AVAILABILITY AND USAGE OF TECHNOLOGY-BASED MATERIALS FOR SCIENCE CURRICULUM DELIVERY: LECTURERS' PERSPECTIVES IN TERTIARY INSTITUTIONS IN TARABA STATE, NIGERIA.

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Abstract
The study investigated the availability and usage of technology-based materials for Science curriculum delivery in tertiary institutions in Taraba State. A descriptive survey research design was used. The population comprised all science lecturers in the two government-owned Universities (Federal and State) in Taraba State. The sample comprised 89 Science lecturers from two purposively selected tertiary institutions. The instrument, Availability and Usage of Technology-based Materials Questionnaire (AUTMQ) divided into three dimensions was a 36-item questionnaire structured on a 4-point Likert-type scale. The instrument was validated and the reliability coefficient of the three dimensions 0.87, 0.76 and 0.85 respectively was computed and considered good for the study. The data collected was analyzed using means and standard deviation. Results showed that most (about 60%) of the listed technology-based materials are available, but the frequency of usage was poor. The findings also revealed that majority of the respondents agreed to all the statements (such as lack of fund, electricity, computer gadgets & internet connectivity, appropriate skills to operate e-learning, amongst others) as hindrances to the utilization of technology-based materials. The results also revealed that there was no significant difference between Federal and State universities in terms of availability, usage and hindrances to the utilization of technology-based materials for science curriculum delivery. Based on the findings recommendations were made amongst which is that; Federal and State governments should provide adequate quantities of new technological devices in tertiary institutions in the State and lecturers should be trained on their usage.

Keywords: *Technology-Based Materials, Science Curriculum Delivery, Tertiary Institutions.*

Introduction

In this age of globalisation, there is an increasing demand on the Tertiary Institutions to embrace the opportunities presented by technological development. The demand in Taraba State is expanding exponentially. This increase in demand for Tertiary Institutions can be attributed to the advert of the knowledge-driven society (Katz, 2011) that is, a society that requires higher levels of skills and qualifications for employment. The old practice where a job is for life is no longer tenable as labour markets demand knowledge and skills that require regular updates. Emphasis, therefore in this computerized age is on

life-long learning and the Tertiary Institutions are expected to do this using new technologies.

To meet the changing world-wide demand for education, electronic learning (E-learning) has been adopted in the developed countries to overcome many of the barriers to Tertiary educational opportunity to a teeming population of students. There is need to appraise the extent to which science lecturers in Taraba State utilize technology-based materials in science curriculum delivery.

The new teaching and learning technology-based materials in science classrooms includes: (i)Those that are primarily used for communication between people (human to human interaction) otherwise known as communication technologies which permit communication between teachers and students such as fax, radio, teleconferencing, video-conferencing and the internet; and (ii) Those that are primarily used by individuals on their own (human to computer interaction) which are called learning resources technologies which are used to convey subject contents such as print materials, videotapes, audio tapes, television, computer-based course wares or software and CD-ROM (Compact Disk-Read Only Memory).

The teaching and learning of science subjects at the tertiary levels involves helping students to learn science, acquire problem-solving skills, develop critical thinking skills, and also helping them to know how and where to obtain needed information, develop the spirit of enquiry and above all prepare them for the process of life-long education (Inomiesa & Osakwe, 2012). To achieve these, the institutions should deploy technology-based materials in the teaching of basic sciences for maximum benefit. To keep pace with the rapid scientific and technological changes, there is urgent need to move beyond the passive learning activities that characterized lectures towards more engaged, active and investigative science lessons. It has been proven by Felder and Brent (2010) that students, irrespective of their ages, tribes or school locations are equally hungry for scientific knowledge. Information technologies ranging from videotapes and laser disks to powerful computing and communication technologies have the potential to recast the relationship between Lecturers and their students during science lessons. But, they further revealed that the challenges facing Tertiary Institutions Lecturers in ICT acquisition are poor skills, knowledge, access to the new technological devices, inability to utilize them, as well as inability to adopt different approaches to science curriculum delivery.
The use of these technology-based materials (TBTM) fosters positive attitude towards the study of sciences and enhances achievement in sciences. There is need to appraise the extent of the availability and utilization of these technology-based materials for science curriculum delivery in Tertiary Institutions in Taraba State. Technology-based teaching materials (TBTM) also known as Information Communication Technology in Education (ICTE) is a technology trend that has brought education and the world at large into a global village. The media and telecommunications which has revolutionized the economy, business, industry, politics and education. The

