ASSESSMENT OF AVAILABILITY AND UTILIZATION OF INFORMATION TECHNOLOGY (IT) FOR EFFECTIVE TEACHING OF SCIENCES IN SECONDARY SCHOOLS IN CROSS RIVER STATE, NIGERIA

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Abstract

The knowledge-driven world is a new economic order that has science and technology as its bedrock. Effective teaching and learning of science is a function of the availability and appropriate utilization of instructional materials which majorly include Information Technology (IT) systems. This study was designed to assess the availability and use of IT systems for effective teaching of science subjects such as Mathematics, Physics, Chemistry and Biology among secondary schools in Cross River State. The survey involved 600 science teachers drawn through disproportionate stratified sampling from science teachers who attended the 2009 Science Teachers' Re-training Workshop in the 3 centres in Cross River State. A 24-item structured questionnaire tagged Information Technology System Availability and Utilization Questionnaire (ITSAUQ) with a Cronbach Alpha reliability estimate of .65 was used to collect data for the study. Data analysis technique adopted was the one – sample mean t-test. The result showed that both availability and utilization of IT systems in secondary schools in Cross River State are significantly low. Based on the findings, conclusion was drawn and recommendations were made.

In most of the progressive nations, science and technology have long been adopted as an instrument per excellence for nation building. The essence of this was captured by Fafunwa (1994), when he cautioned that we are living in a world where science and technology have become an integral part of the world culture and any country overlooking this significant truism does so at its peril.

Today, globalization has brought with it a more intense competitive environment and new requirements for sustainable development and competitiveness, especially in the fields of science and technology. This new prevailing competitive environment has fuelled the growth of knowledge-intensive production by increasing scientific and technological interactions and re-invigorated the need for innovation across disciplines, functions and sectors.

The number of jobs that require Science and Technology, Engineering and Mathematics (STEM) skills today, is increasing (U. S. Department of Education, 2010). This, according to Osisioma (2011), has precipitated a greater need for scientific literacy for citizenship and the demand for high level skills jobs in STEM is paralleled by the needs that the world is facing, such as energy crisis, HIV/AIDS pandemic, global warming, food security, poverty, high rate of unemployment and crime rate among others.

Moreso, the 21st century is a knowledge era that is driven by creativity, innovation and information. Therefore, ingenuity, agility and technological competencies are skills necessary to be effective and productive in today's competitive world. To that effect, Osisioma (2011) saw the need to recognize that a 21st century education with science and technology is the bedrock of this global competitiveness- the engine not simply an input in the economy, and Nigeria moving towards accomplishing its vision 20-2020 must reflect this understanding particularly in its scientifical and technological education designs.

Unfortunately, the state of Science and Technology, particularly IT in Nigeria, is still a matter of great concern (Nnorom, Osuafor and Okeke, 2011;Oyong and Okey,2009). This concern stems from the realization that Nigeria cannot develop as rapidly as it aspires to, without creating an adequate pool of both IT systems and the Scientific and Technological Manpower to effectively utilize the systems to transform the nation (Ozoro, 1977).

Today, Nigeria's enthusiasm to achieve vision 20-2020 might hit the rock if appropriate care is not taken to redirect the teaching of sciences in our schools. The key goal of vision 20-2020 is that Nigeria would be one of the 20th largest economies in the world, able to consolidate its leadership role in Africa and establish itself as a significant player in the global economical and political arena. Given the country's abundant resources and its coastal location, Obioma (2010) and Amaefuna (2011) noted that very little has been achieved, and attributed her failure to inadequate technological infrastructure. Amaefuna (2011) reasoned that scientific and technological development in Nigeria cannot take place without proper

understanding of science and its effective teaching in our schools.

Nenty (2010) noted that poor attention which Nigeria maintains in relation to IT availability and application and compared this with the attention at the highest level of South African Government to the role of IT in the promotion of social and overall national development and global competitiveness which has led to an overhaul in the education and skills development system at all levels. It was noted that as at 2007, 50.9% of SA schools had computers and 22.6% of them used computers for teaching and learning but back home in Nigeria, the leading IT department (University of Ife) ranked 7,752th in the world and 98th in Africa (Infodev. Org, 2007; Vanguard, 2010). The growth of African nations cannot be without a political will, to effectively institute a functional national ICT policy that will adequately equip schools with ICT and face the big nationwide challenge of enhancing technology literacy, electric power and telecommunication infrastructure (Nenty, 2010).

