



Computer Education Research Journal (CERJ)

Volume 5: Issue No. 1 pp 07-20, 2018

COMPUTER BASED TESTING SKILL NEEDS OF SECONDARY SCHOOL STUDENTS FOR SUSTAINABLE DEVELOPMENT IN EXTERNAL EXAMINATION PREPAREDNESS

BY

Nnadi, HillarySunday, Ibezim, NnennaE. & Atabong Timothy Agendia
DEPARTMENT OF COMPUTER AND ROBOTICS EDUCATION

UNIVERSITY OF NIGERIA, NSUKKA

Phone: +234 - 8062400782, +234 - 8063279753

e-mail: hillary.nnadi@unn.edu.ng, nnenna.ibeziim@unn.edu.ng & tagendia@yahoo.com

ABSTRACT

This study was carried out to determine skill needs of secondary school students for external examination preparedness in Nsukka metropolis. The study adopted survey research approach to investigate the skill needs of the students such as booting the computer system, use of input and output devices, use of office application, connecting to the internet and confidence building attitudes hence five appropriate research questions were posed to guide the study. The population for the study is 755 SS 3 students in 2016/2017 academic session from nine public secondary schools. The data analyzed was obtained from 100 female and 80 male students using simple random technique to select 20 students from each of the nine public schools. The instrument used for data collection was a structured CBT Skill Need Questionnaire (CSNQ), made up of 72 skill items on 4-point scale which was also validated by three experts. In carrying out the research five research questions and five hypotheses were answered and tested using the data collected. Mean was used to answer the research questions while t-test was used for testing the hypothesis at 0.05 level of confidence. The findings on the research questions indicated that 50 skill items were highly needed and 22 skill items were averagely needed by the students while the findings on testing the hypotheses indicated that there is no significant difference in the mean ratings of the responses of female and male students on 31 out of 72 skill items while the remaining 41 shows that there is a significant difference in the mean ratings of the responses of female and male students. It was recommended that curriculum planners, the government, computer studies teachers and secondary school students should make use of the findings of this study to equip the students with basic skill needs for success in Computer-based external examinations.

Introduction

In educational institutions teaching and guidance activities are supposed to take place so that appropriate skills and knowledge can be acquired by the students. A machinery through which the extent of knowledge and skill acquisition is determined at each stage of education has also been set up. This is in form of examination which is organized in order to evaluate, assess and test knowledge and skills.

According to Suleman (2015) examination can be defined as the process of determining the

extent to which students have achieved the instructional objectives in particular subject area as planned. Test, Assessment and Examination can be used interchangeably, however, in view of Okoro (2000), assessment is a form of evaluation that uses collected data for estimating the worth, quality and effectiveness of a programme. Examination indicates the extent of factual knowledge acquired by students, predict future education achievement and provide a means of selecting suitable candidates for certain educational

courses. Schools need to conduct examinations as yardstick for assessment. It is the most practical way of assessment in education. Examinations could be internal or external. It could be oral or written, essay or objective type, theory or practical constitutes an integral part of the education process. Examples of internal examinations are continuous assessment tests, terminal, semester and annual or promotional examinations. Examples of external (public) examinations common in Nigerian schools are Common Entrance Examination for admission into secondary school. School Certificates examination is conducted by West African Examination (WAEC) and National Examination Council (NECO). Entrance examination into higher institution is conducted by the Joint Admission Matriculation Board (JAMB). To be able to access the skills and knowledge possessed by the students, different methods can be employed.

There are various examination methods used in education institutions to assess academic progress, for example, paper-pencil-based examinations which is the predominant mode of student's assessment in Nigeria. In this method, students are assessed using paper and pen on cognitive abilities. This method of assessment has imposed serious limitations to the effectiveness of the conduct of examination. The traditional method is characterized by various forms of examination malpractices. The threat of examination malpractices on the validity of examination outcomes and other challenges have resulted in some examination bodies adopting a different method of administration. One of such is the Joint Admissions and Matriculation Board (JAMB) that has introduced Computer Based Testing (CBT) in the conduct of Unified Tertiary Matriculation Examination (UTME), other bodies like West African Examination Council (WAEC) and National Examination Council (NECO) are also planning to adopt CBT examination.

Computer – based examinations are the form of assessment in which the computer is an integral part of question papers, delivery, and response storage, marking of response or reporting of results from a test or exercise (Whittington, Bull & Danson, 2000). The rapid advancement of

Information and Communication Technologies (ICT) in teaching and learning has shifted the paradigm, (Uysal&Kazu, 2009) from paper-pencil-based to computer-based system of examinations.

Computer-based tests offer several benefits over traditional paper-and-pencil or paper-based tests. Technology based assessment provide opportunities to measure complex form of knowledge and reasoning that is not possible to engage and assess through traditional methods (Bodmann& Robinson, 2004). In Nigeria, employers now conduct aptitude test for job seekers through electronic means; the universities and other tertiary institutions are registering and conducting electronic examination for their students through the internet and other electronic and networking gadgets. Similarly, different examination bodies in the country such as West Africa Examination Council (WAEC), National Examinations Council (NECO), National Business and Technical Examination Board (NABTEB), and National Teachers' Institute (NTI), among others register their students through electronic means (Olawale&Shafii, 2010). In view of Mubashrah, Tariq, &Shami, (2012) computer and related technologies provide powerful tools to meet the new challenges of designing and implementing assessments methods that go beyond the conventional practices and facilitate to record a broader repertoire of cognitive skills and knowledge. The expectation of the Government is that computer education would make the students computer literate in line with the computer revolution permeating the globe.

Skill is learning to carry out a task with pre-determined results often within a given amount of [time](#), [energy](#), or both. Skills can often be divided into [domain](#) general and domain-specific skills,(Howland, 2003). However, the students are expected to be able to know how to boot the computer system, make use of the input/output devices, use Microsoft office application, how to connect to the internet and confidence building attitudes on the use of the computer system. These skills are needed for success in CBT.

In view of Omeh (2010) a need is something that is required to fill an existing essential gap. In

bridging this gap, secondary students need to possess various skills to get well prepared for CBT. This work is geared towards identifying CBT skill needs of secondary school students in Nsukka metropolis for external examination preparedness.

Statement of the problem

Few years ago external examinations were conducted through pencil and paper, student's efforts were usually concentrated on studying hard on the content of the subject matter to enable them pass very well in the examination such as WAEC, NECO and UTME. With the development in technology, emphasis is now gradually changing from pencil and paper examination to the use of computer especially with examination body like JAMB and other companies who will like to recruit competent employees from various location. Secondary school students are now faced with difficulties of passing computer based examination because they lack the knowledge and skills for interacting with the computer. The students may be competent enough in the subject matter but finds it difficult in passing due to lack of necessary skills for using the computer. The result of this inadequacy in skill needs is failure and delay in securing admission into the higher institution. However, the study calls for an investigation on the CBT skill needs of secondary school students for external examination preparedness.

Purpose of the Study

The major purpose of the study is to determine basic CBT skill needs for external examination preparedness of secondary school students in Nsukka Metropolis. Specifically, the study seeks to determine the skill needs of secondary school students in:

1. Booting on a computer.
2. Operating of the I/O devices.
3. Use of Microsoft office application software.
4. Connecting to the internet.
5. Confidence building attitudes on the use of computer.

Research Questions.

The following questions were posed to guide the study:

1. What are the CBT skill needs of the students on booting the computer system for success in external examination?

2. What are the CBT skill needs of the students in operating input and output devices for success in external examination?

3. What are the CBT skill needs of the student in the use of Microsoft office application software for success in external examination?

4. What are the CBT skill needs of the students in connecting to internet for success in external examination?

5. What are the CBT skill needs of the students in confidence building attitude for success in external examination?

Hypotheses.

Ho₁ There is no significant difference in the ratings of the responses of Male and Female students on booting the computer system for success in external examination.

Ho₂ There is no significant difference in the mean ratings of the responses of Male and Female students in operating input and output devices for success in external examination.

Ho₃ There is no significant difference in the mean ratings of responses of Male and Female students in the use of Microsoft office application software for success in external examination.

Ho₄ There is no significant difference in the mean ratings of the responses of Male and Female students in connecting to internet for success in external examination.

Ho₅ There is no significant difference in the mean ratings of the responses of Male and Female students in confidence building attitude for success in external examination.

Methodology

In carrying out this study, the researcher made use of survey design. The study was carried out in Nsukka metropolis in Enugu State. Population of the study was 755. Sample for the study was 180 made up of 100 female and 80 male students in SS 3 using simple random sampling technique for selecting the sample. Each individual is chosen randomly by chances, such that each individual has the same probability of being chosen at any stage during the sampling process.

A structured questionnaire was used as an instrument for data collection for answering the research questions. Each questionnaire item had four response options of Highly Needed (4), Averagely Needed (3), Slightly Needed (2), and Not Needed (1). The questionnaire was face

validated by 3 experts, one lecturer from the department of computer education and two computer studies teacher from secondary schools in Nsukka metropolis. The questionnaire was used to collect data through the help of the Computer Studies teachers. The data collected were analyzed using weighted mean to answer the research questions, and t-test statistics to test the hypothesis at 0.05 level of significant. The real limit of numbers was used to take decision on the mean as follows: 4.00 – 3.50 (Highly Needed), 3.49 – 2.50 (Averagely Needed), 2.49 – 1.50 (Slightly Needed) 1.49 – 1.00 (Not Needed). In deciding on the significant difference in the mean ratings of the responses of male and female students the p-value was used as follows: Any item whose p-value is greater than 0.05, indicated that there is no significant difference in the mean ratings of the responses of the two groups of respondents on CBT skill needs of secondary school students on the item. Therefore the hypothesis of no

significant was upheld for that item; if the P-value of any item is less than 0.05, it indicated that there is significant difference in the responses of the two groups of respondents and the hypothesis of no significant difference was not upheld for such an item.

Results

The result for this study was obtained from the research questions answered and hypotheses tested through the analysis of the data

Research question 1: What are the CBT skill needs of the students on booting the computer system for success in external examination?

Ho₁: There is no significant difference in the ratings of the responses of Male and Female students on booting the computer system for success in external examination.

Data for answering this research question and testing the hypothesis is as shown in Table 1.

Table 1: Mean and t-test analysis of the responses of male and female students on booting the Computer System for success in external examination

SN	CBT skills in booting the computer system	\bar{X}_m	SD1	\bar{X}_f	SD2	Sig	DECISION
1	Connect power cable to power source	3.30	0.46	3.50	0.50	0.09	NS
2	Connect the VGA (video Graphic Adapter) cable from the monitor to system unit	3.50	0.50	3.32	0.47	0.10	NS
3	Locate and press the power button to start up the monitor	3.44	0.51	3.25	0.43	0.04	S
4	Turn on the power button on the computer	3.28	0.46	3.47	0.50	0.03	S
5	Connect the VGA(video Graphic Adapter cable to ports.	3.40	0.49	3.18	0.39	0.02	S
6	Observe various sounds made by the computer system during booting (for missing hardware)	3.21	0.41	3.41	0.49	0.01	S
7	Observe id the system is loading	3.38	0.49	3.31	0.47	0.50	NS
8	Check if CPU jumps to address the BIOS	3.35	0.48	3.38	0.48	0.49	NS
9	Observe if the BIOS runs post (power on self test) and other necessary check on computer system.	3.15	0.36	3.56	0.50	0.00	S
10	Observe if the BIOS locates the MBR (Master Boot Record)	3.60	0.49	3.17	0.38	0.00	S
11	Check if the primary boot loader						

	runs from MBR and locates the secondary boot loader.	3.21	0.72	3.50	0.50	0.04	S
12	Observe if the secondary boot loader loads the operating system and the windows logo is displayed on the screen of the monitor of the computer system.	3.50	0.50	3.20	0.72	0.02	S
13	Respond to prompt command	3.48	0.62	3.01	0.49	0.03	S

Key: \bar{X}_1 = Mean for Male, \bar{X}_2 = Mean for Female, SD1= Standard Deviation for Males, SD2 = Standard Deviation Females, S= Significant, NS= Not Significant.

Table 1 shows that the significant values of the items ranged from 0.09 - 0.50 for items 1,2,7,8 which are greater than 0.05 level of significance. This shows that the null hypothesis is upheld for those items. However, the table further showed that the significant values of items 3, 4, and 5 ranged from 0.00 – 0.05, indicating that for these items the null hypothesis of no significant difference in the responses of male and female students on Booting the Computer System for success in external examination is not upheld.

Research question 2: What are the CBT skill needs of the students in operating input and output devices for success in external examination?

Ho₂: There is no significant difference in the mean ratings of the responses of Male and Female students in operating input and output devices for success in external examination.

Data for answering this research question and testing the hypothesis is as shown in Table 2.

Table 2
Mean and t-test analysis of the responses of male and female students on operating input and output devices for success in external examination

SN	CBT skills in operating input and output devices	\bar{X}_m	SD1	\bar{X}_F	SD2	Sig	DECISION
1	Identify if the monitor displayed the desktop icons	3.30	0.46	3.50	0.50	0.09	NS
2	Locate and press the buttons at the base of the monitor to adjust the volume, brightness, contrast and colour of the monitor	3.50	0.51	3.32	0.47	0.10	NS
3	Click on the left button of the mouse to select an item	3.44	0.50	3.25	0.43	0.03	S
4	Click on the left button of the mouse twice to pop up a small dialog box	3.28	0.46	3.47	0.50	0.02	S
5	Click on the right button of the mouse twice to open a selected item	3.40	0.49	3.18	0.39	0.02	S
6	Operate mouse effectively	3.21	0.41	3.41	0.49	0.01	S
7	Display the help dialog box	3.38	0.49	3.31	0.47	0.50	NS
8	Activate the menu bar options	3.35	0.48	3.38	0.48	0.49	NS
9	Open windows task manager	3.15	0.36	3.56	0.54	0.00	S
10	Display windows	3.60	0.49	3.17	0.38	0.00	S
11	Display start menu	3.21	0.72	3.50	0.50	0.04	S
12	Highlight a document	3.50	0.50	3.20	0.72	0.02	S
13	Copy a document	3.65	0.48	3.50	0.50	0.00	S
14	Paste a document	3.51	0.50	3.20	0.40	0.00	S
15	Bold a document	3.36	0.68	3.50	0.50	0.09	NS
16	Cut an item	3.42	0.69	3.32	0.47	0.10	NS
17	Delete an item	4.00	0.00	3.18	0.53	0.51	NS

Key: \bar{X}_1 = Mean for Male, \bar{X}_2 = Mean for Female, SD1= Standard Deviation for Males, SD2 = Standard Deviation for Females, S= Significant, NS= Not Significant.

Table 7 shows that the significant values of the items ranged from 0.09 - 0.51 for items 1,2,7,8,15,16,17 which are greater than 0.05 level of significance. This shows that the null hypothesis is upheld for these items. However, the table further showed that the significant values of items 3, 4, 5, 6, 9, 10,11, 12,13, and 14 ranged from 0.00 – 0.04, indicating that for these items the null hypothesis of no significant difference in the responses of male and female students on operating input and output devices for success in external examinations is not upheld

Research question 3: What are the CBT skill needs of the students in the use of Microsoft office application software for success in external examination?

H₀: There is no significant difference in the mean ratings of responses of Male and Female students in the use of Microsoft office application software for success in external examination.

Data for answering this research question and testing the hypothesis is as shown in Table 3.

Table 3: Mean and t-test analysis of responses of male and female students on the use of Microsoft office application software for success in external examination.

SN	CBT skill needs in the use of Microsoft office application software	\bar{X}_m	SD1	\bar{X}_F	SD2	Sig	DECISION
1	Locate Microsoft office all programs	3.30	0.40	3.50	0.50	0.09	NS
2	Open any application of your choice such as word, excel, Access etc	3.50	0.50	3.32	0.47	0.10	NS
3	Observe the menu bar	3.44	0.46	3.25	0.43	0.03	S
4	Create a document	3.28	0.53	3.47	0.50	0.02	S
5	Format a document	3.40	0.46	3.18	0.39	0.02	S
6	Navigate around the environment	3.21	0.50	3.41	0.49	0.01	S
7	Use short cut keys	3.38	0.46	3.31	0.47	0.50	NS
8	Highlight a document	3.35	0.44	3.38	0.48	0.49	NS
9	Copy a document	3.15	0.50	3.56	0.50	0.00	S
10	Bold face test	3.60	0.68	3.17	0.38	0.00	S
11	Insert an object	3.21	0.64	3.50	0.50	0.04	S
12	Change cases of character	3.50	0.49	3.20	0.72	0.02	S
13	Save a document	3.65	0.48	3.50	0.51	0.00	S
14	Open a document	3.50	0.49	3.20	0.41	0.00	S
15	Open multiple applications	3.36	0.41	3.50	0.52	0.09	NS
16	Minimize an open application	3.51	0.31	3.32	0.49	0.10	NS
17	Maximize an open application	3.36	0.43	3.18	0.53	0.51	NS
18	Close an open application	3.42	0.40	3.11	0.45	0.53	NS

Key: \bar{X}_1 = Mean for Male, \bar{X}_2 = Mean for Female, SD1 = Standard Deviation for Males, SD2 = Standard Deviation for females, S = Significant, NS = Not Significant.

Table 3 shows that the significant values of the items ranged from 0.09 - 0.53 for items 1,2,7,8,16,17,18 which are greater than 0.05 level of significance. This shows that the null hypothesis is upheld for those items. however, the table further showed that the significant values of items 3, 4, 5, 6, 9, 10, 11, 12, 13, and 14 ranged from 0.00 – 0.04, indicating that for these items the null hypothesis of no significant difference in the responses of male and female students on use of Microsoft office application software for success in external examination is

not upheld.

Research question 4: What are the CBT skill needs of the students in connecting to internet for success in external examination?

Ho₄: There is no significant difference in the mean ratings of the responses of Male and Female students in connecting to internet for success in external examination.

Data for answering this question and testing the hypothesis is as shown in Table 4.