TBTM uses various information superhighway namely: the internet. Intranet and extranet to function. The TBTM is a science of information that uses the computer and multi-electronic resources in collecting, processing, storing, retrieving and transmitting or disseminating information to any part of the world (Nwana, Ofoegbu & Egbe, 2017). TBTM has permeated virtually all major aspects of human endeavour and it has crept into the educational system and created great impact in the science curriculum.

TBTM has been considered a priority in global education and Nigeria is not left out. The Federal government of Nigeria in the National Policy on Education (FRN,

Revised 2014) recognizes TBTM as a product of technological change and as an innovation in education . It is in this view that Computer Education was introduced as an integral part of TBTM in the Nigerian educational system (Nwana, Ofoegbu & Egbe, 2017) which main purpose was for acquisition of computer literacy and skills that are needed in all facets of human life in the 215t century. Hartley, (2007) aptly pointed out that, the new curriculum is TBTM - driven with emphasis on practical, concrete and hands - on experiences since its emphasis on creative thinking among others. Also, Jegede, and Owolabi, (2018) remarked that both the teachers and the students would achieve better curriculum outcomes with the use of TBTM resources. The need for availability and utilization of TBTM resources in teaching-learning situations is on the increase. The government has made effort towards the building of TBTM facilities and procurement of TBTM resources for various schools and colleges. The study carried out by Etiubon (2014) opined that availability of functional laboratory promotes students' participation during laboratory activities which in turn enables them identify problems, pose relevant questions, perform experiment, make judgement on alternative hypothesis and interpretation of data. Students, therefore, learn to discover, learn from discovery and learn by discovery when exposed to the use of educational technology laboratory. Hence, Dynarski, Agodini, Heaviside, Novak, Carey, Campuzano, Means, Murphy, Penuel, Javitz, Emery and Sussex (2017) reported that there are major differences in the use of educational technology to teach and traditional teaching method in class. Itighise, (2016) discovered in the survey of resources for the teaching and learning of biology in some new institutions that out of 80% of the old school that had laboratories, none had a well-equipped science laboratory. About 40% of the schools had no laboratory at all, while the remaining 60% had room labelled laboratory but without adequate apparatus. Another finding by Itighise (2016) also showed that lecturers do not make adequate use of interactive whiteboard available in educational technology laboratory for instructional delivery.

For some years now, Taraba State Government have found it increasingly difficult to fund Tertiary Institutions adequately. Over the years Tertiary Institutions in Taraba State has grown quantitatively as there has been astronomical increase in the number of Tertiary Institutions in Taraba State from

three (3) in 1999 to six (6) in 2011. This rapid growth in number of Tertiary Institution causing serious financial demands on the state economy as it entails greater funding of Tertiary Institutions by both Federal and State Governments. Also, research reports by Dabalen, Oni and Adekola (2000) on the labour market prospects of Tertiary Institution graduates show that employers of labour are unwilling to recruit Nigerian graduates for the following reasons: a) The graduates are poorly trained as such and unproductive on their jobs; b) The graduates are unskilled, not computer literate and lack skills in operating most technological devices; and c) The graduates lack oral and written communication skills.