Several other studies within the literature converge in reporting inadequate IT systems as a reason for the poor state of science teaching and learning and subsequently translating into persistent poor performance in sciences of senior secondary school students in SSCE (Awodi, 1981; Ajayi, 1999; Nwosu and Okeke, 1995; Ikokwu, 2010 and Okeke, 2010). In their separate works, Madu (2004) and Okebukola (2005) reported on the falling standard of science teaching in Nigeria and with Nwagbo (2010) identified teacher-centred approach as an obstructing factor in students' understanding and achievement in core science subjects.

The potential usefulness of IT in Education has been recognized by Narayanasamy (2000), whose research studies stated that computers when used appropriately in instruction enhance students' learning, increase motivation, improve attendance, and induce positive attitudes relatively to the predominantly used lecture method. Although many science teachers employ lecture method for reasons of being less tasking, allowing for a wider coverage of content within a short time and handling of large class sizes, it does not always produce positive learning outcomes in many science students (Okoli and Egbunonu, 2011). In the same vein, Durosaro (2010) and Osisioma (2011) noted that teaching of science and technology should be effectively handled if the nation is to produce world-class highly skilled manpower who can think critically and reflectively. The authors noted however, that the lecture method and rote learning it promotes, may not achieve this goal.

Science in its broadest sense refers to all human activities involving organized knowledge of natural phenomena; and technology on the other hand simply refers to the process of solving the practical needs of the society. The symbiotic relationship existing between the two makes science sterile and technology moribund in the absence of one or the other (Okoli et al ,2011). The call for enhancement in teaching and learning of sciences using instructional materials such

as IT systems cannot be overemphasized at this time in the globe when it is IT that drives everything (Nenty, 2010).

Information Technology (IT) is a set of tools that helps one work with information and perform tasks related to information processing (Hage and Keen, 1996). Ajayi (1999), defined IT as a new way of storing, processing and transmitting information through electronic and telecommunication. The various forms of IT in our society range from computer laptops, computer desktops, handheld computers, digital calculators, internet, CD-ROMs, television, tele and video conferencing, electronic board etc. There are important instructional facilities that have relevance in the 21st century science teaching and learning.

The nation recognizing IT as a key player in the information society, knowledge management as driving global developments and the need for students to be ICT literate, has therefore, included computer/ICT as a core subject in the new senior secondary school curriculum structure (NERDC, 2008). Prior to this, the computer for all Nigerians Initiative (CANI) came as a campaign to take quality and internationally certified and affordable computers to every office, home and school (Info Tech and Telecom Digest, 2008).

Similarly, one lab-top per child (OLPC) project introduced by its founder Professor Nicholas Negroponte during the Obasanjo regime 1999-2007, along with increased internet penetration (rising by 3% within the same period) and National IT Development Agency (NITDA), were all attempts to make IT systems popularly available and enhance their utilization in teaching and learning in our schools (Oyong, 2009). IT, applied to teaching and learning of sciences will result in the following:

- Easy instructional delivery
- Facilitates and enhances transfer of knowledge and skills to students.
- Promotes interactive technology-based teaching/learning as in USA and England (World Bank, 2006; Education Trust Fund, 2006 in Osisioma, 2011).
- Increases confidence with learning in the learning process.
- Helps to increase students' writing skills.
- Presents information in diverse ways
- Gives rise to greater problem solving and critical thinking.
- Makes students to be independent learners (Kosakowski, 2005; Okoli, 2011).

Inspite of the tremendous benefits which are associated with the incorporation of IT systems in teaching/learning of sciences, Etukudo (2003), Okoli & Egbunonu (2011) noted that the adoption of effective interactive technology-assisted teaching in most science classrooms in Nigeria has remained at its lowest ebb. This therefore, underscores the need for the present study to assess the availability of IT systems and their utilization by science teachers in the effective teaching of sciences in secondary schools in Cross River State.

Purpose of the Study

The purpose of this study is to assess the availability and utilization of IT systems for teaching sciences in secondary schools in Cross River State (CRS).

Research Questions

1. To what extent are the IT systems available for teaching sciences in secondary schools in CRS?
2. To what extent do science teachers utilize IT systems in teaching sciences in secondary schools in CRS?

Research Hypotheses

1. The availability of IT systems for science teaching in secondary schools is not significantly high.
2. The utilization of IT system by science teachers is not significantly high.