Table 4: Mean and t-test analysis of responses of male and female students on connecting to internet for success in external examinations.

SN	CBT skill need in connecting to the internet	\bar{X}_M	SD1	\bar{X}_F	SD2	Sig	DECISON
1	Connect to the internet using wired or wireless connections	3.48	0.50	3.57	0.50	0.03	NS
2	Observe when there is available wireless network from the task bar	3.30	0.46	3.29	0.45	0.42	NS
3	Open a web browser	3.25	0.44	3.47	0.50	0.01	S
4	Use the search engine	3.45	0.50	3.25	0.44	0.02	S
5	Type in the keywords to the search engine	3.18	0.39	3.42	0.50	0.00	S
6	Add new tab to web browser	3.39	0.49	3.25	0.44	0.06	NS
7	Download relevant materials through the internet	3.33	0.48	3.31	0.47	0.42	NS
8	Download materials in different format such as pdf and doc	3.37	0.47	3.38	0.49	0.04	S
9	Store and transfer the downloaded materials in storage device	3.59	0.50	3.15	0.36	0.00	S
10	Create and send email	3.16	0.37	3.38	0.49	0.14	NS
11	Upload material on the internet	3.48	0.50	3.52	0.76	0.12	NS
12	Disconnect or logout of the internet	3.22	0.72	3.16	0.57	0.34	NS

Key: \bar{X}_1 = Mean for Male, \bar{X}_2 = Mean for Female, SD1 = Standard Deviation for Males, SD2 = Standard Deviation for Females, S = Significant, NS = Not Significant.

Table 9 shows that the significant values of the items ranged from 0.06 - 0.42 for items 2,7, 10,11 and 12 which greater than 0.05 level of significance. This shows that the null hypothesis is upheld for those items. However, the table further showed that the significant values of items 1, 3, 4, 5, 8, and 9 ranged from 0.00 – 0.04, indicating that for these items 1,3,5,6,8,9 lower than 0.05 level of significance, the null hypothesis of no significant difference in the responses of male and female students

onconnecting to internet for success in external examinations is not upheld.

Research question 5: What are the CBT skill needs of the students in confidence building attitude for success in external examination?

Ho₅: There is no significant difference in the mean ratings of responses of Male and Female students in confidence building attitude for success in external examination.

Data for answering this question and testing the hypothesis is as shown in Table 5.11

Table 5: Mean and t-test analysis of responses of male and female students on confidence building attitude for success in external examination.

SN	CBT skill need in confidence building attitude	\bar{X}_m	SD1	\bar{X}_f	SD2	Sig.	DECISION
1	Accept the truth about oneself	3.30	0.46	3.30	0.46	0.03	S
2	Integrate yourself with likeminded and supportive people	3.50	0.50	3.48	0.50	0.53	NS
3	Start with easy task before going to complex task	3.44	0.51	3.45	0.51	0.00	S
4	Withstand fear of failure	3.28	0.46	3.25	0.45	0.42	NS
5	Recognize and release destructive habits from the past	3.40	0.49	3.39	0.49	0.00	S
6	Stay focused on the positive not negative	3.21	0.41	3.18	0.39	0.63	NS
7	Provide suitable environment and facility for learners to learn.	3.38	0.49	3.37	0.48	0.64	NS
8	Correct learners carefully when they make mistake	3.35	0.48	3.33	0.48	0.09	NS
9	Set realistic goals for each learner	3.15	0.36	3.16	0.37	0.00	S
10	Encourage students to try harder when they fail	3.60	0.49	3.59	0.50	0.00	S
11	Use appropriate teaching strategies that provide an opportunity for equal participation	3.21	0.72	3.22	0.72	0.14	NS
12	Practice on regular bases to develop speed and accuracy	3.50	0.50	3.48	0.50	0.03	S

Key: \bar{X}_1 = Mean for Male, \bar{X}_2 = Mean for Female, SD1 = Standard Deviation for Males, SD2 = Standard Deviation for Females, S = Significant, NS = Not Significant.

Table 10 shows that the significant values of the items ranged from 0.14 - 0.64 for items 2,4,6,7,8,11 which are greater than 0.05 level of significance. This shows that the null hypothesis is upheld for those items. However, the table further showed that the significant values of items 1, 3, 5, 8, 9, 10, and 12 ranged from 0.00 – 0.03, indicating that for these items the null hypothesis of no significant differences in the responses of male and female students on confidence building attitude for success in external examinations is not upheld.

Discussion of the Findings

Based on the analysis of data, certain findings were made which is now discussed. The findings of the study on research question 1 which deals with the CBT skill needs of the students in booting the computer system for success in external examinations revealed that both male and female students needed the CBT skills in booting the computer system. The findings are in agreement with the opinion of Baker (2009) that booting on the computer requires various skills such as: Connect the VGA (video Graphic Adapter) cable from the monitor to system unit,

Locate and press the power button to start up the monitor, etc. This study is also in line with the study of Bodmann and Robinson (2004) who conducted a study on the speed and performance differences among students using CBT and traditional method of assessing students. He observed that the students with skills in CBT performed faster using CBT than the traditional method of assessing students. They also noted that the students had better scores using CBT.

The findings of the study on research question 2 which deals with CBT skill need of the secondary schools students in operating input and output device for success in external examinations revealed that both male and female students needed the CBT skills in operating input and output device. The findings is in agreement with Akukwe (2008) that operating input and output devices involves the following skills: Locate and press the buttons at the base of the monitor to adjust the volume, brightness, contrast and colour of the monitor, Click on the left button of the mouse to select an item etc.

The findings of the study on research questions 3 which deals with the use of Microsoft office application software for success in external examination revealed that both male and female students needed CBT skills in the use of Microsoft office application software. The findings are in agreement with the submission of Olatude et al (2015) that using Microsoft office application software requires skills such as: Open any application of your choice such as word, excel, Access etc, Create a document etc,

The findings of the study on research questions 4, which deals with the CBT skill needs of the students in connecting to internet for success in external examination, revealed that both male and female students needed CBT skills in connecting to the internet for success in external examination. The findings are in agreement with the submission of Olatude et al (2015) that connecting the internet involves various skills such as Observing when there is available wireless network etc.

The findings of the study on research questions 5, which deals with the CBT skill needs of the students in confidence building attitude for success in examination revealed that both male and female students needed the CBT skills in confidence building attitude for success in

external examination. The findings are in line with the submission of Ashley (2013) that building confidence in students requires various skills: Such as accept the truth about oneself, Integrating yourself with likeminded and supportive people etc.

The findings of the null hypothesis analyzed shows that the p-value of 41 items out of 72 items ranged from 0.00-0.04 which are less than 0.05 level of significance, indicates that there is significance difference in the mean rating of responses on CBT skill needs of male and female students in booting the Computer System, operating input and output devices, use of Microsoft office application software, connecting to internet, and confidence building attitude for Success in external examinations as regards to male and female. Therefore, the null hypotheses of no significant difference are not upheld on the 41 items. The p-values of the remaining 31 items range from 0.09-0.50 which is greater than 0.05 level of significance, indicates that there is no significance difference in the mean rating of responses of male and female on CBT skill needs of Secondary School Students in Nsukka in Booting the Computer System, Operating input and output devices, Use of Microsoft office application software, Connecting to internet, and Confidence building attitude for success in external examinations on the 31 items. Hence, the null hypothesis of no significant difference is upheld on the 31 items. The findings from testing the hypotheses is in agreement to the work conducted by Baker (2009), Akukwe (2008), Olatunde et al (2015) and Ashley (2013)

Conclusion

Over the years, pen and pencil have been used as a mode of examination for entrance into the higher institution. Ever since the development in ICT, emphasis is now placed on the use of computer as a tool for conducting examination into the university. A number of these students, though intelligent in the subject area, are ignorant or lack the basic skills on the use of computer for assessment, hence, they have not been as successful as they ought to be in Computer based assessment. Their lack of skill in Computer Based assessment therefore indicated the need for training in the use of computer for carrying out assessment. This

study identified the skills needed to enhance the preparedness of secondary school students for success in CBT. The study has had some contribution to knowledge and practice through the 72 skills needed by secondary school students for success in CBT. The information provided can be utilized by the secondary school students to seek for training in the above areas in any computer training outfit. Computer studies teacher can use the information from this work in preparing their students for CBT. The curriculum planners can incorporate the five areas of skills in the final year subject of the senior secondary school students for training them in the use of computer for success in eternal examination.

Recommendation

Based on the findings and conclusion, the recommendations were made:

1. Curriculum planners should be requested by the government to integrate the findings of this study in the subject of final year students in secondary schools to help them have access to areas of computer in which they should be trained for success in CBT
2. The government should direct teachers to make use of the findings of this study, integrate it to the programme of the students in their various schools to train the final year secondary school students for success in CBT.
3. Secondary school students should use the findings of this study either through the library or publication where they are available to seek for training for success in CBT

REFERENCES.

- Akukwe, D. C. (2008). *Computer Studies for junior secondary school*. Ibadan. Evan brothers' publishers Ltd.
- Ashly Miller (2013). *How to build a student self confidence*. Retrieved July 25th, 2016 from <http://www.ashlymiller.com>
- Baker, R.T. (2009). *Assessing the impact of technology on teaching and learning: Student perspectives*. Middle Tennessee State University. Retrieved July 12th, 2016 from <http://www.mtsu.edu>
- Bodmann, S. M. and Robinson, D. H. (2004). Speed and Performance Differences among Computer-Based and Paper-Pencil Tests. *Journal of Educational Computing Research*, 31(1), 51–60.
- Howland G. (2002). Balancing gameplay hooks. In Laramee F. D. (Ed.), *Game design perspectives* (pp. 78-84). Hingham, MA: Charles River Media
- Mubashrah, J., Tariq, R.H. & Shami, P.A. (2012). Computer-based vs paper-based examinations: perceptions of university teachers. *The Turkish online Journal of Educational Technology (TOJET)*, 11(4), 371-381.
- Okoro, O.M (2000). *Programme Evaluation in Education*. Obosi: Pacific College Press.
- Olawale and Shafi'i M.A. (2010). E- Exams System for Nigerian Universities with Emphasis on Security and Result Integrity, *The Seventh International Conference on e-learning for knowledge- Based Society*, Thailand.
- Olatunde A., Ijaku O., Mohammed Y., (2015). *Information and Communication Technology for junior secondary school*. West African book publishers Ltd.
- Omeh R.U. (2010). Competency Improvement Meets of crop farmers in soil Erosion in Enugu State. An unpublished M.ED project, Department of Vocational and Technical Education, University of Nigeria, Nsukka.
- Suleman, Q., Gul, R., Ambrin, S. and Kamran F. (2015). Factors Contributing to Examination Malpractices at Secondary School Level in Kohat Division, Pakistan. *Journal of Education and Learning*. 9(2), 165-182.
- Uysal, O. and Kuzu, A. (2009). A Thesis Proposal: Quality Standards of Online

Higher Education in Turkey. Internationalization and the Role of University Networks. *Proceedings of the 2009 EMUNI Conference on Higher Education and Research*, Potorož, Slovenia, 25 – 26 September. Retrieved December 25, 2010 From http://www.emuni.si/Files//Denis/Conference/EMUNI_HE-R/Proceedings/Papers/48.pdf

Whittington, D., Bull, J., & Danson M. (2000). Web-Based Assessment: Two UK Initiatives. The Sixth Australian World Wide Web Conference, *Rihga Colonial Club Resort*, Cairns, 12-17 June 2000, Australia. Retrieved October 12, 2010 from <http://www.ausweb.scu.edu.au/aw2k/papers/index.html>.



Computer Education Research Journal (CERJ)

Volume 5: Issue No. 1 pp 12-22, 2018

PROSPECTS OF PRIMARY SCHOOL TEACHERS IN THE UTILIZATION OF INFORMATION TECHNOLOGY FACILITIES IN TEACHING AND LEARNING IN OBUDU, CROSS RIVER STATE

BY

Ehujuo Anthony Ifeanyi
Computer Education Department
University of Nigeria, Nsukka
ehujuoanthonyifeanyi@gmail.com
08034887266

Ugwu Eunice Ifenyinwa
Home Economics Department
University of Nigeria, Nsukka
ugwu.eunice@unn.edu.ng
08064099663

Eze Ogbonnaya Okorie
Industrial Technical Education Department
University of Nigeria, Nsukka
ogbonnaya.eze@unn.edu.ng
07037571372

Ugwoke Chinyere Kate
Industrial Technical Education Department
University of Nigeria, Nsukka
kate.ugwoke.pg80898@unn.edu.ng
08030441716

ABSTRACT

The study focused on the Prospects of Primary School Teachers in the Utilization of Information Technology Facilities in Teaching and Learning in Obudu, Cross River State. Specifically, the study aimed at finding out the extent to which primary school teachers have utilized IT facilities in teaching and learning in primary schools, Obudu, and the challenges encountered by primary school teachers in the application of IT facilities in teaching and learning in Obudu. Two research questions and two null hypotheses guided the study. The population for the study was 120 primary school teachers from urban primary schools, Obudu. Questionnaire was used for data collection, consisting of 22 items used to elicit responses from the respondents. Data collected were analyzed using mean and standard deviation, while anova was used to test the two null hypotheses at significance level of 0.05. The findings revealed that primary school teachers in urban primary schools, Obudu do not make use of IT facilities in teaching and learning; it was also revealed that there are challenges facing primary school teachers in the application of IT facilities in teaching and learning, which includes: lack of IT facilities, and among others. Recommendations were made to remedy the situation which includes: Government should make IT facilities available in primary schools and among others.

Key words: Prospects, Primary School, Teachers, Teaching and Learning, IT, Utilization

Introduction

The world today is fast undergoing transition from analog to digital as a result of the present developments in Information Technology (IT). It has enlarged our intellectual horizon and technological know-how. Information Technology (IT) stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals), computers as well as necessary enterprise software, middleware,

storage, and audio-visual (Brakel & Chisenga, 2003). Information Technologies are electronic technologies used for information storage and retrieval. Utilization of IT facilities is therefore a sine qua non for qualitative instructional service delivery in primary schools. Milken Exchange on Education Technology (1999) defines IT as computer-based tools used by people to work with the information and communication processing needs of an organization. It encompasses the computer hardware and

software, the network and several other devices (video, audio, photography camera, and among others) that convert information (text), images, sound, motion, and so on into common digital form. IT has a wider spectrum of applications with enormous relevance to primary schools' teaching and learning activities. IT utilization is the presentation and distribution of instructional content through web environment (e-teaching) or systems offering an integrated range of tools (stand-alone computer instruction, CD ROM amongst others) to support learning and communication (Yusuf, 2005). Instructional service delivery has to do with teaching/learning activities that take place in the classrooms. Therefore, quality of instructional service delivery entails the extent of effectiveness to which primary school teachers carry out their classroom teaching/learning process. IT facilities according to Yusuf (2005) are as follows: Internet-Connected Laptops, Internet-Connected Desktop Computers, CD-ROM Database, Cyber cafe, Virtual Library (Digital Library), Website, Functional E-mail Address, Computer Laboratory, Computer Networking (Wide Area Network and Local Area Network), Examination Scoring Machine (OMR), Electronics Class Roll (ECR), Multimedia Classrooms (Audio Visual Centre), Computer Screen Reading Software, and Educational Software. There is an expectation that in the nearest future, IT facilities will be effectively utilized by teachers in teaching and learning in primary schools, Obudu.

Prospect is the possibility of something happening soon; a chance or the likelihood that something will happen in the near future, especially something desirable; vision of future; something that is expected or certain to happen in the future, or a mental picture of what may happen in the future; expectations of success; the likelihood of being successful or prosperous in the future, especially in a job or career (Yusuf, 2005). Expectations of teachers towards IT utilization in teaching and learning, and the ability to establish an interaction between technological innovation and human values, partly determine development and globalization. Primary school teachers are reluctant to the application of IT facilities in teaching and learning (Nwagwu, 2006). Primary school teachers prefer to remain in

analog era rather than responding to the global change, and they are so reluctant and adamant towards the acquisition of ICT skills (Wima & Lawler, 2007). This is a serious problem because, the world is fast becoming a global village and everyone needs to respond positively to the change to avoid being left behind. Many countries today view understanding of IT and mastering the basic skills and concepts of IT as part of the core of education. UNESCO aims to ensure that all countries, both developed and developing, have access to the best educational facilities necessary to prepare young people to play full roles in modern society. It is very necessary and important for primary school teachers to embrace and appreciate IT because; it has become, within a very short time, one of the basic building blocks of education and modern society (Suithwood, 2004). Some of the importance of IT in teaching and learning in primary schools according to Wima and Lawler, (2007) are as follows:

It will improve pupils' achievements and performances in teaching and learning activities. The leadership of IT will be improved and IT priority for development will be high. Investment in IT resources will improve teaching, and make IT part of everyday learning. It will systematically evaluate the impact of IT in improving learning and raising standards across the curriculum. Using IT will contribute positively to the personal development and future economic well-being of pupils. It will develop pupils' skills of working independently and cooperatively. It will support pupils with learning difficulties, enabling them to make at least the progress expected. It will equip teachers/pupils with internet skills and knowledge. Most teachers will have good subject knowledge in some aspects of IT and also confident and competent users of it. Increasingly, teaching assistants are acquiring good subject knowledge; pupils with learning difficulties or disabilities make good progress where teaching assistants have the necessary subject knowledge and skills to support them effectively. Assessment of pupils' performance will be made easy through the use of IT facilities.