The inappropriate knowledge and skills among Tertiary Institution graduates have contributed to graduate unemployment in Taraba State. These deficiencies in skills acquisition among Nigerian graduates could be attributed to poor quality of education and poor exposure of these science graduates to innovative information and communication technology (ICT). Also, the low achievement in science and science education courses in the universities could also be attributed to traditional teaching mode that promotes activeness of teachers and passiveness of learners who perceive learning content with just the auditory mode.The need for adoption of innovative teaching using Technology-based materials becomes imperative in this 21st century where ICT has made the world a global village. The purpose of the study therefore is to assess the availability, usage and hindrances to utilization of Technology-Based materials for science curriculum delivery in Taraba State tertiary institutions.

The following research questions were raised to guide the study,

i. To what extent are technology-based materials available to science Lecturers in Taraba state Tertiary Institutions for science curriculum delivery?
ii. To what extent are technology-based materials used by science Lecturers in Taraba State Tertiary Institutions for science curriculum delivery?
iii. What are the hindrances to the usage of technology-based materials for science curriculum delivery by science Lecturers in Tertiary Institutions in Taraba state?
iv. Is there any significant difference between Science Lecturers in Federal and State Universities in the availability, usage and hindrances to the utilization of technology-based materials for science curriculum delivery?

Methodology

The study was a descriptive survey design, which was carried out in both Federal and State Tertiary Institutions in Taraba State. The population comprised all science Lecturers in the Tertiary Institutions in Taraba State. The sample consisted of 47 Lecturers from the two Universities in Taraba State, 42 Lecturers from other Tertiary Institutions in Taraba State. The purpose of the study and research questions guided the researchers. The instrument for data collection was a 36-item questionnaire structured on a 4 - point Likert-type scale developed by the researchers. The questionnaire was Strongly Agree 4, Agree 3, Disagree 2 and Strongly Disagree 1.

In testing the questionnaires validity, a content and face validity was done by experts (arbitrators) in the field of science education outside this study after it was scrutinized and corrected, how well the different items in a single dimension combine to measure the same thing. In testing the reliability of the instrument, Alpha (Cronbach) coefficients were calculated for the components of each measurement scale to verify internal consistency. The internal consistency estimates for every component of each dimension (i. Availability of Technology-based materials, ii. Usage of Technology-based materials, and iii. Hindrances to the usage of Technology-based materials) with reliability indexes of 0.87, 0.76 and 0.85 respectively; which were considered good for the study. The data collected were analyzed using means and standard deviation in answering the research questions. The cut off mean of 2.50 was considered as the acceptable level for availability, usage and hindrances to the usage of Technology-based materials for Science curriculum delivery.

Results

The results were presented according to research questions on Tables 1,2 and 3.

Table 1: Mean responses and Standard Deviation (SD) of Respondents on the Availability of Technology-based materials for Science Curriculum Delivery

S/N	Availability of New Technological Resources Items	Universities			
		Federal		State	
		Mean	SD	Mean	SD
1	Print materials & E- books	3.30	0.98	3.10	1.10
2	Overhead projector	2.55	0.87	2.56	0.94
3	Digital Video Disc (DVD)	1.84	0.37	1.76	0.35
4	Interactive CD-ROM	2.21	0.66	2.37	0.62
5	Models	2.82	0.74	2.80	0.81
6	Marker & Electronic Board	3.20	0.88	3.41	0.77
7	Course-Ware Templates	2.89	0.76	2.79	0.59
8	Computer	3.27	0.80	3.21	0.85
9	Internet connectivity	1.99	0.41	1.89	0.38
10	Flash memories	2.95	0.79	2.91	0.72
11	Slide & Multimedia projectors	1.95	0.45	1.88	0.35
12	On-line educational tools	1.71	0.31	1.97	0.33
13	Printer	2.64	0.99	2.55	0.82
14	Audio and Video discs (CDs)	2.94	0.62	2.52	0.51
15	Computer software programmes	2.00	0.52	1.96	0.43
	Grand mean	**2.53**		**2.58**	
	Weighted mean=2.56				

