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Research Paper Biology

Biology Laboratory Material Resources Utilization in Colleges of Education: Implications for Curriculum Delivery in Nigerian Secondary Schools

Nwagbo Chinwe Department of Science Education, University of Nigeria, Nsukka.

Chilee Gloria Department of Science Education, University of Nigeria, Nsukka.

ABSTRACT

The study examined the utilization of biology labora-tory material resources in Colleges of Education (COE) and its implications for curriculum delivery in Nigerian secondary schools. Descriptive survey re-search design was adopted for the study. A sample of 406 persons was randomly drawn from a population of 2023 persons. Two researcher-developed instruments were used for data collection. Data were analysed us-ing mean and standard deviation. The findings of the study revealed that majority of the easily available and less expensive materials such as textbooks and chats were utilized to a great extent while some expensive biology material resources such as computers and overhead projectors were utilized to a low extent. Some factors constraining the utilization of modern laboratory material resources and their implications for curriculum delivery were also highlighted, based on which some recommendations were proffered which include that adequate funding of colleges of Education and ICT training of COE teachers.

KEYWORDS: Biology, Laboratory, Resources, Material, Utilization

Introduction

Science education is a veritable tool for scientific and technological advancement of any nation. This fact is enshrined in the national policy on education (Federal Republic of Nigeria (FRN), 2004), which states that science education should among other things equip students to live effectively in the modern age of science and technology. To achieve this, resources for science and technology teaching and learning must be adequately provided for and judiciously utilized in educational institutions such as Colleges of Education (COE), where teachers of basic and secondary levels of education are trained. Colleges of education are among the institutions legally authorized to train teachers and award Nigeria Certificate in Education (NCE) to qualified students. The National Policy on Education stated that, the minimum qualification for entry into the teaching profession shall be the Nigeria Certificate in Education (NCE).

By implication, NCE holders are to teach in primary, junior or senior secondary schools, depending on their course of study. Teaching cannot be effectively done without the necessary instructional resources. Resources according to Umeh (2006) mean something that can be used to enhance or improve educational programmes and promote teaching and learning. Biology laboratory resources can be human or material. The human resources has to do with personnel such as lecturers/teachers, laboratory technologist/assistants and students. The biology laboratory material resources are those materials available to the biology teacher for teaching and learning. For the purpose of this study, only the laboratory material resources would be surveyed. They include textbooks, computers, thermometers, fire extinguishers, first aid kits, oven, incubators, chalkboards, model/mock-ups, television, radio and other projected and non-projected devices. The main purpose of the utilization of material resources is to improve the quality of teaching and learning, thereby helping to actualize the objectives of the biology curriculum.

The Biology Curriculum for Secondary Schools as outlined in the 2008 curriculum document, is designed to prepare students to acquire: (1) Adequate laboratory and field skills in biology. (2) Meaningful and relevant knowledge in biology. (3) Ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture. (4) Reasonable and functional scientific attitude (Federal Ministry of Education, (FME), 2009). In pursuance of the above stated objectives, the content and context of the curriculum places emphases on field studies, guided discovery, laboratory techniques and skills along with conceptual thinking. The curriculum is intended to provide a modern biology course as well as meet the needs of the learner and the society through relevant and functionality in its contents, methods, processes and applications. The use of these material resources in teaching offers students the opportunity to develop scientific skill such as observation, objectivity, creativity, communication, and critical thinking among others. Despite the expected benefits of utilizing material resources in the teaching/learning process, there has been consistent failure in students' performance in biology of the West African Senior School Certificate Examination in biology in Nigeria (Umeh, 2006). The failure has been attributed to under-utilization of some material resources in teacher training institutions. Umeh (2006) is of the view that audio visual aids such as television, computers and projectors are not utilized in schools due to lack of knowledge on the proper use of such resources for teaching. Jatua and Jatau (2008) expressed the view that material resources utilized by teachers in teaching science (biology) were textbooks, chemicals, charts, microscopes, chalkboards and flasks which are cheap and have wider applicability in the teaching and learning of biology in schools. Onyeji (2003) had earlier reported that none of these new media is available, accessible or used in communicating Science, Technology and Mathematics (STM) in secondary schools. From the research findings, biology teachers agree that lack of skills/competencies required for resources use, insufficient period for practical work, inadequate laboratory and instructional materials, heavy teaching loads and large class size are the biggest factors hindering the use of resources in teaching biology. Imogie (2010) attributed the problem to increase in students' enrolment into science subjects (especially biology) which makes the available resources to be grossly insufficient for any meaningful activity-based learning. If undergraduate teachers in colleges of education are not trained using the modern biology laboratory resources, poor performance of biology student in secondary schools will continue, since these NCE teachers cannot give what they do not have.

