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Challenges of Teaching Basic Science and Technology (BST) in Anambra State Public Schools

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CHALLENGES OF TEACHING BASIC SCIENCE AND TECHNOLOGY (BST) IN ANAMBRA STATE PUBLIC SCHOOLS

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Abstract

This study investigated the challenges constraining effective teaching of Basic Science and Technology (BST) in the public schools of Anambra state. A research question guided the study which adopted a descriptive survey research design. A sample of six hundred and sixty-one (661) was composed of a population of six thousand six hundred and fifteen (6615) BST teachers in the State. Proportionate stratified random sampling technique was used. A 21-item, four-point rating Questionnaire, developed and validated by the researcher, was used for data collection. The contents of the instrument were clustered into four sections namely: Curricular Materials, Instructional Materials, Human Resources and Teaching Methodology. The instrument, with a reliability index of 0.75, was adjudged reliable and usable for the study. Data were analyzed using simple mean ratings. Results indicated among others that: BST curricula materials were adequately provided to schools (mean=2.99), instructional materials are inadequately supplied (mean=2.31), Relevant human resource was in short supply (mean=1.93) as well as Methodological shortcomings (mean=2.28). Some recommendations including that: BST laboratories and equipment should be provided in schools to complement the resources available from immediate school environment; Training and recruitment of specialist BST teachers and retraining of available teachers in science disciplines, is a sine qua non towards realizing the goals of teaching BST; Regular refresher courses are necessary to update BST teachers' skills, knowledge of the subject matter and teaching methodology, were made.

Introduction

The constitution of the Federal Republic of Nigeria (FRN, 1999) provided a justification for the establishment of the Universal Basic Education (UBE) in Nigeria when it stated that government shall direct its policy towards ensuring that there are equal and adequate educational opportunities at all levels for her citizenry. It went furthermore to state that "government shall as and when practicable provide Free, Compulsory and Universal Primary Education, Free Secondary Education." The UBE programme, therefore, covers the first nine years of formal education programme in Nigeria, ranging from the Lower Basic (first three years of primary school), Middle Basic (primary school years 4-6) and Upper Basic education (the first three years of secondary school or the junior secondary school).

The UBE as a reform programme is in response to the government's desire to attain the Millennium Development Goals (MDGs) by 2015 as well as the need to meet the critical targets of the National Economic, Empowerment and Development Strategies (NEEDS) summarized as values re-orientation, poverty eradication, job creation, wealth generation and using education to empower the people. Towards this need, the existing primary science curricula were reviewed, restructured and realigned to fit into the 9 year Basic Education. Also, fundamental concepts of the technology which hither-to was not taught in primary schools at

all, were infused to give a hybrid programme called Basic Science and Technology (BST) for lower and middle Basic Education (Nigerian Educational Research and Development Council, 2006). Similarly, the Federal Republic of Nigeria (FRN,2013) enlisted BST as one of the core subjects at Junior Secondary Schools consisting of Basic Science, Basic Technology, Information Technology and Physical and Health Education.

The general objective of BST education is to enable the learner to observe and explore the environment using their sense organs. The design of the curriculum is based on the idea of spirality of themes which are arranged from year one to year six. The thematic approach to the content organization was adopted. The major recurrent themes are:

- You and Environment
- Living and Non-living things.
- You and Technology
- You and Energy

The spiral nature of these themes ensures that content becomes gradually difficult as learners progress from primary one to six. Also, emerging issues covered:

- Value orientation
- Peace and dialogue
- Human right education
- Family life/HIV AIDS education, and
- Entrepreneurial skills were infused into the relevant contents.

For each year, the main topic is given along with performance objectives, the contents, teacher and pupils' activities, materials and evaluation guides.

In line with the general objectives of BST, the Federal Ministry Education (1992:5) outlined the specific objectives of teaching primary science (now BST) as:

(a) to enable Nigeria child to explore and observe his environment
(b) develop basic science process such as observing, manipulating, classifying, communicating, inferring, hypothesizing, interpreting data and formulating models.
(c) develop a functional knowledge of science concepts and principles
(d) explain simple natural phenomena
(e) develop scientific attitude including curiosity, critical reflection and objectivity.

Generally, BST is an attempt to provide a holistic presentation of fundamental issues of science and technology to pupils. It is designed to expose pupils to developing science and technology skills, which will assist them, make informed decisions, develop survival strategies and learn to contribute and live effectively in the global community. Given the afore-mentioned goals which BST is set to achieve, it is pertinent at this juncture to investigate the extent of attainment of these stated goals. In other words, are there impediments militating the realization of the stated goals? In specific terms: Are necessary curricular materials provided?, To what extent are trained human resource available, motivated and provided with the requisite material resources? What of the methodology of instruction adopted in teaching BST?