Table 1 shows that items 1,2,5.6.7,8,10,13 and 14 have mean scores above the cut off mean of 2.50 which is the acceptable level for availability. This means that only 60% of these technological resources are available to a large extent (Weighted mean=2.56); while the other items (3,4,9,11,12&15) have mean scores below the cutoff point of 2.50. This indicates that these technological resources (Print materials & E-books. Overhead projector. Models, Marker & Electronic board. Course-ware templates, Computer, Flash memories. Printer, and Audio & video discs) are available to a large extent for science curriculum delivery in the Tertiary Institutions (universities) in Taraba State. Also, result in Table 1 showed that the mean difference between the Federal (Grand mean=2.53) and State (Grand mean=2.58) universities in the availability of technology-based materials for Science curriculum delivery is 0.05 which is quite negligible or insignificant.

Table 2: Mean responses and Standard Deviation of Respondents on the Extent of Utilization of Technology-based materials for Science Curriculum Delivery

S/N	Extent of Utilization of New Tehcnological Resources Items	Universities			
		Federal		State	
		Mean	SD	Mean	SD
16	Print materials & E- books	3.21	0.61	3.05	0.72
17	Overhead projector	2.51	0.56	2.50	0.57
18	Digital Video Disc (DVD)	1.76	0.34	1.84	0.31
19	Interactive CD-ROM	1.54	0.56	1.99	0.27
20	Models	2.72	0.51	2.75	0.54
21	Marker & Electronic Board	3.00	0.73	3.14	0.78
22	Course-Ware Templates	2.86	0.54	2.76	0.59
23	Computer	3.20	0.61	3.23	0.62
24	Internet connectivity	2.46	0.57	1.73	0.55
25	Flash memories	2.54	0.54	2.65	0.51
26	Slide & Multimedia projectors	1.81	0.38	1.57	0.31
27	On-line educational tools	1.64	0.41	1.95	0.54
28	Printer	2.84	0.66	2.79	0.63
29	Audio and Video discs (CDs)	2.67	0.55	2.50	0.50
30	Computer software programmes	2.02	0.47	1.91	0.41
	Grand mean	**2.45**		**2.42**	
	Weighted Mean= 2.44				

From Table 2, the mean rating of item 16,17,20,21,22,23, 25,28 and 29 is above 2.50; while the other items (18,19,24,26,27, & 30) have mean scores below the cut-off point of 2.50. This indicates that these technological resources (Print materials & E-books, Overhead projector, Models, Marker & Electronic board, Course-ware templates, Computer, Flash memories, Printer) are used to a large extent. While the others: Digital Video Disc (DVD), Interactive CD-ROM, Internet connectivity, Slide & Multimedia projectors, On-line educational tools, and Computer software programmes) were among the new technologies that were not sufficiently available in the Tertiary Institutions (universities) in Taraba State.

Table 2 further revealed a weighted mean of 2.44 out of the maximum obtainable

4.00, which is lesser than the standard mean of 2.50. This implies that the lecturers' frequent usage of the technology-based materials for Science curriculum delivery is quite poor. Also, result in Table 2 showed that the grand mean between the Federal and State universities was 2.45 and 2.42 respectively which is lesser than the standard mean of 2.50; and the mean difference is 0.03 (quite negligible or insignificant) in the usage of technology-based materials for Science curriculum delivery.

Table 3: Mean responses and Standard Deviation of Respondents on the Hindrances to the utilization of Technology-based materials for Science Curriculum Delivery

S/N	Hinderances to New Tehcnological Resources Items	Universities			
		Federal		State	
		Mean	SD	Mean	SD
31.	Lack of fund to equip the science laboratories with technology-based materials.	3.94	0.97	3.86	0.98
32.	Lack of ICT gadgets and internet connectivity	2.96	0.74	3.23	0.81
33.	Lack of electric power supply or standby electric generating set	3.79	0.88	3.85	0.89
34	Lack of appropriate skills to operate e-leaming.	3.26	0.91	3.40	0.77
35.	Lack of motivation of lecturers to use ICT gadgets.	2.68	0.66	2.72	0.71
36	Time factors in terms of curriculum overload.	2.77	0.62	2.88	0.78
	Grand Mean	**3.23**		**3.32**	
	Weighted Mean= 3.28				