Methodology

Design

The descriptive research survey design was adopted for the study.

Sample and Sampling Technique

The science teachers in CRS who attended the CRS teachers' re-training programme at the 3 centres: Calabar, Ikom and Ogoja 2009 numbering 2,347 constituted the population for the study. The sample of 600 science teachers was selected using disproportionate stratified random sampling technique from this science teachers pool.

Instrumentation

The instrument for data collection was a questionnaire tagged Information Technology Systems Availability and Utilization Questionnaire (ITSAUQ) meant for science teachers who took part in the 2009 re-training program in the 3 zones of CRS. It comprised of 24 items divided into two groups of 12 items each for availability and utilization of IT systems. The IT systems assessed, included computer laptop, computer desktop, portable Fm radio, digital camera, internet, television and compact disc, teleconferencing, video conferencing, facsimile machine (Fax), projector, electronic bulletin board and web cast. Responses were elicited through a 4-point modified Likert-type scale: Highly Available (HA), Moderately Available (MA), Sparingly Available (SA) and Not Available (NA), for section A measuring availability of IT systems. Section B of ITSAUQ was on the utilization of the IT systems and based on 4-point scale, thus, very often utilized (VOU), often utilized (OU), seldomly utilized (SU) and never utilized (NU). The reliability coefficient of the instrument was .65.

Data Collection Procedure

The researchers as resource persons in the re-training programme were able to administer the 600 questionnaires to the respondents and all were completely filled and returned.

Analysis of Data and Results

A t-test of one-sample mean was used in testing the hypotheses at .05 level of significance using statistical package for social sciences software (SPSS).

Ho: Availability of IT system is not significantly high

For the availability of IT systems to be considered significantly high, the researchers reasoned that the score representing such high level should be greater than 30 (which is the midpoint between moderately and sparingly available, 2.5 multiplied by 12, the number of items measuring that variable). Thus, the statistical version of hypothesis one is that the mean score representing such high availability is not significantly greater than 30.00.

Ho: $\mu = 30.00$

H1: $\mu > 30.00$

A t-test of one-sample mean was used to test this hypothesis. The results of the analysis are as shown in Table 1.

Table 1: One-Sample Mean T-Test Analysis of Whether the Availability of IT Systems is Significantly High.

Variable	$\bar{X}$	SD	t	Sig
Availability of IT systems	14.5	3.70	-102.112*	.000
Hypothesized mean	30.00			

*P>.05, critical t = 1.69; df, n-1 = 599, N=600

The result of the analysis shows that the mean score of the availability of IT systems of 14.50 is lower than the hypothesized mean of 30.00. This means that the availability of IT systems in the secondary schools sampled for the study is significantly low. The calculated t-value is greater than the critical t-value of 1.65 (a one-tailed test). However, the negative value of -102.112 further confirms a significantly low IT availability.

Ho: The utilization of IT systems is not significantly high.

For the utilization of IT systems to be considered significantly high, the researchers reasoned that the score representing such high level should be greater than 30.00 (which is the midpoint between often utilized and seldomly utilized, i.e. 2.5 multiplied by 12, the number of items measuring the variable). Thus, the statistical version of hypothesis two is that the mean score representing such high utilization of IT system is not significantly greater than 30.00.

Ho: $\mu = 30.00$

H1: $\mu > 30.00$

A t-test of one-sample mean was used to test this hypothesis. The results of the analysis are as shown in Table 2.

Table 2: One-Sample Mean T-Test Analysis of Whether the Utilization of IT Systems is Significantly High

Variable	$\bar{X}$	SD	t	Sig
Availability of IT systems	13.92	3.22	-122.26*	.000
Hypothesized mean	30.00			

*P>.05, critical t = 1.69; df, n-1= 599, N=600

The result of the analysis shows that the mean score of the utilization of IT systems of 13.92 is lower than the hypothesized mean of 30.00. This means that the utilization of IT systems in the secondary schools sampled for the study is significantly low. The calculated t-value is greater than the critical t-value of 1.65 (a one-tailed test). However, the negative value of -122.26 further confirms a significantly low IT utilization in teaching sciences in Cross River State.