Since this study was aimed at identifying the challenges constraining effective teaching of BST in Nigerian public schools with particular reference to Anambra state, it was equally necessary to do some status-update on the teaching and learning of BST in schools.

The World Economic Forum (WEF) in 2015 Global Competitive Ranking (GCR) had noted that Nigeria must improve on her infrastructure which undoubtedly includes those of

Educational institutions, be it at primary, secondary or tertiary levels, for any sustainable growth through innovation (Akpan,2008). The state of school laboratories and workshops must be improved upon for meaningful teaching and learning of BST in schools.

The rationale for activity-based instructional delivery in schools cannot be over-emphasized. Science practical exercises and BST in particular, when carried out in school laboratories have been most exciting for students. Most science students look forward to days when they have science practical and could display their skills. BST teaching and learning should be activity and inquiry-based. Students should be left to find out whatever they have been taught in the classrooms on their own, the laboratory provides ample opportunity for such exploration. Students generally, are interested and enjoy practical work where their involvement is greatly valued and they can work and interact in-groups with their colleagues and get a lot of personal attention from their teacher. Science laboratory teaching and learning engenders learner-centred behaviours which are the hallmark of contemporary emphases in the classroom. It is a fertile ground in nurturing a whole lot of educational objectives be it cognitive, psychomotor or affective domain. The task of providing enabling environment for BST teaching and learning is quite enormous and requires the attention of and input from all stakeholders.

To complement government effort towards providing an enabling environment for creativity and innovation, BST teachers have the responsibility of utilizing activity-based learning techniques and improvise the unavailable instructional materials within the local environment to engender students' learning. On the part of the students, they are expected to:

i. apply BST knowledge into new situations;

ii. question all material things, objects and observed phenomena in the environment;

iii. Search for data and their meaning;

iv. demand for verification and logical reasoning;

v. be critical, creative and innovative in thinking

Evidence abounds in the literature on the constraints militating against effective teaching and learning of STEM. The WAEC Chief Examiners' Report for WASSCE, (2016) for Agricultural Science, Biology, Chemistry, Mathematics and Physics, and a summary of the NABTEB Chief Examiners' Report (2012-2017) for Technical Education which dwelt extensively on candidates' weaknesses and suggested remedies, had earlier been reported elsewhere (Anaekwe, 2019). On a general note, Aremu and Sokan cited in Tele and Gyang (2015), opined that the search for causation of students' poor academic achievement is unending. Some of the factors often put forward as responsible include, but not limited to study habits, teachers consultation, association with wrong peers, parental factors, low motivation of teachers and abstract nature of science concepts. Morakinyo (2003), attributed the poor academic performance of secondary school students to teachers' non-commitment to duty which manifests in several ways like poor attendance to lessons, lateness to school/class, unsavoury comments about students' performance that could damage their ego, poor method of teaching among others.

Although most of the available literature (Anaekwe, 2019; Nnaka and Anaekwe, 2015) centre on teaching constraints and students' under-achievement in Science, Technology, Engineering and Mathematics (STEM), at the senior secondary school level, one would not take it for granted that all is well with BST at the lower levels. Indeed, it should be better understood that

the observed under-achievement at the upper echelon of the education ladder, is a cumulative effect of deplorable conditions of teaching and learning of BST at the lower classes. For instance, the teacher quality and availability need not be compromised if the standard is to be guaranteed. A situation where Teacher Education Institutions (Colleges of Education, Faculties of Education in Universities among others) has to date, continued to train specialist Integrated Science teachers (primarily for the UBE programme), while the Curriculum of UBE (by NERDC) and FRN (2013), emphasizes BST as a core subject for the 9 years of Basic education is, to say the least deplorable. If we fail to get it right at the foundation level of instructional delivery through guaranteeing the provision of enabling environment, the envisioned superstructure may be a mirage.

The theory of functionalism was employed to further justify the relevance of this study and externalise the association between the optimal provision of the enabling environment-curricular and instructional materials, human capital, effective methodological inputs and a robust BST delivery system. Functionalism as propounded by Emile Durkheim cited in Andersen & Taylor (2005), is used in explaining that the optimal functioning of any system in human society, is dependent on the harmony existing within the constituent parts. According to Durkheim, a society /system is made up of smaller units that formed the whole and once any part is broken or removed, society/ system becomes incomplete. Hence, effective BST instructional delivery in Nigeria is realizable to the extent the requisite enabling conditions are optimally provided. By implication, the government and all stakeholders in education are challenged to provide the needed human and infrastructural facilities for the successful teaching and learning of BST in schools.