IT will establish pupils' attainment on entry into primary school or take into account their

achievements outside school. It will increase the use of IT in other subjects in primary schools. Information technologies have the potential to accelerate, enrich, and deepen skills, to motivate and engage pupils, to help relate school experience to work practices, create economic viability for tomorrow's workers, as well as strengthening teaching and learning activities in primary schools. In this technology-driven age, IT competence helps everyone to survive. The demand for computer literacy is increasing in Nigeria, because; employees realized that computers and other IT facilities can enhance efficiency. It has created new instructional techniques that use IT to provide different modality of instruments. For the students, IT use allows for increased individualization of learning. In schools where new technologies are used, pupils have access to tools that adjust to their attention span and provide valuable and immediate feedback for literacy enhancement. IT application will prove beneficial in improving Nigeria's educational system and giving pupils a better education. A technologically-advanced workforce will lead to IT growth in Nigeria, with the potential to improve military technology and telecommunications, media communications, and skilled IT professionals who will be well-equipped to solve IT problems in Nigeria and other parts of the world. Because of the fundamental importance of IT in the tasks of teaching and learning today, primary school teachers ought to develop interest in IT and embrace its application in teaching and learning in primary schools.

Primary school is the first stage in Nigeria education system with duration of six (6) years; it is a lower academic level that prepares a learner for transition to a higher level in education; it is an elementary or infant stage in academic hierarchy (Davis & Tearle, 1999). In the primary school, teaching and learning are done at a lower level.

Teaching and learning are best thought of, not as separate and independent activities, but rather as two sides of the same coin, interconnected and interrelated. Teaching is the process or act of impacting knowledge on learners; the process of dishing out instructions to learners; an act of delivering a lesson; the process of coaching someone or group of

persons; the process of training someone or group of persons, either in a formal or informal platform (Sharples, 2014). The act of dishing out instructions to learners is done by a teacher.

A teacher on the other hand is someone that impacts or transfers knowledge, skills, idea, information, experience and among others to learners; someone that adds new knowledge, skills, idea, information, experience and among others to learners; someone that improves on the intellectual state of learners (Sharples, 2014). Learning occurs when someone gives out knowledge, skills, idea, information, experience and among others to learners.

Learning is the acquisition of knowledge or skills; knowledge or skill gained through education; a relatively permanent change in behavior or understanding; acquisition of information or skill; to acquire knowledge of a subject or skill through education or experience; to find out about something or somebody; to gain information about somebody or something; to memorize something such as facts, poem, a piece of music or dance; to teach a topic or skill to somebody (Sharples, 2014).

Ndiku, (2003), conducted a study on the problems encountered by school personnel in the implementation of computer use in primary schools in Uasin Gishu District. The population for the study was 200 respondents from Uasin Gishu District. The purpose of the study was to determine the challenges encountered by school personnel in the implementation of computer use in primary schools in Uasin Gishu District. The design of the study was a survey research design. A structured questionnaire was used for data collection. The findings revealed that teachers are too reluctant to respond to global change because of the challenges they encounter such as: poor information infrastructure, lack of IT facilities/components and among others. The study reviewed above is related to the present study as both studies have interest in IT application in teaching and learning in primary schools. The study under review differs from the current study as it dwelt on the problems encountered by school personnel in the implementation of computer use in primary schools while, the current study determines the prospects of primary school teachers in the utilization of information technology facilities in teaching and learning.

The study under review showed that no study has been done on the prospects of primary school teachers in the utilization of information technology facilities in teaching and learning in Obudu, Cross River State, which is the gap this study seeks to fill.

Purpose of the Study

The main purpose of this study was to determine the prospects of primary school teachers in the utilization of information technology facilities in teaching and learning in Obudu, Cross River State. Specifically, this study determined:

1. The extent to which primary school teachers have utilized IT facilities in teaching and learning in primary schools, Obudu, Cross River State.
2. The challenges encountered by primary school teachers in the application of IT facilities in teaching and learning in Obudu, Cross River State.

Research Questions

The following research questions guided the study:

1. To what extent have teachers utilized IT facilities in teaching and learning in primary schools, Obudu, Cross River State?
2. What are the challenges encountered by primary school teachers in the application of IT facilities in teaching and learning in Obudu, Cross River State?

Research Hypotheses

The following null hypotheses will be tested at 0.05 level of probability:

- i. **Ho 1:** There is no significant difference in the mean responses of teachers in St. Stephen Primary School, St. Charles Primary School, St. Patrick Primary School, Convert Primary School, High Standard Primary School, and Vatical Primary School on the extent to which primary school teachers have utilized IT facilities in teaching and learning in primary schools, Obudu, Cross River State.
- ii. **Ho 2:** There is no significant difference in the mean responses of teachers in

St. Stephen Primary School, St. Charles Primary School, St. Patrick Primary School, Convert Primary School, High Standard Primary School, and Vatical Primary School on the challenges encountered by primary school teachers in the application of IT facilities in teaching and learning in Obudu, Cross River State.

Methodology

Design of the Study

Descriptive survey research design was used in this study. This research design suited this study since the study sought to ascertain the opinions of respondents on the prospects of urban primary school teachers in the utilization of information technology facilities in teaching and learning in Obudu, Cross River State.

Area of the Study

This study was carried out in urban primary schools, Obudu, Cross River State. This area was chosen because they are not making use of IT facilities in teaching and learning and because of its proximity to the researcher. Six primary schools were used for the study. They are St. Stephen Primary School, Obudu, St. Charles Primary School, Obudu, St. Patrick Primary School, Obudu, Convert Primary School, Obudu, High Standard Primary School, Obudu, and Vatical Primary School, Obudu, Cross River State.

Population for the Study

The population of the study was all the primary school teachers from the six selected primary schools comprising of 20 teachers from St. Stephen Primary School, Obudu, 20 teachers from St. Charles Primary School, Obudu, 20 teachers from St. Patrick Primary School, Obudu, 20 teachers from Convert Primary School, Obudu, 20 teachers from High Standard Primary School, Obudu, and 20 teachers from Vatical Primary School, Obudu, Cross River State, making a total of 120 teachers.

Sample and Sampling Techniques

Total population sampling were used which is a type of purposive sampling technique that involves examining the entire population.

Instrument for Data Collection

A structured questionnaire was used to collect data for the study. The questionnaire

contained 22 items and was structured in line with the two research questions. The instrument was presented in three sections. Section A sought respondents' personal data, while sections B-C sought responses on the two research questions to elicit information from the respondents. The questionnaire was on a four points scale: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD) with assigned weight of 4, 3, 2, and 1 respectively.

Validation of Instrument

The instrument was subjected to face-validation by three experts from the Department of Computer Science, University of Calabar, Calabar, Cross River State. The advice and criticism of these experts were used to modify the instrument.

Reliability of the Instrument

The reliability of the instrument was established by trial testing using primary school teachers in Government Primary School, Gboko, Benue State; that did not form part of the sample. Cronbach Alpha reliability test was used to determine the internal consistency of the instrument on data obtained. The analyzed data yielded a reliability coefficient of 0.84, which showed that the instrument was reliable.

Method of Data Collection

The researcher employed the services of three research assistants to administer the questionnaires to the respondents. These assistants administered the questionnaires to the respondents and ensured that the correct and required responses were made. One hundred and twenty copies of questionnaires were distributed by hand. All the copies distributed were completed correctly and returned, showing a 100% return rate.

Method of Data Analysis

Statistical Package for Social Sciences (SPSS) was used for data analysis. The data collected were analyzed using mean and standard deviation. The hypotheses were tested using the analysis of variance (ANOVA) to ascertain the significant difference in the mean responses of the respondents at 0.05 level of probability. ANOVA was used because more than two groups were involved. Since the items were based on 4 points scale, the acceptable mean score was 2.50. Thus, mean rating of 2.50 and above were considered as agreed, while items with mean rating below 2.50 were considered as disagreed. Respondent opinions were interpreted using real limit of numbers.

Findings

The following findings were made:

1. **Research Question 1:** To what extent have teachers utilized IT facilities in teaching and learning in primary schools, Obudu, Cross River State?

Table 1: The mean rating and standard deviation of respondents on the extent to which primary school teachers have utilized IT facilities in teaching and learning in primary schools, Obudu, Cross River State

S/N	ITEMS	MEAN	SD	REMARK
1	Primary school teachers use IT facilities to teach	2.00	0.72	Disagree
2	IT facilities are available in my school	1.98	0.74	Disagree
3	Primary school teachers own computers/laptops	1.86	0.72	Disagree
4	Primary school teachers are computer literates	1.73	0.71	Disagree
5	Primary school teachers are responding to the global change (Analog-Digital era)	1.66	0.70	Disagree
6	Computer Assisted Instruction is used in my school	1.64	0.77	Disagree
7	Primary school teachers undergo ICT training	1.57	0.73	Disagree
8	Internet facilities/services are available in my school	1.59	0.81	Disagree
9	Primary school teachers have ICT skills/knowledge	1.59	0.83	Disagree
10	Primary school teachers undergo ICT re-training	1.60	0.80	Disagree
11	Primary school teachers have interest in ICT application	1.96	0.97	Disagree

The data presented in table 1 revealed that eleven items on the extent to which primary school teachers have utilized IT facilities in teaching and learning in primary schools, Obudu, Cross River State had their mean values ranging from 1.57 to 2.00. This showed that the mean of each of the eleven items was below the real limit of 2.50, indicating that primary school

teachers disagree that they do not make use of IT facilities in teaching and learning. The table further showed that the standard deviation (SD) of the items were within the range of 0.70 to 0.97 in eleven items indicating that the opinions of the respondents were not far from each other in their responses to the eleven items.

Research Question 2: What are the challenges encountered by primary school teachers in the application of IT facilities in teaching and learning in Obudu, Cross River State?

Table 2: The mean rating and standard deviation of respondents on the challenges encountered by primary school teachers in the application of IT facilities in teaching and learning in Obudu, Cross River State

S/N	ITEMS	MEAN	SD	REMARK
1	There is poor IT infrastructure in the primary schools	3.55	1.48	Agree
2	IT development and application are not well established in my school	3.03	1.22	Agree
3	Primary school teachers lack IT facilities	3.21	1.06	Agree
4	Electricity failure has been a persistent problem militating against ICT application in my school	3.55	0.91	Agree
5	Primary schools don't offer ICT training programmes	3.34	0.90	Agree
6	Non integration of ICT into primary school curriculum	3.40	0.85	Agree
7	Poor ICT policy/project implementation strategy in primary schools	3.41	0.80	Agree
8	Inadequate ICT manpower in primary schools	3.41	0.79	Agree
9	The cost of ICT facilities/components is too high	3.44	0.77	Agree
10	Primary school teachers lack ICT skills	3.45	1.42	Agree
11	Poor perception of ICTs among primary school teachers	3.40	0.77	Agree

Data presented in table two revealed that eleven items on the challenges encountered by primary school teachers in the application of IT facilities in teaching and learning in Obudu, Cross River State had their mean values ranging from 3.03 to 3.55. This showed that the mean of each of the eleven items was above the real limit of 2.50, indicating that the respondents agree that all the eleven items are challenges facing primary school teachers in the application of IT facilities in teaching and learning in Obudu, Cross River State. The table further showed that the standard deviation (SD) of the items were within the range of 0.77 to 1.48 in eleven items, indicating that the opinions of the respondents were not far from each other in their responses to the eleven items.

Hypothesis 1

There is no significant difference in the mean responses of teachers in St. Stephen Primary School, St. Charles Primary School, St. Patrick Primary School, Convert Primary School, High Standard Primary School, and Vatical Primary School on the extent to which primary school teachers have utilized IT facilities in teaching and learning in primary schools, Obudu, Cross River State.

Analysis of variance (ANOVA) of the responses of teachers in St. Stephen Primary School, St. Charles Primary School, St. Patrick Primary School, Convert Primary School, High Standard Primary School, and Vatical Primary School on the extent to which primary school teachers have utilized IT facilities in teaching

and learning in primary schools, Obudu, Cross River State.

The result of the analysis of variance in Hypothesis 1 showed the ANOVA result of the mean differences between teachers in St. Stephen Primary School, St. Charles Primary School, St. Patrick Primary School, Convert Primary School, High Standard Primary School, and Vatical Primary School on the extent to which primary school teachers have utilized IT facilities in teaching and learning in primary schools, Obudu, Cross River State. The result showed that an F-ratio of 6.97 with exact probability of 0.00 was obtained. The exact probability value of 0.00 was compared with the significance value of 0.05 used in testing the hypothesis. Since 0.00 is less than 0.05, the null hypothesis which stated that there is no significant difference in the mean responses of teachers in St. Stephen Primary School, St. Charles Primary School, St. Patrick Primary School, Convert Primary School, High Standard Primary School, and Vatical Primary School on the extent to which primary school teachers have utilized IT facilities in teaching and learning in primary schools, Obudu, Cross River State was rejected. Inference drawn was that there is a significant difference in the mean responses of teachers in St. Stephen Primary School, St. Charles Primary School, St. Patrick Primary School, Convert Primary School, High Standard Primary School, and Vatical Primary School on the extent to which primary school teachers have utilized IT facilities in teaching and learning in primary schools, Obudu, Cross River State.

Hypothesis 2

There is no significant difference in the mean responses of teachers in St. Stephen Primary School, St. Charles Primary School, St. Patrick Primary School, Convert Primary School, High Standard Primary School, and Vatical Primary School on the challenges encountered by primary school teachers in the application of IT facilities in teaching and learning in Obudu, Cross River State.

Analysis of variance (ANOVA) of the responses of teachers in St. Stephen Primary School, St. Charles Primary School, St. Patrick Primary School, Convert Primary School, High Standard Primary School, and Vatical Primary

School on the challenges encountered by primary school teachers in the application of IT facilities in teaching and learning in Obudu, Cross River State.

The result of the analysis of variance in Hypothesis 2 showed the ANOVA result of the mean differences between teachers in St. Stephen Primary School, St. Charles Primary School, St. Patrick Primary School, Convert Primary School, High Standard Primary School, and Vatical Primary School on the challenges encountered by primary school teachers in the application of IT facilities in teaching and learning in Obudu, Cross River State. The result showed that an F-ratio of 11.09 with exact probability of 0.00 was obtained. The exact probability value of 0.00 was compared with the significance value of 0.05 used in testing the hypothesis. Since 0.00 is less than 0.05, the null hypothesis which stated that there is no significant difference in the mean responses of teachers in St. Stephen Primary School, St. Charles Primary School, St. Patrick Primary School, Convert Primary School, High Standard Primary School, and Vatical Primary School on the challenges encountered by primary school teachers in the application of IT facilities in teaching and learning in Obudu, Cross River State was rejected. Inference drawn was that there is a significant difference in the mean responses of teachers in St. Stephen Primary School, St. Charles Primary School, St. Patrick Primary School, Convert Primary School, High Standard Primary School, and Vatical Primary School on the challenges encountered by primary school teachers in the application of IT facilities in teaching and learning in Obudu, Cross River State.

Discussion of the Findings

This study sought to determine the Prospects of Primary School Teachers in the Utilization of Information Technology Facilities in Teaching and Learning in Obudu, Cross River State. The findings of the study revealed that primary school teachers in Obudu disagree that they do not make use of IT facilities in teaching and learning. The findings are: primary school teachers do not use IT facilities to teach, IT facilities are not available in urban primary Schools, Obudu, primary school teachers do not own computers/laptops,

primary school teachers are not computer literates, primary school teachers are not responding to the global change (Analog-Digital era), Computer Assisted Instruction (CAI) is not utilized in urban primary Schools, Obudu, primary school teachers do not undergo ICT training, internet facilities/services are not available in urban primary Schools, Obudu, primary school teachers do not have ICT skills/knowledge, primary school teachers do not undergo ICT re-training, and primary school teachers do not have interest in ICT application. These findings are in line with Uwameiye, (2015), who was of the opinion that primary school teachers prefer to remain in analog era rather than responding to the global change, and they are so reluctant and adamant towards the acquisition of ICT skills. This is a serious problem because, the world is fast becoming a global village and everyone needs to respond positively to the change to avoid being left behind (Wima & Lawler, 2007). ICT skills acquisition is a very important skill that primary school teachers must acquire in order to fit into the digital era else, they may no longer be useful with time. For this reason, ICT integration into the school curriculum is very important (Plante & Beattie, 2004). In this era, teaching and learning activities should be learners' based and not teacher's based. It is high time primary school teachers changed their view of ICT or get ready for technological displacement.

This study also revealed some of the challenges encountered by primary school teachers in the application of IT facilities in teaching and learning. These challenges are listed below: There is poor ICT infrastructure in teaching and learning, ICT development and application are not well established in urban primary schools, Obudu, Primary school teachers lack IT facilities, Electricity failure has been a persistent problem militating against ICT application in urban primary Schools, Obudu, Urban primary schools in Obudodo not offer ICT training programmes, Non integration of ICT into primary school curriculum, Poor ICT policy/project implementation strategy in primary schools, Inadequate ICT manpower in primary schools, The cost of ICT facilities/components is too high, Primary school teachers lack ICT skills, and Poor perception of ICTs among primary school

teacher.

These findings are in line with Okwudishu, (2005), who pointed out that there is need for the creation of awareness and use of information and communication technology (ICT) among urban primary school teachers. Plante & Beattie, (2004), are of the opinion that connectivity and ICT integration in urban primary schools is a task that calls for immediate attention. ICT integration into the school curriculum will go a long way in handling most of these challenges. ICT infrastructure as well as ICT development and application, if established in primary schools, will create a good impression in the minds of primary school teachers (Oduroye, 2005). According to Tyler, (1998), lack of ICT knowledge/skills among primary school teachers is as a result of lack of ICT training programmes in urban primary schools. ICT policy/project implementation strategy in urban primary schools is nothing to write home about. The entire system is ICT handicapped. According to Ndiku, (2003), power failure is one of the major problems encountered by urban primary school personnel in the implementation of computer use in primary schools. Availability of ICT facilities and adequate manpower in urban primary schools, Obudu, as well as inculcation of positive attitudes in the minds of primary school teachers towards ICT utilization in teaching and learning, will go a long way in addressing these issues (Nwagwu, 2006).

Conclusion

The adoption and use of IT facilities in primary schools have a positive impact on teaching, learning, and research of primary school teachers. Despite the roles ICT play in education, primary schools in Obudu urban are yet to extensively adopt them for teaching and learning. Efforts geared towards integration of ICTs into the primary school system have not had much impact. Problems such as poor policy and project implementation strategies and poor information infrastructure militate against these efforts.