Discussion of Findings

The study centered on the assessment of availability and utilization of IT systems in effective teaching of sciences in secondary schools in Cross River State. The results revealed low availability and utilization of IT systems in science teaching in secondary schools. These findings are in agreement with the previous researches by Etukudo (2003), Olagunju (2003); Nwosu (2003); Okoli & Osuafor (2008), Nnorom, Osuafor & Okeke (2011). Etukudo (2003) reported non- availability of computers for teaching mathematics in Nigerian secondary schools. In the same vein, Nwosu (2003), Olagunju (2003), and Okoli & Osuafor (2005) reported that no school has commenced the use of computer to teach science, technology and mathematics (STM) subjects. Nnorom, Osuafor and Okeke (2011), also carried out a study which showed non-availability and application of any kind of IT system in Anambra State. The finding of the second hypothesis that not much use is found of IT systems in teaching sciences in some schools, where they exist, is not surprising as a number of reasons could be advanced for that.

Firstly, Njoku (2006) had earlier noted that many teachers seem to be comfortable with giving a dozen of excuses why the think that Nigeria is not yet ripe for an IT revolution rather than realizing that it is indeed getting late. Teachers who are to use available teaching instruction materials for their students, often fail to do so probably due to inadequate training for effective and efficient use of the IT systems, inadequate computer and other IT supply in relation to the large class size of students. The high ratio of students' population to computers can frustrate teacher's effort and interest which may in turn affect his administration and management of classroom role as a teacher. Sending few computers to a school with very large student population amounts to what the Panel on Educational Technology (1977) observed as being sub optimal. A learning environment that is sub optimum cannot encourage collaborations, mutual trust, supportiveness, openness to changes, risk-taking, pleasure and friendliness.

The teachers' low utilization of computer in their pedagogies which constituted the finding of the second hypothesis lends credence to the reconstructionism theory which according to White in Oyong and Okey (2009) asserted that, educators must develop curricula and pedagogical techniques to reconstruct society and educational practices from the current state. Teachers' use of computer covers diverse disciplines

and implies also, the use of diverse computer softwares which drive the hardware. The poor supply and frequent interruption of electricity which serves to power the devices could discourage the teacher from the use of IT systems as instructional aids. Related to this, are the challenges associated with maintaining the IT systems which rob many schools of the use of IT to enhance instruction.

The importance of computer and other IT use cannot be overemphasized in the information age. The global economy growth has created a sense of urgency leading to a call for reforming our approach to education and training which is a critical component of national economic competitiveness. The problem identified in this study equally demands urgent attention so that information technology systems can be introduced in various schools for effective teaching of sciences. Nenty (2010) and Osisioma (2011) reiterated that the urgent attention called to introduce IT in various secondary schools in South Africa, United States of America, Singapore, Finland and Denmark has long been responded to by the various governments. Nigeria appears not to have taken any bold initiative to adequately provide IT systems or popularize their utilization in secondary schools. This explains why there is low or non-availability of IT systems in schools. The nation cannot hope to be self reliant and anchor in the World of Technology given this chronic under funding.

Conclusion

The present global economy is a knowledge economy that is driven by creativity, innovation and knowledge in science, Osisioma (2011). Therefore, ingenuity, agility and technological competencies are 21st century skills that are urgently needed by our students to be effective and productive in the current competitive global community. Nigeria moving towards accomplishing excellence in education through science and technology must respond to the urgent need to equip schools with IT systems.

Recommendation

The following recommendations were made:

- IT should be made to take root in Nigeria through the effort of government, non-governmental associations, all stakeholders in Education since a change in our educational, science and technological misfortunes rests largely on government and educational experts. They should furnish schools with adequate IT facilities and help in their maintenance with adequate provision for constant electricity/generator to support.

- Rapid rise in computer literacy among science teachers should be encouraged through training and re-training programmes as well as their use in pedagogies. In addition to workshop and conference attendance, science

teachers should own personal computers to enhance the frequency and efficiency of use.

- A Functional and well equipped state or national laboratory/centre and training centres for upcoming scientists should be established to serve as a research hub for scientists, engineers and their students.
- Government should prioritize science and technology education by setting up functional and pragmatic agency after the version of the U.S National Science Foundation which does not only fund as is the case with Education Trust Fund (ETF), but will encourage and motivate researchers and students by effectively coordinating and providing research funds.
- Government should support creativity by not only providing funding and an environment conducive to individual scientific and technological projects but also providing patents to original inventions by Nigerians. This will encourage Nigerian scientists and engineers based abroad to come home and support the creation of centre of excellence. This approach has worked for countries like China, Singapore and South Korea and will surely work for us.
- Finally, a take- off point for this nation should be a look at functional models put in place by the developed nations.

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