Statement of the Problem

The issue of learners' under-achievement in STEM, particularly at WAEC/NECO, organized public examinations has raised a lot of concern in the public domain (WAEC Chief Examiners Report for WASSCE, 2016). A closer study of the genesis of the problem would appear that it has a deep-rooted cause in that the foundational bases of science teaching and learning in schools may be shaky. To what extent are due attention and emphases given to BST at the primary and junior secondary schools? One would ask. The implications of allowing the declining trend of achievement in Sciences at the senior secondary level to go unabated is quite obvious. Hence the need to strive to arrest the situation. This sets the stage for investigating the Challenges of teaching BST in schools as a base for improving candidates' preparedness for better performance at senior secondary external examinations. Hence, the problem of the study was to identify the challenges militating against effective teaching and learning of BST in Anambra State public schools.

Research Question

What are the challenges facing the teaching of BST in Anambra State secondary schools?

Method

This study adopted a descriptive survey research design. The perception of the respondents on the extent to which the identified items constituted a challenge in the effective teaching and learning of BST in schools, were collated and analyzed.

The sample consisted of 661 BST teachers drawn from all the six education zones in Anambra state. The sample was proportionately drawn from each of the zones as shown in table 1:

Table 1 Population and sample of BST Teachers in their Zones:

Zones	Aguata	Awka	Nnewi	Ogodi	Onitsha	Otuocha	Total
Population	850	1064	1318	1154	1479	750	6615
Sample	85	106	132	115	148	75	661

Source: Planning, research Statistics (PRS) Unit, Anambra state Universal Basic Education Board (ASUBEB), Awka.

A 21–item Questionnaire developed by the researchers was used for data collection. The Questionnaire was serialized into 4-clusters namely: Curricular Materials, Instructional Materials, Human Resource and Teaching Methodology. The instrument was pilot tested and its reliability determined. Respondents were requested to indicate their extent of agreement or disagreement with the items thus: Strongly Agree (SA=4), Agree (AG=3), Disagree (DI=2) and Strongly Disagree (SD=1).

The Validity of the instrument was ensured through the wise counsel of experts in BST and Educational measurements and Evaluation. Similarly, the reliability of the instrument was ensured through Cronbach Alpha technique and yielded an index of 0.75 which was adjudged to be high enough and reliable for the study. This technique was deemed appropriate for determining the reliability of the instrument because the items were not dichotomously scored.

The copies of the questionnaire were administered to the respondents via a Research Assistant in each Zone. A total of 661 copies of the Questionnaire were filled and returned. The research question was answered using the mean rating. A cut-off point of 2.50 was adopted for decision making as the criterion. An item with a mean rating of 2.50 and above was accepted as facilitating the teaching of BST, while the items with a mean rating less than 2.50, were rejected. This implies that such items were considered as hindering the teaching of BST in schools.

Results

Research Question 1: What are the challenges facing the teaching of BST in Anambra State secondary schools?

Table 2: Mean ratings of Respondents on Challenges of teaching BST

S/N	A: Curricular Materials:	SA	AG	DI	SD	Mean	S.D	Remark
1.	The National Curriculum for BST is comprehensive enough for teaching and learning of the subject.	150	250	110	151	2.60	0.44	Accepted