Recommendations

In order to ensure that primary school teachers' expectations in the utilization of

information technology facilities are met, the following efforts should be made:

- Teachers should be equipped with IT skills to enable them apply it effectively
- Government should make IT facilities available in primary schools

References

- Adomi, E.E., & Anie, S.O. (2006). An assessment of computer literacy skills of professionals in Nigerian university libraries. *Library Hi Tech News* 23 (2): 10-14.
- Adomi, E.E. (2005). Internet development and connectivity in Nigeria. *Program* 39 (3): 257-68.
- Adomi, E.E. (2005b). The effects of a price increase on cybercafé services in Abraka, Nigeria. *The Bottom Line: Managing Library Finances* 18 (2): 78-86.
- Adomi, E.E. (2006). Mobile phone usage patterns of library and information science students at Delta State University, Abraka, Nigeria. *Electronic Journal of Academic and Special Librarianship* 7 (1). Available: <http://southernlibrarianship.icaap.org/v7n01/adomi-e01.htm>.
- Adomi, E.E. (Forthcoming b). African Web portals. In Tatnall, A. (Ed.) *Encyclopaedia of portals technology and applications*. Pennsylvania: Idea Group (in press).
- Adomi, E.E. (Forthcoming c). Africa and the challenges of bridging the digital divide. In Khosrow-Pour, M. (Ed.). *Handbook of public information technology*. Pennsylvania: Idea Group (in press).
- Adomi, E.E. (Forthcoming a). Overnight Internet browsing among cybercafé users in Abraka, Nigeria. *Journal of Community Informatics*. (in press).
- Adomi, E.E., Okiy, R.B., & Ruteyan, J.O. (2003). A Survey of cybercafés in Delta State, Nigeria. *The Electronic Library* 21 (5): 487-95.
- Adomi, E.E., Omodeko, F.S., & Otdo, P.U. (2004). The use of cybercafé at Delta State University, Abraka, Nigeria. *Library Hi Tech* 22 (4), 383-88.
- Aduwa-Ogiegbian, S.E., & Iyamu, E.O.S. (2005). Using information and communication technology in secondary schools in Nigeria. *Educational Technology & Society* 8 (1), 104-112.
- Aginam, E. (2006). NEPAD scores students' ICT education in Africa Low. *Vanguard*. Available: <http://www.vanguardngr.com/articles/2002/features/technology/tec527092006.html>.
- Al-Ansari, H. (2006). Internet use by the faculty members of Kuwait University. *The Electronic Library* 24 (6): 791-803.
- Alayi, G.O. (2003). NITDA and ICT in Nigeria. Available: <http://ejds.org/meeting/2003/ict/papers/Ajayi.pdf>.
- Brakel, P.A., & Chisenga, J. (2003). Impact of ICT based distance learning: The African story. *The Electronic Library* 21 (5), 476-486.
- Davis, N.E., & Tearle, P. (Eds.). (1999). A core curriculum for telematics in teacher

- training. Available:
<http://www.ex.ac.uk/telematics.T3/corecurr/tteach98.htm>
- Enakrire, R., Onyenenia, O.G. (2007). Factors affecting the development of information infrastructure in Africa. *Library High Tech News* 24 (2):15-20.
- Enuku, U.A., & Enuku, O. (1999 & 2000) Breaking down the walls: Computer application in correctional/prison education. *Benin Journal of Educational Studies* 12/13 (1/2): 64-71.
- Evoh, C.J. (2007) Policy networks and the transformation of secondary education Through ICTs in Africa: The prospects and challenges of the NEPAD E-schools Initiative. *International Journal of Education and Development Using Information and Communication Technology (IJEDICT)* 3 (1), 64-84. Available:
<http://ijedict.dec.uwi.edu/include/getdoc.php?id=2198&article=272&mode=pdf>
- Federal Republic of Nigeria (2006). Government in action. Available:
http://www.nigeriafirst.org/article_2090.shtml.
- Federal Republic of Nigeria (2004). National policy on education. 4th ed. Lagos: Nigerian Educational Research and Development Council.
- Goshit, T. (2006). Nigeria's need for ICT: SP. 259 technology and policy in Africa. Available:
<http://ocw.mit.edu/NR/rdonlyres/Special-Programs/SP-259Spring-2006/891209EE-E63B-4617-BA9D-7635A63C754B/0/goshit.pdf>
- Ighoroje, A.D., & Ajayi, O.B. (n.d.). Female awareness level of information technology in Nigeria. Available:
<http://archive.wigsat.org/gasat/papers1/6.txt>
- James, T. (Ed.) (2001). *An information policy handbook for Southern Africa: A knowledge base for decision-makers*. Johannesburg: International Development Research Center's (IDRC) Regional Office for Southern Africa.
- Kaku, F.A. (2005). *The use of Internet by secondary school teachers in the rural areas of Delta State: The case of Udu Local Government Area*. Abraka: Delta State University. Unpublished B.Sc. (LIS) project.
- Lemke, C., & Coughlin, E.C. (1998). *Technology in American schools*. Available:
<http://www.mff.org/pnbs/ME158.pdf>
- Milken Exchange on Education Technology (1999). *Will new teachers be prepared to teach in a digital age?* Santa Monica: Milken Family Foundation. Retrieved from file
<http://www.mf.org/puts/ME154.pdf> on 25/6/2007.
- Ndiku, L. (2003). *The problem encountered by school personnel in the implementation of computer use in primary schools in Uasin Gishu District*. Unpublished thesis: Moi University, Eldoret.
- NITDA (2003). *Use IT: National Information Technology Development Agency*, Abuja Nigeria. Available:
http://www.nitda.gov.ng/use_it.htm.
- Nwagwu, W.E. (2006). Integrating ICTs into

- the globalization of the poor developing countries. *Information Development* 22 (3): 167-179.
- Oduroye, A.P. (2005) Challenges of learning and teaching with computers. Available: <http://www.itnetwork.org.uk/56.htm>
- Okebukola, P. (1997). Old, new, and current technology in education. *UNESCO Africa* 14 (15): 7-18.
- Okebukola, P. (2004). E-learning in varsities, others underway, NUC boss lists strategies. *The Guardian* (12 October): 35, 39.
- Okwudishu, C.H. (2005). *Awareness and use of information and communication technology (ICT) among village secondary school teachers in Aniocha South Local Government Area of Delta State*. Abraka: Delta State University. Unpublished B.Sc. (LIS) project.
- Plante, J., & Beattie, D. (2004). Connectivity and ICT integration in Canadian elementary and secondary schools: First results from the Information and Communications Technologies in Schools Survey, 2003 – 2004. Available: <http://www.stacan.ca/english/research/81-595-MIE200407.pdf>
- Reffell, P., & Whitworth, A. (2002). Information fluency: Critically examining IT education. *New Library World* 103 (1182/1183): 427-35.
- Sharples, J. (2014). A Frustrating Game for Brain-Computer Interface Experiments. *Intelligent Technologies for Interactive Entertainment (INTETAIN)*. pp. 221–227. UK: University of Manchester Publication
- Suithwood, R. (2004). African telecom indicators: What do they use and why? Available: http://www.balanceingact_africa.com/news/back/balancingact_147.html.
- Tyler, K.D. (1998). The problem in computer literacy training. Available: <http://www.ccs.new.edu/home/romulus/papers/mywu/report.htm>.
- Uwameiye, B. E. (2015), Application of ICT in effective teaching and learning of Home Economics in secondary schools in Nigeria: European Scientific Journal. Vol. 11(7).
- Wima, P., & Lawler, M. (2007). Investing in ICTs in educational institutions in developing countries: An evaluation of their impact in Kenya. *International Journal of Education and Development Using ICT*. Available: <http://ijedict.deu.uwi.edu?viewarticle.php?id=241>
- Yusuf, M.O. (2005). Information and communication education: Analyzing the Nigerian national policy for information technology. *International Education Journal* 6 (3), 316-321.
- Yusuf, M. O. (2005). Integrating ICTs in Nigerian tertiary education. *The African Symposium: An Online Journal of African Educational Research Networks*, 5 (2), 43-50.



Computer Education Research Journal (CERJ)

Volume 5: Issue No. 1 pp 23-33, 2018

CLOUD-BASED LEARNING AND ASSESSMENT: BENEFITS AND CHALLENGES

BY

Nannim, Audu Fadip

Department of Science Education, University of Nigeria, Nsukka
fadip.nannim@unn.edu.ng, +2348032607450

ABSTRACT

Technological advancement such as cloud computing has particularly led to a paradigm shift in teaching and learning where teachers and learners now have access to virtual learning resources such as computers, networks, storage and applications which facilitate learning and enhances the way assessment is being done. This technology promotes collaborative learning and real-time feedback as students and teachers can seek and get help anytime and anywhere. The challenges of traditional pen and paper mode of assessment such as printing, logistics and issues relating marking of examinations or quizzes are reduced. This paper explores the concept of cloud computing, cloud-based learning and assessment, types of cloud services and deployment models, cloud-based tools and application for learning and assessment. Particularly, emphasis is laid on applications which facilitate learning and also enhance carrying out of assessment. The paper also discussed some benefits which the Nigerian education sector stands to gain when cloud-based learning and assessment is adopted, while recommendations were proffered to the challenges which often confront the integration of cloud-based technology in learning and in doing assessment.

Keywords: Cloud Computing; Learning; Assessment; Benefits; Challenges

Introduction

There is a paradigm shift in the use of technology in our day to day life, as well as in teaching and learning processes as a result of proliferation of Information and Communication Technology (ICT) infrastructure in our communities and in the education system. The availability of internet access even to the remote communities of the developing nations is an evidence that ICT has permeated all aspects of human endeavor, hence, the world is a global village. This globalization has positively affected our education system from the way we seek information, teach and learn and even the way we perform management/administrative functions in our educational system (Cox,

Abbott, Webb, Blakeley, Beauchamp & Rhodes, 2003).

There are various kinds of computers such as laptop, iPad and other mobile devices such as iPhone, android and other brands of mobile phones which enables access to learning resources online. What this means is that the future of learning technology implies access to teaching and learning anytime and anywhere. The cloud-based learning environment promised greater interaction and collaboration for students with an ever-expanding circle of their peers, not minding their location or country of domicile. It has simplified the way assessment is being conducted because time and space is no longer a barrier to learning and doing assessment as opposed to the traditional lifelong

education. In some cases, there is immediate feedback which is a great motivation to the learners.

The use of cloud-based technologies in learning are referred to as the major trend in Technology-Enhanced Learning (TEL) domain. The swift progress in the cloud-based technologies have led to an outstanding change in the twenty-first century, as well as affecting the demands of modern societies and in our educational system (Buabeng-Andoh, 2012), hence, an increasing need for educational institutions to use ICT in delivering skills and knowledge, which students need in 21st century.

Teaching and learning process has hitherto been viewed as a very hectic and an uninteresting task by some teachers and students (Daschmann, 2013) due to the fact that the chalk and talk method is often very stressful and unmotivating to some learners. The cloud-based learning has gone beyond the use of local educational institutions or universities servers for educational purposes, it has laid a foundation for learning institutions to use technology in storing and sharing of learning or instructional materials online (Atabekova, Gorbatenko & Chilingaryan, 2015). It could be right to say therefore that adopting cloud-based learning and assessment in the Nigerian education system will be of immense benefits as it will save up-front infrastructural cost of purchasing servers and software. It also ensures that teachers and students get the needed applications and other materials for teaching and learning much easier and faster online, hence, saving time and money that would have been spent on the purchase of software. Though, cloud providers provide their services on a “pay as you go” bases, it is still considerably cheaper compared to the cost of buying educational apps to install on computers or servers. Besides, most of these educational apps can be accessed in Apple store or Google Play store of our mobile devices for free.

The cloud technology has a lot of promises in transforming teaching and learning by enabling a learning environment which facilitates the pedagogical shift from the teacher-centred approach to the learner-centred approach. This is due to its constructivist nature which allows learners to interact with the learning applications, hence, learners construct

their learning (Denton, 2012). However, most teachers still lacks the basic knowledge of cloud-based learning and assessment, its benefits and also the requisite skills needed to implement the technology (Mahalingam & Rajan, 2013; Thomas, 2011).

2. Background to Cloud Computing, Cloud-Based Learning and Assessment

Cloud computing simply called the “cloud” has been viewed as a distributed computing paradigm which enables access to virtual resources such as computer, network, storage, applications and development platforms (Mell & Grance, 2009). Microsoft Azura (2017) defines cloud computing as the delivery of computing services such as servers, storage, databases, networking, software, analytics e.t.c over the Internet. The companies which offer these computing services are called cloud providers, typically they charge for cloud computing services based on usage. These resources can scale up and down to meet with the user's demand by creating an impression of every time and anywhere resource availability. The resources can be requested, used and modify by the user without suppliers intervention (Ryczko, 2014).

The cloud provides these resources as services over the internet. The internet is a network of networks which interconnect different computers for the purpose of communication and transfer of data (Leiner et al., 2009). Cloud services can be categorized into three thus: SaaS (Software as a Service), PaaS (Platform as a Service) and IaaS (Infrastructure as a Service) (Zhang, Cheng & Boutaba, 2010). These services are dependent on internet for every time and everywhere availability. Some important providers or stakeholders in cloud computing are Google, Amazon and Microsoft (González-Martínez, Bote-Lorenzo, Gómez-Sánchez & Cano-Parra, 2015).

Boiros (2014) described cloud-based learning as online learning or e-learning that is available in the cloud; meaning that learning resources are stored in a virtual environment and accessed from various forms of web-enabled devices. To evaluate, measure and document the learning outcome or educational needs of

students, there are varieties of cloud-based applications which teachers can use to achieve that. Examples include; Moodle, Google Suites (G-Suites) such as Google classroom, Blogs, WhatsApp and Facebook. According to Rickards and Steele (2014), cloud-based assessment enables teachers to conduct, monitor and guide student progress via the cloud applications.

Today, assessment is no more time consuming and piles of paperwork which involved tedious work, but the internet provides immediate results of assessment. These cloud-based tools or applications enables both formative and summative assessments. In formative assessment, educators use cloud applications for in-process evaluation of students learning which are typically applied many times during the course unit. The purpose of formative assessment is to give educators in-

process feedback about what students are learning or not, so that the instructional approaches and support can be modified accordingly (Great Scholars Partnership, 2014). These take several forms which include quizzes, assignment, group discussions which is not normally graded. Examples of cloud-based applications suitable for formative assessment include Skype, blogs, WhatsApp and Facebook. The summative assessment on the other hand is used to evaluate student learning at the end of a particular instructional period, such as end of unit, course, semester or school year. It is typically scored and graded to determine if students have learned the expected learning objectives for the defined instructional period (Great Scholars Partnership, 2014). The commonly used cloud-based application for summative assessment is the Moodle.

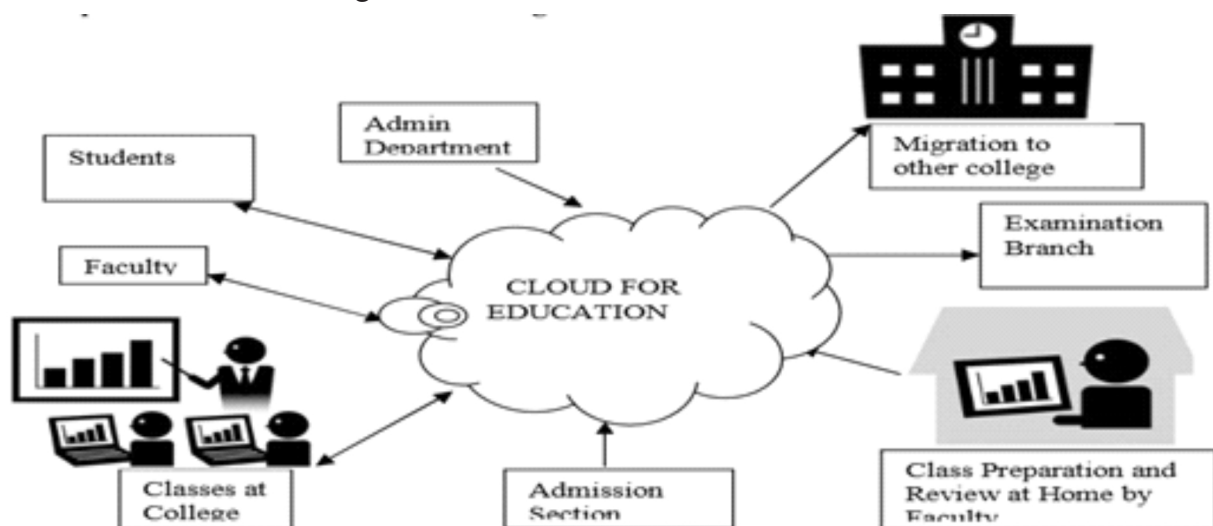


Fig 1: Services attached to Education Cloud. Source: (Yadav, 2014, p. 3110)

Studies have shown that cloud computing is supposed to be the mainstream of educational technology (Uden, 2014; Mahalingam & Rajan, 2013; Thomas, 2011). Recent studies have also presented that cloud computing influence students' overall academic studies and learning (Atabekova, Gorbatenko & Chilingaryan, 2015; Jou & Wang, 2013) because it allows personal learning, enables students to interact and collaborate with ever-expanding circle of their peers and teachers, regardless of geographical location. However, teachers lack awareness of this technology, it's benefits and how to integrate it in teaching and

learning process (Appiahene, Kesse & Ninfakang, 2016; Yadav, 2014). Therefore, this paper explores cloud-based tools for learning and assessment, the benefits and challenges of its adoption in Nigerian education system.

2.1 Types of Cloud Services

Cloud computing offers a pool of virtual resources such as hardware, development platforms or services available over the network. Most of these cloud services fall into three broad categories: infrastructure as a service (IaaS), platform as a service (PaaS) and software as a service (SaaS) (Zhang et al., 2010).