From Table 3, the mean ratings of all the items (items 31-36) are above 2.50 for both Federal and State universities. Table 3 further revealed a weighted mean of 3.28 out of the maximum obtainable 4.00, which is higher than the standard mean of 2.50. This implies that the lecturers' responses on the hindrances to the utilization of Technology-based materials for Science Curriculum Delivery is very high. This indicates that the respondents agreed that all the statements are hindrances to the utilization of technology-based materials for science curriculum delivery. Also, result in Table 3 showed that the mean difference between the Federal (Grand mean=3.23) and State (Grand mean=3.32) universities on the hindrances to the utilization of technology-based materials for Science curriculum delivery is 0.09 which is quite negligible or insignificant.

Based on the data collected and analysed, the following findings were recorded:

i. Only about 60% of the listed technology-based materials (Print materials & E-books, Overhead projector, Models, Marker & Electronic board, Course-ware templates, Computer, Flash memories, Printer, and Audio & video discs) are available to a large extent for science Lecturers in Taraba state tertiary institutions for science curriculum delivery.
ii. Only about 60% of the available technology-based materials are mostly used by science Lecturers, but the weighted mean showed that the frequency of usage is quite poor in

Taraba State tertiary institutions for science curriculum delivery.

iii. Majority of the lecturers agreed that lack of fund to equip the science laboratories with technology-based materials, lack of appropriate skills to operate e-learning, lack of electric power supply or standby electric generating set, lack of ICT gadgets and internet connectivity, lack of motivation of lecturers to use the ICT gadgets, and time factors in terms of curriculum overload; are the hindrances to the usage of technology-based materials for science curriculum delivery by science Lecturers in tertiary institutions in Taraba state.

Discussion of Results

The result of this study as seen in Table 1 showed that most of the technology-based materials were not adequately available in tertiary institutions in Taraba. The result of this study showed that Print materials & E-books, Overhead projector, Models, Marker & Electronic board, Course-ware templates, Computer, Flash memories, Printer, and Audio & video discs were the few technology-based materials available in the universities to a large extent. The other technology-based materials such as Digital Video Disc (DVD), Interactive CD-ROM, Internet connectivity. Slide & Multimedia projectors, On-line educational tools, and Computer software programmes were among the new technologies that were not sufficiently available in both universities. The findings also supports Itighise (2016), Dynarski et al. (2017), Nwana, Ofoegbu and Egbe (2017), and Ifeakor (2018) whose results revealed that many of the ICT resources needed for Science teaching are not available and those available are inadequate; but contradicts findings by Itighise and Babayemi, (2018) whose results revealed adequacy of technology-based materials or gadgets. This result is indicative of the inadequacy of technology-based materials in Taraba State Tertiary Institutions.

The result of this study in Table 2 also showed that only 9 out of the 15 listed materials (Print materials & E-books, Overhead projector, Models, Marker & Electronic board, Course-ware templates, Computer, Flash memories, Printer, and Audio & video discs) were used to a large extent in Science curriculum delivery while the other listed technology-based materials were under-utilized. The findings also supports Itighise, (2016); Onyegegbu, (2016); Nwana, et al (2017); and Itighise and Babayemi, (2018) whose results also revealed that majority of the technology-based materials or resources needed for the teaching of science-subjects are not being used by the teachers. The study also showed that there was no significant difference on the responses of the Lecturers in both Federal and State universities on the utilization of these technological resources in Science curriculum delivery. The findings that technology-based materials are not sufficiently utilized in science teaching is not surprising as some university Lecturers are still adapted to conventional method of teacher-centred pedagogy. They also exhibit non-charlatan attitude towards the utilization of technology-based materials and prefer to use printed materials so as to give them opportunity to sell handouts and text books (Uzodimma, 2018).