2.	BST textbooks are provided to the pupils at no cost.	300	200	61	100	3.05	0.78	Accepted
3.	The contents of the recommended books are relevant to the Nigerian environment.	261	220	80	100	2.97	0.68	Accepted
4.	BST textbooks are provided for teachers' use at no cost.	400	200	20	41	3.45	1.11	Accepted
5.	Other recommended textbooks are available for reference purposes in the school.	200	261	100	100	2.85	0.56	Accepted
	Cluster **mean**					**2.99**	0.71	Accepted
	B: Instructional Materials							
6.	A functional study room/Library is available in my school to support teaching and learning.	20	80	361	200	1.88	0.43	Rejected
	Teachers are encouraged to improvise teaching aids	261	220	80	100	2.97	0.67	Accepted
8.	Standard laboratory for BST is available for effective teaching in my school	10	30	360	261	1.78	0.47	Rejected
9.	There is a nature corner to support teaching in my class	260	300	51	50	3.16	0.79	Accepted
10.	We have adequate standard instructional materials for teaching	20	30	361	250	1.66	0.47	Accepted
	Cluster **Mean**					**2.31**	0.57	Rejected
	C: Human Resource:							
11.	I am a specially trained BST teacher	30	20	251	360	1.58	0.31	Rejected
12.	We have an adequate number of BST teachers in schools	30	21	250	360	1.58	0.31	Rejected
13.	Teachers are encouraged to attend conferences/workshops to update knowledge.	300	200	50	111	3.04	0.79	Accepted
14.	Teachers are often sponsored for further studies to enhance their efficiency.	21	40	300	300	1.67	0.36	Rejected
15.	Science/Hazard Allowance is paid to BST teachers in the state.	21	40	380	220	1.79	0.48	Rejected
	Cluster **Mean**					**1.93**	0.45	Rejected
\	**D:Teaching Methodology:**							
16.	Excursion/field trips are often organized for the students.	160	260	100	141	2.66	0.48	Accepted
17.	I employ Discussion method in my class.	150	262	110	140	2.64	0.47	Accepted
18.	I adopt the Guided Inquiry Approach in my class	50	60	300	251	1.86	0.30	Rejected
19.	I use the lecture method in my class	250	160	100	151	2.77	0.59	*Accepted
20.	I employ a co-operative learning technique in my class instructional delivery.	40	50	321	250	1.82	0.35	Rejected
21.	ICT tools are employed in teaching BST concepts	55	55	351	200	1.95	0.39	Rejected
	Cluster Mean					**2.28**	0.52	Rejected

Discussion

The findings of this study concerning the challenges of Curricular materials are shown in cluster A of table 2. The mean ratings ranged from 2.60 to 3.45, all values, being above the cut-off point of 2.50. This implies that ample provision is made for curricular materials to

facilitate BST teaching and learning (Anaekwe, 2000; Nnaka and Anaekwe, 2015). The importance of relevant textbooks in the teaching and learning of BST cannot be over-emphasized. It is a primary reference point for instructional preparation. The teacher is expected to consult a variety of text-books to have a repertoire of knowledge to facilitate learning. The textbook also predisposes the science teacher to instil in the learners some manipulative skills. The science text-book also has great potentials for the development of the effective attributes of learning. This implies that it aids the learners in the development of their personalities, in developing open-mindedness, developing appreciation and understanding of nature and not merely stuffing their minds with facts. A good science text-book should enable the teacher to motivate the learners towards different career prospects in science as well as the academic and personality attributes needed for such careers. The contents of science text-books often contain not only the facts and theories but also the problems/challenges which are confronting the society, thereby arousing the interest in the learner in these problems. It should help in linking science with life and everyday experiences.

Indeed the Federal Government of Nigeria and particularly the National Educational Research and Development Council (NERDC) is hereby commended for living up to the standards expected of them in the area of making relevant curricular materials freely available to pupils and their teachers. Perhaps, the late arrival of the recommended BST textbooks prompted some schools to embark on the use of other texts like Science is Discovery, Illesanmi Primary Science and Integrated Science for primary schools. These could still serve as additional reference textbooks.

Furthermore, on cluster B: Instructional materials, the mean ratings ranged from 1.58 to 3.16. Apart from the challenges of the library, standard laboratory and instructional materials for BST, teachers are urged to improvise instructional materials and to sustain a nature corner in their classes. This will enhance students' interest in the subject and consequently, their performance in the subject. According to NTI-TESSA (2010:20), the teaching of BST is activity-based and may not necessarily require standard apparatus to teach it… the child's immediate environment serves as the foremost laboratory. Hence teachers are urged to be creative and improvise instructional materials when the standard ones are not available. Because there is a limit to which one could improvise and taking cognizance of the pay-packet of the teachers, the government should pay more attention to the provision of instructional materials for teaching BST. It was perhaps, in this regard that Academic Staff Union of Universities (ASUU), had continued to engage with government on, even though industrial actions, to ensure that relevant instructional materials and basic infrastructure are provided to Nigerian educational institutions, particularly the universities. Similarly, Akpan (2008) had reiterated that infrastructural provision is very critical for the improvement of the standard of science and technology education in Nigeria.