Infrastructure-as-a-Service (IaaS):

At the lowest level of abstraction is the IaaS. It is the most basic category of cloud computing services. With IaaS, you rent IT infrastructure servers and virtual machines (VMs), storage, networks and operating systems from a cloud provider on a pay-as-you-go basis. Example of IaaS are Google compute Engine and Amazon EC2 (González-Martínez et al., 2015).

Platform as a Service (PaaS): The next level, which is usually built upon the IaaS is the Platform-as-a-Service (PaaS). It refers to cloud computing services that supply an on-demand environment for developing, testing, delivering and managing software applications. The PaaS is designed to enable easy and quick development of web or mobile apps not minding setting up or managing the underlying infrastructure of servers, storage, network and databases needed for development. Using the programming runtime environment supported by the providers, PaaS allows users to create and deploy applications onto the cloud infrastructure. At this level, the programming and deployment framework is provided by Google App Engine (GAE) and Microsoft Window Azure.

Software as a Service (SaaS): The best-known model today is the Software-as-a-Service (SaaS). It is a scheme for delivering software applications over the Internet on demand and typically on a subscription basis. Here, cloud providers host and manage the software application and underlying infrastructure. Also, task of maintenance such as software upgrades and security patching is handled by the cloud providers host. With the help of browser on their computer, phone or tablet, users can connect to the application over the Internet, especially through the Apple Store (for Apple Phones) or Google Play (for Androids). The common resources found at this level include multimedia or web services which are usually accessible via a web client (Zhang et al., 2010). G-suites, Moodle, Facebook, WhatsApp are some common example of SaaS applications. These services are offered by the cloud providers, according to different deployment models.

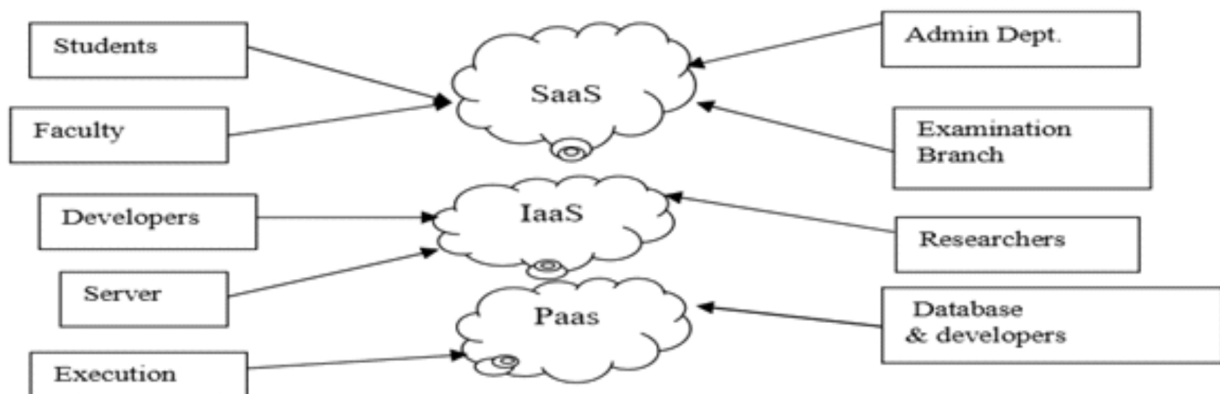


Fig 2: Users of an Educational Cloud Services. **Source:** (Yadav, 2014, p. 3111)

2.2 Cloud Deployment Models

Cloud services or resources are deployed based on the following models: public cloud, private cloud, community cloud and hybrid cloud.

Public clouds are cloud owned and operated by a third-party cloud service provider. Here, the cloud infrastructure is provisioned for use by the general public (González-Martínez et al., 2015). They provide resources such as servers and storage over the Internet. Public cloud ensures that all hardware and software,

including the supporting infrastructure is owned and managed by the cloud providers. Access to these services and management of your account is via the web browser.

Private cloud refers to a cloud where cloud computing resources are used exclusively by a single organization. Here, cloud services and infrastructure are maintained on a private network. It can be physically located in the organization's on-site datacenter. Some organizations do pay third-party service providers to host their private cloud.

A community cloud is a deployment platform which ensures that a cloud infrastructure is used by a particular community

of consumers from organizations that have shared concerns.

Hybrid clouds are a combination of public and private clouds, bound together by technology that allows data and applications to be shared between them. This integration gives organizations greater flexibility and more deployment options. However, the critical tasks are done using private cloud while the non-critical tasks are performed using public cloud.

1. Cloud-Based Tools and Application for Learning and Assessment

Cloud-based tools or applications can be viewed as web-based tools which are assessable through the web browser. They range from basic web browsers to the general online learning environment (OLEs) packages (Cloud based Tools and Applications for Learning, 2015). There are various devices being used today in supporting learning and assessment in our educational institutions which can help to positively transform the learners learning experiences and improving the learning outcome. They include devices such as laptops, iPads, mobile phones, Smartboards/Interactive Whiteboards, network devices and broadband internet connections which grant us access to the cloud. The cloud-based applications include cloud packages such as Moodle, G-Suites, WhatsApp, Twitter, Facebook and YouTube. The application of these cloud-based applications in facilitating learning and assessment is discussed below.

Moodle: It is designed and developed based on the social constructivist theory and practice of teaching and learning (Moodle in education, 2011). It represents one of the most widely used open-source e-learning platforms that made the creation of a course website possible and ensures their access to only the enrolled students (Cole & Foster, 2008). It can be used to support a number of other pedagogical approaches. The modularity, flexibility, security and free availability feature have made it attractive to different learning communities. The use of Moodle as a learning platform has six major functions which include; creation, organization, delivery, communication, collaboration and assessment (Costa, Alvelos & Teixeira, 2012).

It enables the creation or building, sharing and search for a collection or bank of record entries on any topic or subject. It also organized and give access to well-ordered and summarized instructional materials. It enables easy delivery of assignments by students to teachers. Moodle also allows teachers to evaluate students work and provide feedback, including grade in a private mode. It allows synchronous and asynchronous communication whereby students and teachers can exchange ideas by posting comments. It further makes provision for creating and maintaining a list of definitions.

Moodle encourages collaborative activities which are restricted by entries made by the teacher. The assessment facility of this tool makes it possible for teachers to design and build quizzes with a variety of questions, with different types of answers such as multiple choice, true or false, short answer. It guarantees immediate feedback to student, hence, stimulating learning.

Google Suites (G-Suites): Google is at the forefront of offering cloud-based learning and assessment services. Google web applications and services for teaching and learning (G-Suites for education) includes google mail (g-mail), google plus, google drive, google sites, google calendar and google video (G-suites for Education, 2018):

➤ **G-mail:** G-mail is a digital mechanism for exchanging messages through Internet communication platforms. Its quick, secure, low cost, and ability to attach files and share to more than one recipient at a time has made it an inevitable tool for learning. Some of the uses of g-mail for the purpose of learning and assessment include; presenting course contents and learning materials for students, providing learning guidance to learners, enhances evaluation and feedback to the entire class, eliciting feedback from students and grade reporting.

➤ **Google plus (G⁺):** This application offers a free social networking service that can be accessed from various digital devices. A G⁺ social networks between teachers and students can be easily established which would allow users to collaborative and

constructive learning.

➤ **Google drive (Google Docs, Sheets and slides)** – this is a cloud-based approach for document, spreadsheet and presentation creation. The web-based office suite allows real-time collaborative learning as it enables users to create and edit documents online. Google drive enables teachers and students to immediately write down, view, and reply to the ideas conveyed through any connected computer or mobile device. It facilitates learning and increase the ease of conducting assessment.

➤ **Google sites:** This is a structured wiki- and webpage-creation application which allows users to create dynamic web pages with their partners which enables the ease of writing a document. The use of Google sites can therefore assist teachers and students in and expressing their views hence encouraging collaboration and can also be used by teachers as a means of assessing progress.

➤ **Google Calendar** – This is an online calendar and scheduling system.

➤ **Google Video** – Is a video hosting service which can be used to attach instructional videos for learners' use.

YouTube: YouTube is a powerful tool which can be used for teaching and learning as it enhances students learning in the classroom. Many educational videos are made available on YouTube for students use, which keeps students up to date on the world around them. Tutorials lectures on various subjects and topics e.g showing students how certain laboratory experiments are being conducted are also deposited there to help in elaborating what is taught in class (Pappas, 2015). Teachers also find this tool very useful as it served as a reservoir for instructional aids, though care is needed in selecting content on YouTube as irrelevant content or misguided information may be accessed and used and which instead of helping learners, it will rather confuse them. It is also advisable that teachers upload their own tutorial videos and send the links to students to access. According to Hicks (2015), the following should guide teachers in using YouTube:

➤ Bring in videos that show a more fun side of the lesson, which engages and make

learning of the subject more interesting.

➤ You can give students recommended extra resources or assignment through YouTube playlist.

➤ Create a video recorded class lesson or lectures and save them for future viewing. YouTube has made it so easy to send the link of video one created for any student that missed a class or keep tract of the videos in case for review before the next lecture delivery on the same lesson.

Blogs: A blog (web log) is a website that allows the user to update its content by simply uploading a post and or attaching files to it (Queen Mary University of London, n.d, Using blogs in your teaching, para. 2). It can serve as a pedagogical tool through creative communication. Its user-friendly interfaces make it easier to be integrated into a multi-aspect manner which include all learners in the learning process (Azizinezhad & Hashemi, 2011). Some benefits of using blogs in learning include; creating an easy way for students and teachers to get content onto the web quickly and easier; it enables students to extend discussion on topics or subjects outside the classroom; creating a room for wider discussion and contribution by global audience with similar experiences. Furthermore, it helps the teacher in predicting the level of students understanding prior to lesson; enhances information management through it's use for keeping personal learning material such as lesson notes, reference links, thoughts etc. It can also facilitate collaboration among students as it can engage shy students while encouraging the more confident ones to be challenged.

Facebook: This is a social networking tool which enables individuals or groups to engage in a peer-to-peer conversation, generation and exchange of contents online (Queen Mary University of London, n.d, Using Facebook in your teaching, para. 2). This found application in learning in the sense that a “public” or “closed” group can be setup for a particular course or subject whereby members interact around the content being shared. Facebook facilitates learning through its tools such as wall for posting comments, galleries for posting images, facility for messaging and “news feed” which keep updates on the main page of latest

activity by members for you to see (Clements, 2015). The main benefits of Facebook in learning/assessment include; it is one of the most popular social application and most students are familiar with its interface and comfortable with using it, therefore, it is easier for them to adopt or build it into their routine; it encourages collaboration between teachers and learners within the group; extends the classroom and can assist you in helping manage your students time; Facebook can be used for assessment and feedback as student can send their assignments via message inbox. The feedback can be relayed back to them immediately via their individual inbox.

WhatsApp: The main purpose of WhatsApp is facilitation of communication 'chatting'. Education basically, is nothing but communication. WhatsApp provide a faster and seamless channel through which teachers and students can communicate (WhatsApp 4 your phone, n.d, WhatsApp for education, para. 2). It could be viewed as a means of dispersing educational resources and information to students hence facilitating learning. Ways in which WhatsApp can be used to facilitate learning include:

➤ **Group Chart:** A learning and study group with virtual classes can be created for students, which will enable students that are sick or unable to get to class to use this feature to connect and participate in the classroom. It also ensures that teachers stay connected to students whereby assignments can be sent to students anytime and anywhere. Homework and assignments can also be discussed in this group. Teachers can maximize this feature by making use of it as an opportunity for facilitation of learning outside the classroom.

➤ **Audio/Video Lesson:** A recording of audio or video lesson can be shared through the group or send directly to individual students on WhatsApp. This facilitates learning because students can listen to it over and over again to ensure that they get the lesson as well as helping those that missed the class.

➤ **Facilitation of real time communication:** WhatsApp enhances real time communication between students and teachers and also between teachers and parents. This is made possible because with WhatsApp, it is easier to add parents or students to your chart as

far as you have their phone number.

➤ **Sending of Graphic materials/feedback:** Pictures or charts can be send to a group or directly to students even when they are absent in a class. Report cards can also be send directly to parent through their phone numbers. This enables parent to appraised their worth's performance at all times.

Benefits of Adopting Cloud-Based Learning and Assessment in Nigeria

The application of cloud computing would be highly practical and beneficial in the Nigerian education for both teachers and students since most students now have computers such as laptops, smart phones and other mobile devices. This technology allows teachers and students to access powerful services and massive computing resources such as useful educational application, and tools openly at anytime and anywhere (Jou & Wang, 2013). Furthermore, since cloud computing allow software as a service (SaaS) and not just a standalone program, the interconnectivity feature so offered would allow teachers to deliver an entire learning processes with much ease and convenience, this will enable students to learn effectively. What this means is that there are a lot of benefits which the Nigerian education sector stand to gain when this technology is adopted for the purposes of learning and assessment.

The following are some of the benefits that the Nigerian Educational system stand to gain when it adopts cloud-based learning and assessment:

Speed: The availability of cloud-based infrastructures have made it possible for the 21st century students and teacher to have faster access to learning resources over the cloud. This made it easier to create a classroom environment that engages users and facilitate the learning. Most of these services are provided on demand and self-service, huge computing resources can be provisioned in minutes, typically with just a few mouse clicks, hence taking pressure off teachers in terms of lesson planning and delivery. Conducting assessment is also enhanced as students can view their results immediately after clicking the submit button.

Collaboration: Teachers as facilitators can leverage on the cloud service such as those of google and Microsoft to facilitate collaborative learning among students. This enables students to create their project via the cloud through Microsoft SkyDrive or google Drive and synchronously editing and commenting collaboratively, hence constructing their knowledge at anytime and anywhere.

Realtime feedback: The provision of real time feedback during knowledge construction is very vital to students' success. The cloud provides an effective and efficient means of managing the students' assignment such as group projects. Students are required to work as a team as they create their reports while the teacher moderates the knowledge construction and intervene in a timely manner.

Document version control: One of the major challenges of asynchronous documents is version control, but with cloud computing applications such as google drive and Microsoft drives, there is no need to maintain document version as it is live and gets updated collaboratively. It is also very possible to have access to the older version of the document throughout the life of the document.

Reduced cost: Adopting cloud-based learning and assessment eliminates the capital expense of buying hardware and software and setting up and running on-site datacenters. It saves the cost that would be used for electricity and cooling systems, Information Technology (IT) experts managing the infrastructure and purchasing racks of servers. The money that would be used for buying ink and papers for production of question papers is saved.

Challenges of Implementing Cloud-Based Learning and Assessment

Implementing cloud-based learning and assessment come with some challenges which affects its full integration into the Nigerian educational space. Some of these challenges include;

Unavailability of IT infrastructure: This is one of the greatest challenges confronting students and teachers who wished to adopt this

technology. This could be due to low fund allocation to education from the national budget or high level of corruption experienced in the country which affect the purchased of facilities which facilitates cloud computing. The low speed internet connectivity in Nigeria due to low bandwidth is a big challenge since resources are stored in the cloud and could take a longer time to retrieve the information, this defeats the goals of cloud computing.

Lack of training: Their appeared inadequate training in institutions of learning which focused on teachers' professional development on digital media skills such as those of cloud-based tools and applications (Amusa & Atinmo, 2016; Archibong et al., 2010). Students also lack training on how to exploit the available resources in their disposal such as mobile devices to access these cloud services for the purposes learning. Institutions of learning should make training and retraining of teachers and students on the use of cloud-based learning technology a priority through organizing of awareness and competency workshop and seminar regularly.

Plethora of Apps: There is an over abundant of applications online which creates a lot of confusion and challenge for teachers in choosing and adopting the appropriate one (Murray & Olcese, 2011). A simple search keyword 'education' in Google Play presents 1000s of apps. There is a need by stakeholders in education to develop a model which will facilitate peer review and a platform for sharing the best practices regarding the development of learning apps.

Teachers resistance to change: There has been resistance to adoption of new technology by teachers in certain quarters (Mahalingam & Rajan, 2013). This is because they are often comfortable with their traditional methods of teaching since the new method will require them to learn new skills, hence it is seen as a tool for tech savvy teachers' prerogatives. There should be a reward system for teachers and students who successfully adopt this technology.

Technological obsolesces outpaces the learning curve: Technology change so fast that

before the teachers could finish learning one, an upgraded version or a better competitive product is already in the market. This is a serious challenge because it is confusing and frustrating when one is learning how to use an application and suddenly, there is an upgrade to it which required him/her to learn how to use it again. This attribute discourages teachers in adopting new technology because they will prefer to wait and watch, and using their busy schedules for other things.

Conclusion and Recommendation

We can now see that the cloud offers a lot of opportunity for both teachers and students in their teaching and learning processes. The proliferation of ICT infrastructure in most of our communities and schools should be a motivating factor for accepting and implementing this technology. This paper has explored the concept of cloud computing with much emphasis on its uses for learning purposes and in carrying out assessment functions. The use of cloud technology in education ensures that teachers and students have faster access to learning resources over the cloud. Collaboration, Realtime feedback and reduced cost of buying hardware and software are other benefits. To effectively and efficiently integrate this technology into our education system for the purposes of learning and assessment, the following is recommended: government, school authorities and all stakeholders in education business should put more effort towards tackling the problem of inadequate ICT infrastructure by making available all the necessary facilities needed for cloud-based learning and assessment. Regular training and retraining of staff and students on awareness and use of cloud-based technology for the purposes of learning and assessment should be a key priority in schools. Teachers who have successfully adopted the use of this technology in their teaching should be motivated through offers of award and scholarship.

