing and organizing resources for teaching and learning is referred to as resource utilization (Lewin 2000) Resources utilization has to do with the extent to when facilities are provided to schools, these are three possibilities, they are either used effective 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 under utilized. When there is so much pressure on the use of an 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, Lewin (2000) however reported that science facilities are only important when they are used.

Similarly Awoniyo (1999) reported that the availability of resource input into the education system has no value for achieving educational objectives if they are not actually.

One of the major problems facing the teaching and learning of science is connected with the management of available resources (Ogunleye, 2003) movement of resources requires the science teacher himself be resourceful and creative and be careful in handling and using available facilities are handled cautiously especially the fragile ones. This is necessary because once the facilities are misused they cannot offer the best service required.

5) Maintenance of Facilities

The process in which good care is taken of tools and equipment to prolong their life span is referred to as maintenance. It involves all activities put in place to keep and restore the condition of facilities. Momoh and Onjewu (2006) define maintenance as any action or group of action taken to keep a facility in good working conclusion for as long as possible. When activities such as repairs, servicing, greasing etc are put in place to keep or restore the component of an item, the item is being maintained.

Laboratory equipment and facilities must be adequately taken care of in order to ensure their normal working conditions. Maintenance prevents deterioration and also weeds out obsolete items which no longer serve the required function. Momoh and Onjewu (2006) identified the followings as objectives of maintenance of facilities:-
-To ensure that facilities are always available to provide services to for maximum benefits to staff and students.
-To ensure operational readiness of facilities for continuous service so as to reduce losses which may result from down time.
- To protect operating personnel and save facilities
- To extend the use of the facility for maximum benefit. Maintenances could be routine ongoing activities such as daily or weekly cleaning of the laboratory equipment and facilities, it could be periodic activities such as inspection and lubrication of parts of equipment to ensure continued working condition or corrective maintenance which include activities carried out to fix back a failed equipment or facility maintenance also involves the security of the equipment and facilities. Security here covers protection from physical damage from pests, fire, rain etc. It also pertains to protection from theft or unauthorized use.

Teachers should not wait for an equipment to breakdown completely before it is serviced. Report of the need for repairs or replacement of equipment must be made to school authority with the view to making immediate arrangement for the repairs and maintenance to avoid waste and depreciation.

However it has been reported that one of the major problems facing the teaching and learning of science is connected with the management of available resources (Ogunleye, 2003) that inability to appropriately manage resource in the laboratory is a sign of poor management. Kalat (2006) also reported poor maintenance culture among teachers. That outright hostility,

manhandling, inferior texture, weathering, over use etc are among the factors inhibiting proper management of facilities. Moses (2006) reported that maintenance culture is very poor in Nigerian schools, homes, offices and industries. That facilities and equipment are laying waste due to breakdown, some are forced to breakdown by dust and cobwebs due to negligence and lack of care.

3. STATEMENT OF THE PROBLEM

The unique position of biology among other secondary schools science subjects demand that it's teaching should be practical. This can only be possible with adequate equipment and facilities which make up the learning environment. Teaching-learning facilities supplement written and spoken words, they also give clarity and concreteness to instruction. However, Ogu (2008) has reported that most school laboratories are empty or filled with inadequate, obsolete and damaged laboratory facilities. This study aimed at finding out the level of availability, extend of use and maintenance of biology laboratory facilities in secondary schools in Sokoto state.

4. RESEARCH QUESTIONS

The following questions were raised to give this study.

1. What type of laboratories are available in secondary schools in Sokoto state

2. Are there adequate facilities for the teaching of biology in secondary schools in Sokoto.

3. Are the available facilities adequately utilized by biology teachers in Sokoto state?

4. Are the available facilities regularly maintained by the biology teachers in secondary schools in Sokoto state?

5. METHODOLOGY

Descriptive design was adopted for the study. Five senior secondary schools were selected from each of the six zonal education offices in the state using stratified sampling technique. A total of 30 senior secondary schools with 30 biology teachers one from each of the schools were sampled far this study.