The findings from Table 3 showed that lack of fund to equip the science laboratories with technology-based materials, lack of appropriate skills to operate e-learning, lack of ICT gadgets and internet connectivity, lack of electric power supply or standby electric generating set, time factors in terms of curriculum overload, and lack of motivation of lecturers to use ICT gadgets; are hindrances to the utilization of technology-based materials for science curriculum delivery. Lecturers and all stakeholders in education should know that the world is changing drastically in the area of technology and need people of highest potential in science curriculum who can deliver with understanding, with verve and with success. This would make undergraduates to fit into the new technological world. Also, many science Lecturers are poorly motivated, some lack the technical skills in the use of these new technological devices, hence they are not enthusiastic in their teaching. For the fact that some lack the technical skills in the use of these technology-based materials hence shy away from using them. This situation in Taraba State tertiary institutions does not differ remarkably from what is obtained at the secondary education level. Also, Ifeakor (2018); and Okoli and Osuafor (2018) reported a similar situation on the state of material resources in secondary schools. From their respective studies the researcher found out that resources are poorly provided and under usage by science teachers in secondary schools. Lack of fund to equip the science laboratories with technology-based materials has adversely affected the the needed materials in science teaching. Uzodimma (2018) buttressing this point stated that the amount of money available to higher Institutions in Taraba State for procurement of quality instructional, learning and research facilities and their maintenance is grossly inadequate. Thus, the rapid technological changes and increased globalization in the knowledge world and the society and the issue of ICT and its connectivity calls for increased funding for procurement of these technological resources in the Tertiary Institutions.

The findings of this study also revealed that there was an insignificant difference between responses of Science Lecturers from Federal and State universities in the availability and usage of technology-based materials, and hindrances to the usage of technology-based materials for science curriculum delivery. The inadequacy in availability and poor usage of technology-based materials for teaching science courses in Taraba State Tertiary Institutions have serious implications for the quality of graduates from Nigerian Tertiary Institutions system. Many graduates fail to acquire the relevant skills needed for the world of work in this 21ST century. Many do not possess the technical skills needed to operate ICT gadgets. For Tertiary Institutions in Taraba State to produce graduates with intellectual capacities, sound technological ideas and skills there is need to provide adequate number of technological resources as well as Lecturers with proper skills in utilization of ICT component for effective science curriculum delivery. The lack or insufficient funds to acquire adequate ICT gadgets and internet connectivity, poor

power or electricity supply and lack of appropriate skills to operate e-learning tends to pose as major hindrances to the usage of technology-based materials for science curriculum delivery.

5.0 Conclusion

Based on the findings of the study the following conclusions were drawn: The glaring challenge in Taraba State Tertiary Institutions is the provision and usage of technology-based Materials devices that will enable Tertiary Institutions graduates in the state to meet the demands and challenges in a fast-changing world. These Technology-Based devices are redefining science curriculum delivery, hence, science lecturers in the Tertiary Institutions should arm themselves with the appropriate knowledge and skills for usage of these technological resources in science curriculum delivery.

Recommendations

Based on the findings of the study the following recommendations were made:

1. Review of the existing Teacher Education Programme to incorporate skills in the use of new technological devices in science curriculum delivery.
2. Federal and State governments should provide adequate quantity of technology-based teaching materials such as computers, CDROMS, video disc/tape players as well as ready made software packages in teaching Biology, Chemistry and Physics for the Tertiary Institutions in the state.
3. In-service training programme should be organized for serving teachers through sponsoring them to workshops, seminars and conferences in order to acquire appropriate skills to operate e-learning in science curriculum delivery.
4. National University Commission (NUC) should organize accreditation programmes more regularly to ensure that these new technological devices are available and properly utilized in various Tertiary Institutions in science curriculum delivery.
5. The managers of tertiary institutions in the state should ensure that there are adequate ICT gadgets and internet connectivity, electric power supply or standby electric generating set, time in terms of curriculum overload, and motivation of lecturers to use these gadgets in science teaching.

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