REFERENCES

- Amusa, O. I., & Atinmo, M. (2016). Availability, Level of use and Constraints to use of Electronic Resources by Law Lecturers in Public Universities in Nigeria. *Italian Journal of Library and Information Science (Jlis. it)*, 7(3), 139-172.
- Appiahene, P., Kesse, B. Y., & Ninfaakang, C. B. (2016). Cloud Computing Technology Model for Teaching and Learning of ICT. *International Journal of Computer Applications*, 143(5), 22-26
- Archibong, I. A., Ogbiji, J., & Anijaobi-Idem, F. (2010). ICT competence among academic staff in universities in Cross Rivers State, Nigeria. *Computer and Information Science*, 3(4), 109-115.
- Atabekova, A., Gorbatenko, R., & Chilingaryan, K. (2015). Students' attitude to cloud-based learning in university diverse environment: a case of Russia. *Educational Research and Reviews*, 10(1), 1-9.
- Azizinezhad, M., & Hashemi, M. (2011). The use of blogs in teaching and learning translation. *Procedia-Social and Behavioral Sciences*, 28, 867-871.
- Boiros, P. (2014). What is Cloud-Based Learning? Retrieved September 27, 2017, from <http://blogs.skillsoft.com/learning-re-imagined/2014/07/what-is-cloud-based-learning.html>
- Buabeng-Andoh, C. (2012). Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education and Development using Information and Communication Technology*, 8(1), 136-155.
- Clements, J. C. (2015). Using Facebook to enhance independent student engagement: A case study of first-year undergraduates. *Higher Education Studies*, 5(4), 131.

- Cloud based Tools & Applications for Learning. (2015). *PDST Technology in Education*. Retrieved on 14/08/2017 from www.pdsttechnologyineducation.ie/en/.../Cloud-based-Tools-and-Applications.pdf
- Cole, J., & Foster, H. (2008). *Using Moodle: Teaching with the popular open source course management system*, O.R. Media, Editor: United States of America.
- Costa, C., Alvelos, H., & Teixeira, L. (2012). The use of Moodle e-learning platform: A study in a Portuguese University, *Procedia Technology*, 5, 334-343.
- Cox, M., Abbott, C., Webb, M., Blakeley, B., Beauchamp, T., & Rhodes, V. (2003.). *ICT and attainment: A review of the research literature. ICT in School Research and Evaluation Series*, (17). Westminster; London, Department for Education and Skills (DFES)
- Daschmann, E. C. (2013). *Boredom in School from the Perspectives of Students, Teachers, and Parents* (Doctoral dissertation).
- Denton, D. W. (2012). Enhancing instruction through constructivism, cooperative learning, and cloud computing. *TechTrends*, 56(4), 34-41.
- González-Martínez, J. A., Bote-Lorenzo, M. L., Gómez-Sánchez, E., & Cano-Parra, R. (2015). Cloud computing and education: A state-of-the-art survey. *Computers & Education*, 80, 132-151.
- Great Scholars Partnership (2014). Assessment. *The Glossary of Education Reform*. Retrieved May 7, 2018, from <https://www.edglossary.org/assessment/>
- G-Suites for Education (2018). What is g suite for education? Retrieved May 7, 2018, from
- Hicks, K. (2015). The teacher's guide to classroom YouTube in the classroom. *Edudemic: connecting education & technology*. Retrieved May 8, 2018, from <http://www.edudemic.com/youtube-in-classroom/>
- Jou, M., & Wang, J. J. (2013). Observations of achievement and motivation in using cloud computing driven CAD: Comparison of college students with high school and vocational high school backgrounds. *Computers in Human Behavior*, 29(2), 364–369.
- Leiner, B. M., Cerf, V. G., Clark, D. D., Kahn, R. E., Kleinrock, L., Lynch, D. C., ... & Wolff, S. (2009). A brief history of the Internet. *ACM SIGCOMM Computer Communication Review*, 39(5), 22-31.
- Mahalingam, T., & Rajan, A. V. (2013, December). Cloud and mobile computing: Affordances of the 21st century teaching and learning. In *Current Trends in Information Technology (CTIT), 2013 International Conference on* (pp. 125-128). IEEE.
- Mell, P., & Grance, T. (2009). The NIST definition of cloud computing. Technical Report 15, National Institute of Standards and Technology, Information Technology Laboratory.
- Microsoft Azura. (2017). What is cloud computing? A beginner's guide. Retrieved September 21, 2017, from <https://azure.microsoft.com/en-us/overview/what-is-cloud-computing/>
- Moodle in education. (2011). Retrieved August 17, 2017, from https://docs.moodle.org/20/en/Moodle_in_education
- Murray, O.T., & Olcese, N.R. (2011).

- Teaching and learning with iPads, ready or not? *TechTrends* 55(6), pp. 42-48. Retrieved from <http://search.proquest.com/docview/906064041?accountid=1215>. DOI:<http://dx.doi.org/10.1007/s11528-011-0540-6>.
- Pappas, C. (2015). 8 important reasons why YouTube should be part of your eLearning course. *eLearning Industry*. Retrieved May 6, 2018, from <https://elearningindustry.com/8-important-reasons-youtube-part-elearning-course>
- Queen Mary University of London. (n.d). Using blogs in your teaching. *E-learning Unit*. Retrieved May 8, 2018, from <https://elearning.qmul.ac.uk/enhancing-your-teaching/using-social-media/using-blogs-in-your-teaching/>
- Queen Mary University of London. (n.d). Using facebook in your teaching. *E-learning Unit*. Retrieved May 8, 2018, from <https://elearning.qmul.ac.uk/enhancing-your-teaching/using-social-media/using-facebook-in-your-teaching/>
- Rickards, A., & Steele, A. (2014, June). Student Perceptions of a Cloud Assessment Learning Environment. In *EdMedia: World Conference on Educational Media and Technology* (pp. 2497-2506). Association for the Advancement of Computing in Education (AACE).
- Ryczko, W. (2014). *Introduction to Cloud Computing*. Retrieved August 17, 2017, from <https://www.future-processing.pl/blog/introduction-to-cloud-computing/>
- Thomas, P. Y. (2011). Cloud computing: a potential paradigm for practicing the scholarship of teaching and learning. *The Electronic Library*, 29(2), 214e224.
- Uden L. (2014). Learning Technology for Education in Cloud: Third International Workshop, LTEC 2014, Proceedings, Chile, Santiago, Springer.
- WhatsApp 4 your Phone. (n.d). WhatsApp for Education. Retrieved September 21, 2017, from <http://www.wapp4phone.com/facts/whatsapp-education/>
- Yadav, K. (2014). Role of Cloud computing in Education. *International Journal of Innovative Research in Computer and Communication Engineering*, 2(2), 3108-3112.
- Zhang, Q., Cheng, L., & Boutaba, R. (2010). Cloud computing: state-of-the-art and research challenges. *Journal of Internet Services and Applications*, 1(1), 7-88.



Computer Education Research Journal (CERJ)

Volume 5: Issue No. 1 pp 34-40, 2018

EDUCATORS' ATTITUDE TOWARDS E-LEARNING APPROACH IN SCIENCE EDUCATION TEACHING AND LEARNING PROCESS

BY

NWOKE, BRIGHT IHECHUKWU Ph.D
DEPARTMENT OF MATHEMATICS
e-mail: bincng@yahoo.com phone no: 08033404186

AND

CHARLES C. NNAJIETO Ph.D
e-mail: drcharlesnnajieto2016@gmail.com
DEPARTMENT OF EDUCATIONAL FOUNDATIONS
ALVAN IKOKU FEDERAL COLLEGE OF EDUCATION OWERRI

ABSTRACT

The study was carried out to determine educators' attitude towards application of e-learning approach in science education teaching and learning process. A sample of 130 science educators in School from Sciences in Alvan Ikoku Federal College of Education, Owerri, Imo State was used for the study. The descriptive survey research design was adopted in carrying out the study. A 15 item likert 4 points type of rating scale titled "Educators Attitude Towards E-Learning (EATE-L)" was used to generate data. It had reliability coefficient of 0.71 determined using Parsons Product Moment Correlation Coefficient formula. The data generated was analyzed using mean and standard deviation to answer research questions while chi-square (X^2) and t-test statistical tools were used to test the hypotheses at 0.05 level of significance. The result of the study revealed that science education educators in institutions of higher learning have positive attitude towards application of e-learning approach in teaching and learning process. Based on the result, it was recommended that teacher educators should employ e-learning approach in teaching and learning science education in higher institutions.

Keywords: Educators, Attitude, E-learning, Science Education

Introduction

Science education is the field concerned with sharing scientific knowledge and methods with people not traditionally considered part of the scientific community (Ohunene & Ozoji, 2014). Aina (2013) indicated that science education in Nigeria concentrates on the teaching of science concepts, method of teaching and addressing misconceptions held by learners regarding science concepts. According to Umeasiegbo and Esomonu (2012) science education is an integrated field of study which

considers both the subject matter of science disciplines such as biology, chemistry, physics, agriculture, etc, as well as the processes involved in the learning and teaching of science. Okeke (2007) in Umeasiegbo et al (2012) termed it to imply exposing learners, usually prospective teachers of science to scientific and technological knowledge, to the nature of science, scientific processes, and attitudes as well as equipping them with professional skills of a science teacher.

Science education is very important for

the development of individuals and nation. This implies that, any nation that wants technological and scientific development must pay attention to its science education. Science education must be the basis for informed participation in a technological society, a part of a continuing process of education, a preparation for the world of work and a means for student's personal development (science council of Canada in Veena, Sufian & Anuradha, 2012). Reddy (2007) in Veena et al (2012) indicated that science has connected to innovation and brought about viable technologies and a beneficial manufacture leading to a sustainable development in the modern world. It can be conveniently said that science, technology, innovation and manufacture are the pillars of a sustainable development in an industrialized world and plays a major role in the world economy (Veena et al, 2012).

Despite the huge importance of science education in national development of a nation, there are still noticeable poor performances of students in this area of study. Kola in Aina (2013) noted that as important as these courses are, students' performance has not been encouraging in them and this is worrisome and called for investigation. The traditional method applied in the teaching and learning of sciences across all levels of education has made it difficult to achieve the desired goal of science education in the nation. Kolaja (2009) observed that chalkboard and textbooks have continued to dominate classroom activities in most schools and institutions in Nigeria. According to Okpala in Ohunene et al (2011) there was emphasis made on government policies with respect to development of science education at all levels as documented in the National Policy on Education 2004. It mentioned that at the primary level, science education be introduced and taught by specialist teachers of which practical, explanatory and experimental methods be used in teaching. At secondary level, science education be taught of which English, Mathematics and Biology are made compulsory for all students. At the tertiary level, more resources are devoted to science and technology education. Based on this premise, many educational institutions have now integrated a great number of contemporary, international, technology driven and inter-cultural grounded

contexts which have developed new pedagogical configurations that no longer resemble conventional forms of teaching (Cheng, 2000).

The application of technologies in the teaching and learning of sciences is reflected in the use and adoption of various teaching and learning approaches in order to empower learners, one of the learning approaches to emerge as a consequence of integrating technologies in education is e-learning technology (Yamani, 2014). Nwoke, Ikwuanusi and Ugo (2016) defined e-learning as the application of various information communication and technology facilities in education. E-learning is the use of information and communication technology e.g. internet computer, mobile phone, learning management system (LMS), television, radios and others to enhance teaching and learning activities (Tareq & Kalyankar, 2014). E-learning is the use of new multimedia technologies and the internet to improve the quality of learning by facilitating access to resources and services as well as remote exchanges and collaboration (Commission of the European Communities, 2011). Khan (2005) pointed that e-learning has been described in various ways as learning using a member of different technologies and methods for delivery e.g. computer based training (CBT), internet based training (IBT), web-based instruction (WBI), advanced distributed learning (ADL), distributed learning (DL), distance learning, online learning (OL), mobile learning (m-learning) or remote learning and learning management system (LMS).

E-learning can be self-paced in which case, the individual can learn at his or her own free period, the class can be communicated virtually, instruction can be communicated virtually, instructors and students are located in different part of the globe and take part in class wherever it is convenient for them. The flexibility of e-learning makes it the most suitable means of education in this part of the world (Adeola, Adewale & Alese, 2013 in Nwoke et al, 2016). E-learning offers services of new possibilities to science education learners as it allows them access resources related to their course area, learners can have first hand information in the subject areas. Learners can design their own learning pattern

and time. Barker and Wendel (2001) noted that students in virtual schools showed greater improvement than their counterparts in conventional school in critical thinking, researching, using computers, learning independently, problem-solving, creative thinking, decision-making and time management. Oloyo, Adewumi and Ajibola (2012) indicated that evidence suggest that e-learning is more efficient because learners gain knowledge, skills and attitudes faster than through traditional instructor-led methods. This efficiency is likely to translate into improved motivation and performance.

Irrespective of the benefits associated with application of e-learning in science education, most educators still don't apply it in their process of teaching and learning. The reason suggested for educators' failure to use e-learning is their attitude towards it. Teachers and educators are very important in the implementation of any policy in the education setting. When teachers are of low attitude, the implementation of policies such as application of e-learning will also be low. Attitude is defined as a mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to objects and situations with which it is related (Allport in Okorie & Agah, 2014). Attitudes are beliefs and opinions about objects and ideas and learned pre-dispositions to respond in a favourable or infavourable manner to a particular person, behaviour, belief or object (Sontrock, 2000, Crooks, & Stein, in Haji, 2015). Teachers' attitudes are considered as a major predictor of the use of new technologies in the educational setting (Albrini, 2006). Kluever, Lam and Hoffman (1994) stated that, the successful utilization of technologies in the classroom depends mainly on the teachers' attitudes toward these tools.

The attitude of a person determines his reactions towards a person, objects or situations. Attitudes of a person influences his/her behaviour, this can be negative, positive or neutral. In the context of e-learning, when educators are of positive attitude, they will be more determined to apply it in teaching and learning if negative, they will be discouraged to its application in classroom situations. It

becomes pertinent to determine the direction of educators' attitude with regards to e-learning in science education.

Statement of the Problem

The advent of technology is gradually taking over the entire education system in our institutions of higher learning. This measure has improved the teaching and learning process giving it a new direction especially the e-learning approach. However, the application of e-learning irrespective of its contributions in science education has remained very low in our institutions in Nigeria.

This study was therefore carried out to answer the question; what is the attitude of educators towards application of e-learning approach in science education in institutions of higher learning?

Purpose of the Study

The main purpose of this study was to determine the attitude of educators towards application of e-learning approach in science education. Specifically the study will determine:

- Attitude of science education educators towards application of e-learning approach in teaching and learning process.
- Whether gender is a factor in educators' attitude towards application of e-learning approach in science education teaching and learning process.

Research Questions

The following research questions guided the study:

1. What is educators' attitude towards application of e-learning approach in science education teaching and learning process?
2. What is the difference between the response mean of male and female educators towards application of e-learning approach in science education teaching and learning process?

Hypotheses

The following hypotheses were formulated for the study:

H₀₁: There is no significant relationship between educators' attitude and application of e-learning approach in science education teaching and learning process.

H₀₂: There is no significant difference between response mean of male and female educators towards application of e-learning approach in science education teaching and learning process.

Methodology

The descriptive survey research design was adopted in determining the attitude of educators towards application of e-learning approach in science education teaching and learning process. The population of the study consists of all the one hundred and thirty (130) science educators in school of Science in Alvan Ikoku Federal College of Education, Owerri, Imo State. The census sample method was adopted in selecting all members of the population since it is not very large. This consists of eighty three (83) male educators and forty seven (47) female educators. The instrument for data collection was a researcher made 15 item likert 4 point type rating scale titled "Educators Attitude Towards E-Learning (EATE-L)" ranging from Strongly Agree (SA) = 4 points, Agree (A) = 3 points, Disagree (D) = 2 points, to Strongly Disagree (SD) = 1 point. The instrument was distributed into two sections;

Section A dealt with respondents demographic variables while Section B dealt with items related to the objectives of the study. The face and content validity of the instrument was determined by a psychologist, science educationist and measurement and evaluation expert from School of Education and School of Sciences of Alvan Ikoku Federal College of Education, Owerri. Their inputs guided the restructuring of the instrument. To establish the reliability of the instrument, it was administered on 25 science educators in Faculty of Education of Imo State University, Owerri on test-retest basis. Their responses were analyzed using Pearsons Product Moment Correlation Coefficient formula which gave a reliability coefficient (r) of 0.71 which was considered suitable for the study.

To administer the instrument, the researcher visited the respondents in their various departments and explained the reason for the study and assured them that, any information given will only be used for the study. After that, they were handed the instrument to fill out and they were collected the next day. The exercise lasted for 5 days after which all the instrument were recovered. The data generated was analyzed using mean and standard deviation to answer research questions. Any response mean within and above the instrument scale mean of 2.50 was accepted while any response mean below was rejected. While the hypotheses were tested using chi-square (X^2) and t-test statistical tools at 0.05 level of significance.

Results

Rq1: What is educators' attitude towards application of e-learning approach in science education teaching and learning process?

Table 1: Summary of Educators Mean Responses

S/N	Item	Mean (\bar{X})	SD	Remark
1.	I like using e-learning approach in teaching	3.35	0.74	Accept
2.	I use internet to give students first hand information on concepts taught	3.24	0.68	„
3.	Using e-learning in the classroom is interesting	3.41	1.00	„
4.	Projecting pictures from the internet to screen in the classroom motivates my students	3.12	0.78	„
5.	I enjoy teaching using the e-learning approach	3.33	0.72	„
6.	I refer to the internet for resources needed to teach my students	3.00	0.68	„
7.	Technological facilities help me access information needed for my teaching	5.12	0.71	„

8.	e-learning approach enables me draw attention of students in classroom	3.18	0.72	„
9.	Using e-learning approach reduces the pressure of teaching on me	2.98	0.81	„
10.	I feel very confident whenever I employ e-learning approach in my classroom	3.00	0.75	„
11.	Using e-learning in classroom leads to students commitment in the teaching/learning process	3.32	0.84	„
12.	Technologies improve my teaching ability in the classroom	3.24	0.74	„
13.	Technologies help me manage students with learning difficulties	3.20	0.70	„
14.	The application of e-learning approach in classroom gives me satisfaction as a teacher	3.30	0.81	„
15.	e-learning approach improves my students academic performance	3.15	0.91	„

Average mean \bar{X} = 3.20

Table 1 shows that all items on the questionnaire were accepted as they had mean responses greater than the instrument scale mean of 2.50. Also, the Grand mean response of 3.20 is also greater than instrument scale mean. This indicates that science education educators have high positive attitude towards e-learning approach in science education teaching and learning process.