The purpose of the study is to determine the extent of utilization of biology laboratory materials in Colleges of Education in South Eastern Nigeria.

Research Questions

The following research questions guided the study:

1) To what extent are biology laboratory material resources utilized in Colleges of Education (COEs) in South Eastern Nigeria?
2) What are the constraints to effective utilization of biology laboratory material resources in COEs in South Eastern Nigeria?

Research Method

The design of the study is descriptive survey. The study was conducted in south eastern Nigeria and targeted Colleges of Education (COE). There are five states in south eastern Nigeria, with seven public colleges of education: three federal and four states owned. Purposive random sampling technique was adopted in selecting two out of the five states, based on the availability of both state and federal colleges of education. Two federal and two state-owned COE were used for the study. The population is made up of 2023 persons (1932 students, 79 lecturers and 12 laboratory technologists/assistant). The sample consists of 406 persons (359 students, 41 lecturers and 6 laboratory technologists/assistants). Only final year (300 level) COE students were used for the study. Two researcher-made instruments namely: Biology Laboratory Resources Utilization Scale (BLRUS) and Biology Resources Utilization

Constraints Assessment Inventory (BRUCAI) were used for data collection. BLRUS is a 46 item instrument (abridge in table 1) while BRUCAI consists of 28 items (abridged in table 2). The instruments were validated using four experts from science education. The reliability coefficients of the instruments were established using Cronbach Alpha (BLRUS: 0.91; BRUCAI: 0.92). The students' questionnaires for the study were distributed by the researchers and two research assistants. The completed questionnaires were collected back on the same day. Data collected were analysed using mean and standard deviation. Details of tables 1&2 are in appendices A&B.

Results and Discussions

The results obtained from the analysed data were presented in Tables 1&2 according to the research questions.

Data in Table 1 show the extent to which biology laboratory material resources are utilized in colleges of education. Items with mean scores of 2.50 and above are regarded as being utilized to a great extent (UGE) while items with mean scores below 2.50 are regarded as being utilized to a low extent (ULE). From the results, most of the materials utilized to a great extent, such as chalkboard, textbooks, models and flasks and so on, are cheap and could easily be accessed. Among those laboratory material resources utilized to a low extent are the new technological equipments like the overhead projectors, computers and video taped instructions, which are quite expensive and more difficult to manipulate.

Table 1: Mean and Standard Deviation of Respondents on the Biology Laboratory Resources Utilization Scale (BLRUS)

S/No	Biology Laboratory Material Resources	Mean ($\bar{x}$)	Std. Dev. (δ)	Dec.
1	Chalkboards	3.00	1.02	UGE
2	Map	2.25	1.05	ULE
3	Textbooks	2.61	1.05	UGE
3	Models	3.14	1.16	UGE
4	Overhead Projectors	1.55	.74	ULE
5	Videotaped instruction	1.52	.77	ULE
6	Real objects	2.38	1.16	ULE
7	Computers	2.10	1.09	ULE
8	Whiteboard	2.83	1.13	UGE
9	Chemicals	3.40	1.00	UGE
10	Microscopes	2.75	1.06	UGE
11	Flasks	2.79	1.10	UGE
12	Dessicator	1.85	1.02	ULE
13	Text tubes	3.06	1.09	UGE
14	Thermometers	2.54	1.04	UGE
15	Incubator	2.07	1.05	ULE
16	Stove	2.48	1.07	ULE
17	First aid box	2.51	1.02	UGE
18	Water baths	2.55	1.02	UGE
19	Centrifuges	2.03	1.04	ULE
20	Refrigerators/freezers	2.08	1.13	ULE

Std. Dev. =Standard Deviation (δ); UGE=Utilized to a great extent; ULE=Unutilized to a low extent; Dec = Decision.

Some of the COE teachers may not have been trained on their usage for curriculum delivery, hence they resort to using the ones they are familiar with. These results agree with the findings of other researchers (Jatau and Jatau,2008; Umeh, 2006 and Onyeji, 2003) whose results reveal that most of biology laboratory material resources utilized in colleges of education are the ones that are less expensive, easy to use and are readily available. These results also indicated that most of the rarely utilized biology laboratory material resources such as computers and projectors are the new technological resources that are expensive and more difficult to manipulate. This they attributed to lack of knowledge, lack of infrastructural facilities, lack of accessibility and low/restricted applicability of these resources in the teaching of biology in colleges of education. Umeh (2006) noted that the use of educational television and computer CD- Rom to teach aspects of Ecology and Genetics can be very effective for conventional teaching in biology. Also, the use of TV and Video films can be very formidable especially for teaching biological concepts where practical field trips and demonstrations are difficult to embark on.