6. INSTRUMENTATION

An observation schedule with a check list of 30 items was used in collecting data for this study. The researcher visited each of the schools twice. On the first visit, the available laboratories and the facilities in them were observed. On the second visit the biology teachers were observed while teaching. Data collected were analyzed using descriptive statistics.

FINDINGS Research Question 1

What type of laboratories are available in secondary schools in Sokoto State.

Table 1: Types of Laboratories Available in secondary schools in Sokoto State.

SN	Types of Laboratory	Frequency	Percentage
1.	General laboratory	11	36.66%
2.	Special biology laboratory	06	20.66%
3.	No Laboratory	13	43.33%

Table I shows the type of laboratories available in Secondary Schools, Sokoto State from the table it could be observed that 36.66% of school have one general laboratory, 20.66% have special laboratory for each of the sciences while 43.33% have no laboratory at all.

Research Question 2

Are there adequate facilities for the teaching of biology in Secondary School laboratories in Sokoto State? To determine the adequacy of laboratory facilities the following criteria was adopted:-

1.1 (One facility per student) -Adequate
1.10 (One facility per ten students) - Fairly adequate
1.10 (One facility for more than ten students) - Inadequate

Table 2: Adequacy of facilities in the laboratory

	Frequency	Percentage
Adequate	03	10.00
Fairly Adequate	07	23.33
Inadequate	20	66.66

From table 2 it could be observed that only 10% of all the schools in Sokoto state have adequate laboratory facilities.

66.66% of the aboratories have inadequate laboratory facilities while 23.33% are fairly equipped

Table 3: Facility availability and utilization in Biology Laboratories in Sokot state

		Frequency	Percentage
1.	Availability	11	36.66%
2.	Not available	19	63.33%
3.	No. in good condition	07	23.33%
4.	No. in use	07	23.33%

Table 3 depicts the availability and level of utilization of facilities in biology laboratories in secondary schools in Sokoto state. Out of the 30 laboratories observed only 11 have some facilities in them that is 36.66%, the remaining 19 (63.33%) laboratories have no facilities in them of the 11 items available only 7 (23.33%) are in good condition that they could be used in the teaching of biology.

Research Question 4

Are the available facilities regularly maintained by the biology teachers in secondary schools in Sokoto State?

From physical observation the following were discovered;

1. Most schools have no laboratories where they exist they are poorly equipped and poorly maintained.
2. Lack of water and electricity in all the laboratories observed.
3. Teacher's reluctance and inability to conduct practical lessons.
4. Some facilities are locked up in the store or in the principal's office for security reasons.
5. Poor maintenance culture was also observed some broken down facilities are left in the laboratory where they constitute a threat to free movement of students.

7. DISCUSSION OF FINDINGS

The Study discovered that there are very few schools with special laboratories for each of the science subjects. Instead one general laboratory is available for all the core science subjects (Chemistry, Physics and biology) where the laboratories exists they lack basic requirements they lack water and electricity for the conduct of practical. The laboratories are poorly equipped and poorly maintained. This finding supported Ajayi (2008) which reported that school laboratories have inadequate infrastructure, most of the equipment are broken down and are too old for modern science teaching and learning. And because of the age of the equipment spare parts for their replacement are no longer available. Ogu (2008) also discovered that school laboratories are empty or filled with inadequate, obsolete and damaged facilities. Biology teacher were also found to be reluctant in conducting practical even where some facilities were available. They also show nonchalant attitude towards effecting minor repairs on some of the facilities that indicated a general poor maintenance culture among biology teachers in Sokoto State.

8. CONCLUSION

Based on the findings of this study, it was concluded that biology laboratories in Sokoto state have inadequate facilities, the few available ones are not optimally utilized and a lot of facilities are laying waste due to negligence and lack of care.

RECOMMENDATIONS

Based on the findings of this study the following recommendations are made.

1. All science laboratories should be well equipped with relevant, and modern facilities for effective teaching and learning. Biology teachers should improvise where standard facilities are not available using local materials.
2. Biology teachers should make the best use of available facilities to enable learners make use of more than one sense in learning for better retention of knowledge.
3. Biology teachers should develop a more positive maintenance culture to ensure longer life span of available equipment and facilities.

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