Rq2: What is the difference between the response mean of male and female educators towards application of e-learning approach in science education teaching and learning process?

Table 2: Summary of Gender Response Mean

Gender	N	Mean \bar{X}	SD	Diff in Mean
Male	83	3.24	0.74	
Female	47	3.19	0.73	0.05

Table 2 shows that male educators had response mean of 3.24 with standard deviation of 0.74 while the female had 3.19 with standard deviation of 0.73. These gave a minor difference in mean of 0.05 indicating little or no difference between both respondents.

H₀, There is no significant relationship between educators' attitude and application of e-learning approach in science education teaching and learning process.

Table 3: Summary of Chi-Square Analysis

No of Rows	No. of Column	df	\bar{X}^2_{cal}	$\bar{X}^2_{-0.05}$	P-value	Decision
15	4	42	190.122	58.124	0.000	S

Table 3 shows that, calculated chi-square (X^2) value 190.122 is greater than the table value 58.124 at degree of freedom 42 and 0.05 level of significance, also $P < 0.05$. Based on the result, the null hypothesis is rejected and the alternative accepted. This implies that there is a significant relationship between educators' attitude and application of e-learning approach in science education teaching and learning process.

H₀, There is no significant difference between response mean of male and female educators towards application of e-learning approach in science education teaching and learning process

Table 4: Summary oft-test Analysis

Gender	N	Mean	SD	df	t-cal	t-0.05
Male	83	3.24	0.74	128	0.385	1.96
Female	47	3.19	0.73			

Table 4 shows that t-calculated value (0.384) is less than the table value (1.96) at 0.05 and degree of freedom 128. Based on the result, the null hypothesis is up held at 0.05 level of significance.

Discussion of Findings

The result of the study revealed that all the items on the table were accepted as they had mean response greater than the instrument scale mean, also the grand mean was also higher than the scale mean. The result implies that educators of science education have positive attitudes towards the application of e-learning approach in teaching as it benefited both the educators and the learners. The statistical analysis showed a significant relationship between educators' attitude and application of e-learning in science education lecture delivery. This result is in agreement with Sanchez, Marcos, Gonzalez and Guanlin (2012) which indicated that teachers have positive attitudes towards the use of ICTs in teaching as a result of the benefits derivable from it.

Also, the study revealed that gender was not a factor in the attitude of educators towards application of e-learning approach in science education. The statistical analysis showed no significant difference between the response means of male and female educators on their attitudes towards application of e-learning in science education. This result is in disagreement with Paul (2016) which showed that male and female teachers differ significantly in their attitude towards using new technology.

Conclusion

The result of the study revealed that educators in institutions of higher learning have positive attitude towards application of e-learning approach in science education learning process and as such they apply same in lecture delivery.

Recommendations

Based on the result of the study, the

following recommendations are made;

1. Teacher educators should employ e-learning approach in teaching science education as to enhance learning in the various subject areas.
2. The government, NGOs, and school managers should organize workshops, seminars and symposium as to train educators on effective use of e-learning in teaching.
3. In-service teachers should be encouraged on using technologies in teaching and learning through e-learning approach.
4. Educators in institutions of higher learning should be encouraged to be ICT compliant so as to fit in the new technological trend.
5. Curriculum planners should include the use of e-learning approach in teaching and learning processes.

References

- Aina, J. K. (2013). Importance of science education to national development And problems militating against its development. *American Journal of Educational Research* 1(7): 225 – 229
- Barker, K. & Wendel, T. (2001). E-learning studying Canada's virtual secondary schools. Kelowna, BC: society for the advancement of excellence in education. Retrieved from <http://www.excellenceineducation.ca/pdfs/006.pdt>
- Cheng, Y. C. (2000). A paradigm shift in science learning and teaching. *Asia-Pacific Forum on Science Learning and Teaching* 1(2)

- Commission of the European Communities (2011). The e-learning action plan designing tomorrow's education. Retrieved on Oct., 6th 2016 from <http://eurolex.europa.cullexunserv/iexUrser.do.uri.com>
- Haji, S. A. (2015). Science teachers' attitudes towards the use of information and communication technology in secondary schools in Cameroon. *International Journal of Social Science and Humanities Research* 3(2): 573 – 585
- Khan, B. (2005). *Managing e-learning strategies: Design, delivery, implementation and evaluation*. Hershey, PA. Information Science
- Kluever, C.; Lani, T. & Hoffman, R. (1994). The computer attitude scale. Assessing changes in teachers attitudes towards computers. *Journal of Educational Computing Research* 11(3): 251 – 256
- Kolajo, T. (2009). Implementation and issues in E-education in Nigeria: Problems and prospects. *Approaches in International Journal of Research Development* 1(2): 290 – 297
- Albrini, A. (2006). Teachers' attitudes toward information and communication technologies: The case of Syrian EFL Teachers. *Computers and Education* 47(4): 373 – 398
- Nwoke, B. I.; Ikwuanusi, E. N. & Ugo, C. (2016). Students perceptions of use of e-learning in science education. *Journal of Research in National Development* 14(1): 1 – 7
- Ohunene, O. C. & Ozoji, B. E. (2014). Science education and sustainable development in Nigeria. *American Journal of Educational Research* 2(8): 595 – 599
- Okorie, E. U. & Agah, J. J. (2014). Teachers attitude towards the use of computer software package in teaching chemical bonding. *International Journal of Energy and Environmental Research* 2(2): 9 – 18
- Olojo, O. J.; Adequmi, M. G. & Ajisola, K. T. (2012). E-learning and its effects on teaching and learning in a global age. *International Journal of Academic Research in Business and Social Science* 2(1): 203 – 210
- Paul, A. A. (2016). Higher secondary teachers' attitude towards the use of ICT in teaching learning process. *International Education & Research Journal* 2(7): 1 – 2
- Sanchez, A.; Marcos, J. M.; Gonzalez, M. & Guanlin, H. (2012). In-service teachers' attitude towards the use of ICT in the classroom. *Procedia Social and Behavioural Sciences* 46, 1358 – 1364
- Santrock, J. W. (2015). *Psychology (6th Ed)*. USA: The McGraw-Hill Companies Inc.
- Tareq, S. ; Ali, T. & Kalyankar, N. V. (2014). The effect of e-learning approach on students' achievement in fraction math course levels at Yemen's public primary school. *Global Journal of Computer Science and Technology Network Web & Security* 14(2): 44 – 52
- Umeasiegbu, G. D. & Esomonu, N. P. (2010). E-learning in global education challenges and prospects for science and physical education in Nigeria. *Journal of Education and Practice*. 3(14): 44 – 48
- Veena, D.; Sutian, F. & Anuradha, J. ((2012). The role of e-learning in science education vis-à-vis teacher training institutes in middle East. *US-China Education Review* 2, 142 – 148
- Yamani, H. A. (2014). E-learning in Saudi Arabia: Challenges and opportunities. *Journal of Information Technology and Application in Education* 3(4): 169 – 172



Computer Education Research Journal (CERJ)

Volume 5: Issue No. 1 pp 41-48, 2018

THE USE OF INFORMATION COMMUNICATION TECHNOLOGY (ICT) IN SUPPORTING THE TEACHING AND LEARNING OF SCIENCE SUBJECTS IN SECONDARY SCHOOLS.

BY

Olu-Ajayi, Funmilayo Elizabeth
Department of Science Education
Faculty of Education, Ekiti State University
Ado-Ekiti
Email: foluajayi2008@yahoo.com (08038015872)

ABSTRACT

The importance of science to the society call for the need to encourage it's teaching and learning in Nigeria secondary schools. The paper discussed the roles of Information and communication technology (ICT) in the teaching and learning of Science Education in Nigeria. ICT implementation in schools is pivotal to student success due to the changing times and high demands for tech savvy personnel for societal development. The paper further discussed the classroom implications of computer usage and highlighted its benefits to the implementation of secondary school science education. It was noted that ICT is an advanced, easier, interesting tool for use in supporting the teaching and learning of science subjects in schools. It was recommended that ICT should be embraced for easier and interesting assimilation of science knowledge in students, science teachers should endeavor to be literate in computer usage to enable use of appropriate pedagogical software; and the Government and stakeholders in education should encourage the use of informative and communicative technology in every level of education.

Keywords: ICT, supporting, teaching, learning, science subjects, secondary schools.

Introduction

Technology has changed society throughout history. The integration of technology in all facets of life has resulted in developments that make life easier for humans. Over the last few decades, cellular devices like iPads, iPods, computers, and most importantly the Internet, have completely overhauled the way people interact in society and the way educators work in schools. Laptops, tablets, smart phones promote wider participation in the academic community and benefit educators and students alike (Delzotto, 2009). Technology implementation in schools is assumed to be pivotal to students'

success in post-secondary schools due to the changing times and high demands for tech savvy personnel for societal development. It is imperative that teachers of the 21st century adjust to the technological revolution by not only preparing themselves but preparing their students too for the technological real world. Technology has led to the manufacture of tools to help make certain jobs more efficient. Better still to tools that do not just make physical labor easier, but can classify and modify information. A key instrument in the development of information communication has been identified by Kozma and Anderson

(2002) to be the computer. There have been many immense and influential impacts on the developing society due to the development of the computer, an electronic machine use to assess and process data. Computers according to Allison (2002) help perform tasks effectively and efficiently so that human mistakes can be avoided. It is now common for personal computers to be used on a daily basis. The transition caused by the use of personal computers has impacted the world in many different ways. There have been social and economic impacts that have marvelously shifted the way the present day Nigerians live his or her life, the world is becoming a global village as a result of the development in information communication technology (Kozma & Anderson, 2002).

Among the large scale impacts the computer has on the society is the way it has changed social interactions amongst people. Relationships amongst people have altered due to computers and the internet. The ways that people work and communicate via computer networks destabilize many conventional social categories (Arnold, 2011). The usage of computers for social interaction, through social media of these interactions take place as if they are at distinct places but really they are at their homes or work. These types of interactions would have been only possible from face to face meetings prior to this invention but due to the computer these boundaries have been blurred. Life now demands a technologically advanced person and the 21st century classrooms require the same.

In the submission of the World Bank (2001), ICT holds out the opportunity to revolutionize pedagogical methods, expand access to quality education and improve the management of education. , ICT enhances communication in classroom learning and the utilization of blended or online learning Giddens (2002). ICT, to Ibe-Bassey (2011) is regarded as an essential tool for preparing and educating students with the required skills for the global work place. Akudulo (2002) acknowledged in his study that ICT is changing every aspect of human life. ICT is a product of technology, thus use in teaching and learning is subsumed under "Educational technology". Educational

technology is defined as the ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources (Allison, 2002). It refers to the use of both physical hardware and educational theoretic encompassing several domains including learning theory, computer based training, online learning and m-learning Educational technology involves instructional technology which is the act of incorporating forms of technology products to pass instruction to learners. Instructional technology was defined by Ballard (2002) as the theory and practice of design development, utilization, management and evaluation of processes and resources for learning). This is believed to be very important in ensuring success in the teaching / learning process.

Learning of science is imperative to technological development of the society. The need to put up every effort to improve interest in and ease the task of science teaching and learning cannot be overemphasized. Science subjects is unique in its approach and teachings and to improve the teaching and learning of science, the use of ICT should be employed Information communication technology in science education is the process of integrating ICT into science learning in a positive manner that promote a more diverse learning environment and a way for students to learn how to use technology as well as to solve their common assignments. (Scardamatlia and Bereiter, 2000). Science learning requires an active class characterized with teacher-student and student-student interactions and from the study of Whitaker & Coste (2002) it was recorded that effective applications of ICT tools encourage a more lively student involvement in the learning experience, facilitate a greater depth of understanding of course content and promote richer communication between teacher and student Experts in science education encourages a student centered approach of teaching for the development of students' interest and improvement of students participation in lessons. Science education has transformed due to current day usage of the computer in the classroom. Computers are believed to be of help to students in any way they need, including

researching, typing, and searching (Adomi & Kpangbon, 2010). Teachers could make use of computers as well to keep track of grades, type out instruction for their students, engage students in the classroom, and stay in contact with parents and co-workers

OVERVIEW OF ICT IN EDUCATION

ICT is regarded by Ibe-Bassey (2011) as a critical tool for preparing and educating students with the required skills for the global work place. Amayuoyi (2012) viewed ICT as a diverse set of technological tools and resources used to communicate, and manage information. In his study, Anthony (2012) explained that the impact of ICT in education cannot be overemphasized. It is fascinating to note that; ICT manages time and space for teaching and learning, enable students to communicate anywhere and at anytime, helps students to contact their teachers, collect and exchange information at all times. ICT give access to knowledge: Students can with its use, draw on a global pool of knowledge

ICT also enable easier sharing of knowledge among students, exchange ideas of knowledge with the support of ICT and trained them for the future participation in global research communication. Bell and Margaret (2006) itemized the resulting effect of the use of ICT in education to be

- Global access to knowledge
- Instant sharing of experience and best practice
- Self paced and self-based learning
- Interactive and interesting learning through multimedia tools.
- Stimulation of experiential learning
- An atmosphere of innovation, opening windows for new thinking

Bringing excitement and motivation Leach, Ahmed, Makalima and Power (2005) explained in their study on the 'use of information and communication technologies for teacher Education' that 'The capabilities teachers have with new technology give them

the ability to differentiate lessons for better overall learning. Castro- Sanchez & Aleman (2011) opined that students should be more frequently engaged in the meaningful use of computers.

Use of ICT in science education

The use of technology in science education has been present throughout history. Helping people learn in an easier, faster, surer and less expensive can be traced back to the emergence of very early tools like paintings on cave walls. Over the last century, schools have modified their approach to science teaching as well as the methods that are used to enhance student learning. Whenever science teachers are given the opportunity and resources to work with computers, they are being given the opportunity to improve their technology proficiency and learn how computers may further their educational goals. Without some sort of seminar or class to learn how ICT can enhance student learning of science, teachers may be unwilling and/or unable to take time out of their busy schedules to learn the ICT on their own. There are numerous types of programs to prepare science teachers to use ICT in the classroom. Sangraa and Mercedes (2010) explained these programs to include required courses which teach potential science educators how to use instructional technologies, exposure to technology rich classrooms, and collegial support for change. Other approaches to preparing science teachers to integrate technology into teaching and learning include infusing technology integration into methods courses taught by content area experts, Kozma and Anderson (2002) and offering courses taught by education faculty that addresses technology for teaching and learning. Additionally, pre-service and in-service science teachers can attend professional development workshops on the effective use of technology in the classroom (Leach et al. (2005). It is important for pre-service science teachers to complete courses and training sessions to become more adequately prepared for applying technology to future lessons.

All of the time science teachers put in to learn about technology and how to apply it in the classroom is for the benefit of the students. Too

often, the employment of technology is taught to be used as a tool to manage the classroom, rather than a pedagogical tool to support content teaching. The use of ICT was noted by Hannatu (2013) as an important tool to promote students intellectual qualities through higher order of thinking, problem solving, improved communication skills and deep understanding of the learning tools and concept to be taught. As rightly stated by Singh and Mishra (2018) it has become a disservice to students for teachers to ignore technology in the classroom because it is an important aspect to the students' futures. Careful consideration of the role of ICT will lead to new ways of teaching and learning. Interaction with ICT provides students opportunities to ask questions, work together, act as peer tutors, take responsibility for their learning and strive to reach higher expectations (Jain 2006). Science students are naturally more interested in lessons that incorporate technology over traditional lecture methods. To make science learning become more interesting to the typical secondary school students, Kozma and Anderson (2002) opined that schools need to give students the opportunity to use technology in schools, connect students to the world, understand where the learners are going in the future, and help the students get there. It is no longer a luxury to have technology in the science classroom, integration of technology is a requirement for all schools to prepare learners in the 21st Century. As schools progresses in the 21st Century, technology is being used more frequently on a regular basis. With the growth of internet and other interactive technologies in the past three decades, information and communication technologies (ICT) have emerged as important tools for science teaching and learning. Computers are the most popular equipment and most widely used technology throughout all schools. Education has transformed due to current day usage of the computer in the science classroom. Computers help students in any way they need, including researching, typing and searching. Science teachers use computers as well. They use computers to keep track of grades, type out instruction for their students, engage students in the classroom, and stay in contact with parents and co-workers. ICT can be used in science education classroom in the following ways

according to Akudulo (2002):

1. Supplemental teaching tools- Tablets, applications, video and interactive white boards can be used as learning tools as well as teaching tools. Interactive presentation tools, video clips graphic and other audio visual elements are simple ways to keep science students actively engaged in class as well as means to make lessons interesting and keep lessons fresh in students minds.
2. Motivate students to learn- Science students are more stimulated and are apt to learn when they interact with hands on learning tools, which various forms of ICT provides.
3. Science students can learn at their own pace and retain information- Science lessons or activities on laptops or tablets allows science students to read directly, process information and complete work at their own pace. This also helps free up the teachers time so they can give students who may need extra guidance or assistance the attention they require.
4. Additional Learning Resources for students- Provide students with a nearly endless supply of information and resources. The use of informative and communicative technologies which include online lesson plan, educational applications, interactive games, online video and graphic and assessing books and articles via tablets and e-readers support all day learning

ICT and School Administration

Any school that desires ICT must have the capacity to purchase it. However, even with sufficient funds, a technological integration effort is only as strong as the administrative support behind it. (Jain, 2006). A vital aspect of creating a technologically advanced school according to Barber & Mourshed (2007) is having a technologically advanced administration. School administrators can establish databases and spreadsheets as well as quickly send that information out to their staff. Data is the driving force behind most educational decisions and curriculum or staff changes. Test scores, students' performances,

and teacher evaluations are all important pieces of information that every administrative body needs to track. To enhance science students' use of ICT there are a number of procedures an administrator could follow. The administrator may allow the science students to have a meaningful voice in setting school policy in regards to technology use. The principal could make one hundred percent engagement the goal and use a collaboration model to relate science curriculum to students through the use of technology. He/she running the school may allow the science teachers to have a guidance model rather than an instructing one, leaving more responsibility with the students. To enhance ICT in the classroom, the administration would have to orient the school toward the future, keep the computer laboratory open late, and promote technology use while moving towards a one to one computer student usage.