From cluster C, on Human Resource, the mean ratings ranged from 1.58 to 3.04. These values indicated that non-payment of science/hazard allowance, the paucity of specialist BST teachers, non-sponsorship of teachers to further studies hinder effective BST teaching. It is commendable that through such organs as National Teacher's Institute (NTI), Federal Ministry of Education, professional Associations as Science Teachers Association of Nigeria (STAN) etc, regular in-service and refresher courses/workshops are organized to update the professional skills and competencies of BST teaches (Akpan, 2008). Similarly, other stakeholders in education, are urged to do the same. If we would recall that no education system can rise above the quality of her teachers (Federal Republic of Nigeria FRN, 2013), then we would come to

terms with the capacity building of the BST teachers as the drivers of the classroom instructional process.

The generalist approach to primary school teaching in Nigeria is a limiting factor to enriched specialized teaching of BST in primary schools. The non- specialist teachers in an attempt to teach BST may be cheating, rather than teaching the pupils. Indeed, they lack the methodological competence to handle foundation science and technology concepts (Anaekwe and Onyeji, 2003). Another worsening dimension to this problem is the unpalatable nature of pay-packet, with minimal incentive to motivate and ginger the teachers into action. However, the recent effort by the State Government in paying some allowance to teachers of core subjects including basic sciences and English language is a step in the right direction. The government seems to forget that planning and execution of projects, field trips, improvisation of materials etc, usually demand extra-time beyond school schedules. As such some form of reinforcement may be necessary to encourage teachers' efforts, at least to take care of extra hours of duty and associated risks. Another dimension to human resource requirement need of BST instructional delivery is in the area of science laboratory/workshop attendant/assistant. This area is often very much neglected (Mbanefo, 2018). Where they are available in schools, little or no emphases is laid towards them by way of providing further training to improve their functionality.

From cluster D: Methodology, the mean ratings range from 1.82 to 2.77. From this table, the BST teachers adopt excursion and discussion in their teaching but still engages in the use of lecture method (2.77). The use of the lecture method should be discouraged because it renders the pupil inactive at this stage of their education, thereby stifling the spirit of creativity and innovation which are essential ingredients for the effective study of BST. Again, the teachers appeared unfamiliar with some innovative techniques such as cooperative learning strategy, use of ICT and guided inquiry approach which have proven to engender science teaching and learning (Nwagbo and Okoro 2012). Also, Ezeuchu (1988) advocated for the use of scientific toys/models to enable pupils to dismantle, play, reconstruct and copy such instruments, thereby imbibing basic process skills in science. In this way, a more pragmatic avenue to laying a solid foundation for BST teaching and learning would have been assured.

Conclusion

This study investigated the challenges constraining effective teaching and learning of BST in the public schools of Anambra state. A research question guided the study which adopted a descriptive survey research design. A sample of six hundred and sixty-one (661) was composed of a population of six thousand six hundred and fifteen (6615) BST teachers, spread across the educational zones of the State. Proportionate stratified random sampling technique was adopted to compose the sample. A 21-item, four-point rating Questionnaire, developed and validated by the researcher, was used for data collection. The contents of the instrument were clustered into four sections namely: Curricular Materials, Instructional Materials, Human Resources and Teaching Methodology. The instrument, with a reliability index of 0.75, determined using Cronbach Alpha technique was used to collect data for the study. Data were analyzed using simple mean ratings. Results indicated among others that: BST curricula materials were adequately provided to schools (mean=2.99), instructional materials are inadequately supplied (mean=2.31), Relevant human resource was in short supply (mean=1.93)as well as Methodological shortcomings (mean=2.28). Some recommendations including that: BST

laboratories and equipment should be provided in schools to complement the resources available from the immediate school environment for which teachers are encouraged to improvise. Based on the foregoing findings and discussions, it was concluded that attention should be paid to BST teaching and learning through taking proactive measures in providing requisite human and material resources to ensure the laying of a sound basis for scientific and technological development in Nigeria.

Recommendations

It was recommended that:

e-Libraries should be built in school and stocked with relevant BST books to enable the learners to develop reading habit well on time.

ii BST laboratories and equipment should be provided in schools to complement the resources available from the immediate school environment.

iii Training and recruitment of specialist BST teachers and retraining of available teachers in science disciplines is a sine qua non towards realizing the goals of teaching BST.

iv. Regular refresher courses are necessary to update BST teachers' skills, knowledge of the subject matter and teaching methodology

v. Scholarships should be awarded to teacher-trainees who are pursuing programmes in BST and allied fields in tertiary education as a way of salvaging the paucity of teachers in science and technology.

v. BST teachers should endeavour to improvise instructional materials to make their lessons more relevant to the learners' immediate environment

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