Furthermore, students in colleges of Education are not left out of the laboratory material resource utilization problem. Nwankwo, Onuselogu & Uzoechina (2011) reported from their study that students do not make effective use of biology laboratory resources because they are inadequate. Oladipo (2008) had earlier noted that students procure personalized dissecting sets or even computers, for use after laboratory activities, instead of waiting for the limited number of departmental dissecting sets or desk-top computers. The problems are still with us today and are instrumental to non-achievement of biology curriculum objectives in Colleges of Education in Nigeria.

For research question 2, items on Table 2, with mean scores of 3.50 and above were regarded as constituting constraint to a Very Great Extent (CVGE); items with mean scores of 2.50-3.49 were regarded as constituting constrained to a Great Extent (CGE); while items with mean scores below 2.50 were regarded as constituting constrained to a Moderate Extent (CME). Data in Table 2 reveal some of the constraints to utilization of some of the biology laboratory material resources in COEs which will hinder biology curriculum delivery in senior secondary schools. All the respondents agreed that insufficient fund and inadequacy in the quantity and quality of resources in the colleges constrained the utilization of material resources at a very great extent. From the remaining items considered, lack of security services and ignorance on proper use of materials constrained utilization of the resources to a moderate extent while others like: over populated classes, lack of infrastructure and short periods allotted to biology classes, constrained utilization to a great extent. The above result agrees with the findings of other researchers (Imogie, 2010; Umeh, 2006 and Onyeji, 2003), who found out that lack of fund, ignorance on proper use of resources; overpopulated classes and lack of infrastructure among others, hindered effective utilization of biology laboratory resources in colleges of education in Nigeria. These results are not surprising since Nigeria is still grappling with the issue of poor funding in educational systems. Moreover, majority of the COE lecturers are not originally trained using the modern technologies. They are more likely to teach the way they were taught. This calls for the urgent need for inservice retraining of the teacher trainers using modern laboratory equipments.

Table 2: Mean and Standard Deviation of Respondents on the Biology Resources Utilization Constraints Assessment Inventory (BRUCAI)

S/No	Constraints to Biology Laboratory Material Resources	Mean ($\bar{x}$)	Std. Dev. (δ)	Dec
1	Over populated classes	3.28	1.00	CGE
2	Insufficient fund	3.57	.77	CVGE
3	Lack of infrastructure	3.33	.93	CGE
4	Inadequacy in quantity and quality of resources	3.60	.78	CVGE
5	Short time/periods for biology classes	2.99	1.02	CGE
6	No separate time for biology practicals	3.07	1.03	CGE
7	Ignorance on proper use of materials	2.39	.99	CME
8	Lack of specious and well ventilated laboratory	3.43	.83	CGE
9	Lack of storage facilities	3.23	1.07	CGE
10	Lack of security services	2.46	.99	CME

Keys: Std. Dev. = Standard Deviation (δ); CVGE= Constrained to a Very Great Extent; CGE = Constrained to a Great Extent; ME= Constrained to a Moderate Extent.

Implications of the Findings for Biology Curriculum Delivery in Nigeria

The following implications were drawn based on the finding of the study:

- The utilization of the available biology laboratory resources by COE lecturers for curriculum delivery implies that future COE graduate teachers are likely to use them for teaching biology in secondary

schools. This invariably would engender activity-based learning which enhances achievement in biology.

- The low utilization of the modern technology equipments as a result of lecturers' lack of knowledge and skill in utilization of ICT will result to production of teachers that would not be able to use modern technologies for curriculum delivery in their schools, thereby depriving the students of the joy and excitement of the 21st century new technologies.
- Insufficient fund as a major constraint to use of laboratory resources has implication for procurement of unavailable laboratory resources, thereby perpetuating the dearth of modern laboratory equipments.
- Short periods allotted to biology lessons will lead to non-integration of ICT into the school schedule, invariably leading to non-utilization and non-compliance to the new pedagogical strategies.

Recommendations

Based on the above implications, the following recommendations were proffered:

- Federal and State government should organize training workshop for teacher educators on the use of modern technologies for curriculum delivery through their ministries of Education
- Colleges of Education should be adequately funded by the government and priority given for the procurement of modern laboratory equipment.
- More periods should be allocated to biology per week in order to accommodate both practical and integration of ICT for curriculum delivery.

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