Once the teachers notice the head of the school not only use ICT to relay information, but also encourage its use from students, an environment is created where ICT is acceptable in the science classrooms as well. Since most educational buildings are moving towards more technologies and computers in the classroom, science teachers must learn about technology and how it can be implemented into their teaching. This though may be time consuming and may be considered unnecessary by old professionals who have taught for years producing scientists using the conventional teaching methods.

The modern-day teacher is believed to be involved in various school activities and tasks in order to meet up with the requirements of implementing the contemporary school curriculum which keep changing with societal development. teacher's time is precious. Therefore science teachers use the technology when it proves to be accessible, effective, and efficient. Most of the time teachers use computers in ways that address their most direct needs. In order to expand their use of ICT, schools must offer seminars and training sessions in order to properly prepare science teachers to utilize technology to its fullest potential. It is the responsibility of the

administrative body as well as the government to establish ICT training seminars so that the school can be a well-rounded, technologically advanced place of science instruction because the survival of computer usage in secondary classrooms is determined largely by their compatibility with the aims and objective of teachers.

THE REALITY OF ICT USE IN SECONDARY SCHOOL SCIENCE TEACHING AND LEARNING

There are many factors that affect technology use in the science classroom in developing society which leads to a distinct lack of differentiated instruction. Teacher's motivation to use ICT in the secondary school science classroom is at present, adversely influenced by a number of constraints which includes; lack of time to gain confidence and experience with technology, limited access to reliable resources, a science curriculum overloaded with content assessment that requires no use of the technology and a lack of subject – specific guidance for using ICT to support learning. While this technology can in principle, be employed in diverse ways to support different curriculum goals and forms pedagogy, such constraints have often stifled teachers use of ICT in ways which effectively exploit its interactivity. Consequently well integrated and effective classroom use of ICT is currently rare.

Schools may experience financial issues when integrating technology into science instruction. There are conflicting ideas about the value of technology and hence conflicting advice to science teachers about how technology should be incorporated into their teaching methodology. Method are means that teachers use to drive home their lesson presentation thereby making learning experience concrete to learners. Mbakwe) in Eya and Anih (2012) affirms that methodology of teaching is what makes a teacher a professional. The conventional method of teaching science which is teacher centered should be dropped by science teachers. These method only present learners as mere spectators , listening and memorising all that comes from the teachers.

There is a concern about the slow adoption of technology by science teachers. The constantly changing nature of technology makes it difficult for schools and teachers to stay current with new developments. The fact that technology can be quite unreliable makes it less appealing for science teachers to invest their time in it. Most science teachers opt for alternative ways of teaching their lessons without employing the use of technology. Inexperienced science teachers may find it difficult to implement technology because they are still trying to acquire basic science teaching skills. They must first master the content and the pedagogy that is associated with the science curriculum. Until the material is mastered it is difficult to spend the time on figuring out what kind of new technology can be used for its teaching. Science Educators need to examine what technologies are more useful or fit to particular tasks and which ones are less fit, therefore, are easily disposable.

It is not a surprise that some teachers may not like the idea of technology in the classroom because they do not quite understand why it is important or relevant. The greatest deterrent to science teachers' use of available instructional tools seemed to be insufficient time to develop a level of comfort with the technology. Besides that, some teachers just do not approve of technology. Sutton (2013) explained a scenario where a teacher was discouraged from using technology because other teachers in the school rejected his use of digital videos. These other teachers complained about the noise the students made while videotaping and did not desire to learn the technology and the administration did not support the technology use. Innovations such as ICT should be implemented with regard to the internal social structure of the school, but the school is usually about the past in most content areas, with, occasionally, some current events added (Osborne & Dillon, 2008). Technology can bring the past alive for science students to prepare them for the future. Teacher-pupil ratio can also be a big challenge to teachers in the realization of science education and use of ICT, according to Federal Republic of Nigeria (2004) teacher – pupil ratio should be 1-35. Considering the present situation in schools, the researcher is of the opinion that if ICT

equipment is made efficient and man-power is available to manage it, schools will be better off. There should also be a better focus on digitalizing learning contents and provision of learning resource centres to provide trainings on Educational management and integration of ICT for school managers and provision of funds to schools, then using ICT in the teaching and learning of science will be easier and interestingly use, to prepare science students for future jobs and life after school. There is need to focus on augmenting technology in the classroom to work towards educating for the future.

CONCLUSION

This paper examined the role of ICT in science teaching and learning in secondary schools and stated the overview of ICT in education ICT uses in science education, ICT and school administration, classroom uses of ICT, importance of ICT in education and the reality of ICT uses in the secondary school science teaching and learning.

In conclusion, ICT is an advanced, easier, interesting tool to effect science teaching and impact its learning in schools. As advantageous as it is, its accessibility requires finance and training of science teachers for implementation. Technology is ever changing the education world and is becoming more prevalent to the 21st century students, and for a science teacher to not employ technology in his or her classroom is a disservice to his or her students and is not completely preparing them for the “real world”. ICT usage in the science classroom is fun, it engages students in learning, it develops students' professional abilities that can be applied beyond the secondary school, it makes work easier for science teachers and reduces time spent on planning, it improves student test scores, it reaches to various learning styles, it helps students with low attention spans and it encourages homework with assistance available online. ICT is a tool that can be used by science educators to improve learning ability in students, as well to better easily design, deliver, facilitate, and manage instruction. But until that one to one ratio is fully met by all schools for computer usage, science teachers will have to work with what they have, making use of other means of technology and technological materials.

Recommendations

It is thus recommended that

1. Government and stakeholders should organize ICT in-service training/workshops for science teachers
2. Effort towards achieving a one-on-one computer usage for science students in secondary schools should be geared up by stakeholders.
3. Literacy in ICT should be seen as a necessity and not obligatory by secondary school science teachers and students
4. Secondary schools should be adequately funded to meet with the contemporary societal demands.
5. Learning with technology in secondary school science education should be improved on and promoted

References

- Adomi, E. E & Kpangbon, I. (2010). Application of ICT's in Nigeria secondary schools. *Library philosophy and practice* (e-journal) 345, 1 - 8. <http://digitalcommonss.uni.edu/libphilprac/345>.
- Akudulo, L.R. (2002). Restructuring Nigerian secondary education system through ICT driven curriculum. *Journal of the world council for curriculum and instruction*. 3 (1)7-17
- Allison, J. E. (2002). Technology, Development, and Democracy: International Conflict and Cooperation in the Information Age. State University of New York Press
- Amajuoyi, J.J. (2012). Towards effective integration of information and communication technology in universal basic education: issues and challenges to ST in education *Book of Proceedings of 52nd annual conference of science teachers association of Nigeria 2012*. HEBN Publishers
- Anthony, O. (2012). Challenges of Effective use of ICT as a Tool for Implementing the UBE schemes. *Book of Proceedings of 53rd Annual Conference of Science Teachers Association of Nigeria 2012*. HEBN Publishers
- Arnold, C. (2011). "How Technology is eliminating Higher-Skill Jobs," *NPR*, November 3, 2011, Retrieved from <http://www.npr.org/2011/11/03/141949820/how-technology-is-eliminating-higher-skill-jobs>
- Barber, M. & Mourshed, M. (2007). How the world's Best-Performing School Systems Come Out on Top, McKinsey & Company. Retrieved from http://mckinseysociety.com/download/s/reports/Education/Worlds_School_Systems_Final.pdf
- Ballard, M. (2002). "SMART Board Interactive Whiteboards." *Multimedia Schools* 9, 5: 55-57.
- Bell, M. & Avis, P. (2006). Information Technology in Education., Microsoft® Encarta® 2006 (DVD) Microsoft corporation, 2005.
- Castro-Sanchez, J.J. & Aleman, E.C. (2011). Teachers' Opinion Survey on the use of ICT tools to support Attendance-based Teaching. *Journal of Computer and Education*. 56, 911-915
- Delzotto, N. (2009). What are the benefit of information technology in education? Retrieved from mit.edu:/index.htm
- Eya, N.M & Anih, C.A. (2012). Prospect and challenges of Universal Basic Education in Nigerian implementation for STM education – *Proceedings of 53rd annual conference of science teachers association of Nigeria, 2012* HEBN publishers plc.
- Giddens, A. (2002). Runaway world: How globalization is reshaping our lives, London: Profile books.

- Hannatu, A. (2013). The role of ICT in teaching science education in schools. *International letters of Social and humanistic sciences* (19) 217-223.
- Ibe-Bassey, G.S. (2011). Human Capacity Building for Information and Communication Technology: ICT integration in Teacher Education in Nigeria. 32ND Annual conference and international convention, 19th-23rd September, Association of Educational Media and Technology (NAEMT) 15 (3) 1-10.
- Jain, P. (2006). Empowering Africa development using ICT in a knowledge management approach. *The electronic library* 24 (1) 57-67.
- Kozma, R. & Anderson, R. (2002). Qualitative case study of innovative pedagogical practices using ICT. *Journal of Computer Assisted Learning*, 3(18) 387-394.
- Larry, L. Kimble, Robert, E. Yager, & Stuart, O. Yager (2006). Success of a Professional Development Model in Assisting Teachers to Change their teaching to match the more Emphasis Conditions urged in the National Science Education Standards. *Journal of Science Teacher Education*, 3, (17) 309-322.
- Leach, J., Ahmed, A., Makalima, S. & Power, T. (2005). DEEP IMPACT: An investigation of the use of information and communication technologies for teacher education in global south London DFID
- Osborne, J. & Dillon, J. (2010). Good Practice in Science Teaching: What research has to say. Open University Press McGraw-Hill House. Maidenhead, Berkshire England
- Sangraa, A. & Mercedes, J. (2010). The role of information and communication technologies in improving the teaching and learning process in primary and secondary schools. *ALT-J, Research in Learning Technology* 3 (18) 201-220
- Scardamalia & Bereiter (2000). Computer support for knowledge building communities. *International Journal of Science Learning* 2 (4) 311-325
- Singh, S. & Mishra, S. (2018). Identify the impact of ICTS in secondary school education students in government and private schools. *International Journal in Trend in Scientific Research and Development (IJTSRD)* 4 (2) 489-491
- Whitaker, B. & Coste, T. (2002). Developing an Effective IT Integration and Support system. *Journal of Information Technology Education* 1 (1) 53-63.
- World Bank (2001). Information and Communication Technologies. A world bank group strategy Supporting ICT in education and training. The International Bank for Reconstruction and Development/ The World Bank 1818 H Street, N W Washington D.C 20433
- Yusuf, M. (2005). Information and Communication Technologies in Education: Analysing the Nigerian national policy for Information Technology. *International Education Journal* 6(3) 316-321



Computer Education Research Journal (CERJ)

Volume 5: Issue No. 1 pp 49-58, 2018

INHIBITIONS TO ICT UTILISATION IN EKITI STATE UNIVERSITY LIBRARY

BY

ADEPOJU, EUNICE OLAYINKA (P.hD)

florencegunju@gmail.com

08038106953

Faculty of Education, Department of Vocational and Technical Education,
Ekiti State University, Ado-Ekiti,
Nigeria

ABSTRACT

This study investigated the factors that inhibit the utilisation of Information and Communication Technologies (ICTs) by undergraduate students in Ekiti State University Library. The study adopted a survey design approach and the questionnaire was administered on 500 undergraduate students who were library users, among which 365 were males and 135 were females. Data were analyzed using descriptive (frequency distribution) and inferential (Chi-square and t-test analysis) statistical tool. Findings showed that (60.6%) of the students utilizes ICTs while (39.4%) indicated non use of the facilities among the undergraduate students. Findings also revealed that 53.8% indicated that there are many factors affecting the use of ICT facilities in their libraries while 46.2% indicated that they were not affected by any factors in the utilisation of ICT facilities in their library. It was revealed that there were perceived hindrances among undergraduate students towards the use of ICT facilities in Ekiti State University Library, the respondents indicated that inadequacy of the facilities has been the greatest hindrances to the utilisation of ICT. The result of the frequency counts and percentages showing relationship between utilisation of ICT facilities and perceived inhibition of ICT among students revealed that $t\text{-cal}$ (0.915) is greater than $t\text{-tab}$ (0.198). The null hypothesis was rejected, which implies that there was significant relationship between the utilisation and perceived hindrances of ICT among Ekiti State University students.

Theme: Computer Education for Sustainable Development On

Introduction

ICT has positively affected economic, social, political and cultural activities globally. The government in its own capacity realized the importance of ICT and this has made the government to put in place policies and plans to transform their economic, educational, political and social activities into an information and knowledge economy. The Nigerian government is not left out of this policy; several efforts have been made to ensure that Nigeria is not left out of the

adoption of ICT (Ehikhamenor, 2002).

In Africa, organizations are concerned with the poor implementation of ICT in African schools. It has been discovered that despite the efforts of the government in the adoption of ICT for the development of our nation, there are still some barriers that are militating against the effective implementation of ICT in the education system.

The Association of African Universities (AAU, 2000) examined the major

hindrances to the effective application of ICT in African universities and discovered that they are non-technical, human, organizational and financial. Technically, the poor telecommunication infrastructure, absence of national information communication infrastructure, lack of university, coherent plan for ICT, unlimited band width for ICT for teaching, learning and research, lack of connectivity and erratic power supply are hindrances. The non-technical hindrances were the lack of faculty professional development, inadequate plan for ICT integration in universities, lack of personnel and finance, lack of adequate funding on the part of the government and the Universities management to procure ICT infrastructure, lack of maintenance of the available facilities and staff development. Okiy (2006) noted that a number of obstacles have been identified as militating against the application of ICT facilities in university libraries in Nigeria. These include inadequate funding, inadequate power supply, acute shortage of competent manpower for information technology operation and maintenance, lukewarm attitude of the Nigerian government towards the development of ICT facilities and hence the absence of an information policy for Nigeria and low level of computer literacy among Nigerians.

The Library as a custodian of information resources make a wide variety of electronic information sources (EIS) available for the consumption of the university students, staff and researchers within their institutions. Sourcing for the electronic resources by the university and the library is very costly whereby some University Libraries are paying to the tune of Twenty million naira to subscribe for information resources annually. University Libraries are automated but despite the fact, you still see students not using the available electronic resources for literature searching. The inability of Nigerian university students' to make effective use of other ICT facilities in the library and its environments such as digital camera, telephones, radio, television, digital satellite equipment, video conferencing facilities and internet that are major components of ICT constituted a remarkable setback to the effective utilisation of the

university Libraries by undergraduates.

Ekiti State University Library as part of the global shift from the fast fading manual cataloguing system to an automated system of cataloguing, the University Library subscribed to integrated library automation software known as Strategic Library Automation Management (SLAM) Software in 2008. Access to Library holdings is done through the various workstations (OPAC) in the library. The electronic library provide for staff and students access to online resources such as journals, textbooks, periodicals and other research materials. The library subscribed to the following online databases: AGORA, HINARI, JSTOR, HINDAWL, OARE, EBSCOHOST and LexisNexis. The library has changed to Seneyan Library Information Management System (SLIM).

The researcher observed that the extent of availability and accessibility of ICT facilities in the library does not indicate that the available resources are adequately used which has no doubt negatively affected their academic performance. Hence, the researcher decided to investigate the hindrances to the utilisation of the ICT resources in the university library.

Objectives of the Study:

The objectives of the study are to:

- i. determine the ICT facilities used by students in Ekiti State University Library
- ii. investigate the inhibitions to utilisation of ICT facilities in Ekiti State University Library.
- iii. investigate the relationship between utilisation of ICT facilities and perceived inhibition of ICT among students

Research Questions:

This study is guided by the following questions:

- i. What are the ICT facilities used in the university library?
- ii. What are the inhibitions to utilisation of ICT facilities in the university library?

iii. What is the relationship between utilisation of ICT facilities and perceived inhibition of ICT among students?

Literature Review

This section presents a review of literature and studies related to this study. Information and Communication Technologies (ICTs) can be described as a complex varied set of goods, applications and services used for producing, distributing, processing, transforming information (including) telecommunications, television and radio broadcasting, hardware and software, computer services, and electronic media (Marcelle, 2000). ICT facilities comprises of the following: digital camera, computers, internet, World Wide Web (www), E-mail, telephone, projectors, CD-ROMs, Computer Assisted Instruction (CAI), e-library, Open Public Access Catalogue (OPAC), fax machine, photocopiers, scanner, facsimile and multimedia.

From Nigeria's perspective, Ehikhamenor (2002) in a study on Nigerian print media reported that some socio-economic and political factors limit the adoption and use of ICT which include high rate of inflation, unfavourable exchange rate, low wage level, inadequate funding, low gross national product and political instability. High cost of IT facilities has been reported as one of the factors which influence provision and use of ICT services as observed by Adomi (2006), the cost of a computer is too high for many to afford. Brakel and Chisenga (2003), stated that monthly internet rates are exorbitant and the charges for satellites, televisions are unaffordable for most people in Africa and this serves as a barrier to the procurement of ICT facilities in Nigerian schools.

A study carried out by Adomi and Kpangban, (2010) on Application of ICT's in Nigerian secondary schools reported that the low rate of ICT adoption and application in Nigerian secondary schools is attributed to several factors such as limited and poor information infrastructure, inadequate ICT facilities in schools, frequent electricity interruption, non-integration into the school curriculum, poor ICT policy, inadequate ICT manpower, high cost of ICT facilities and

components, limited school budget, limited ICT skills among teachers, poor perception of ICTs among teachers and administrators, inadequate education software, poor management on the parts of school administrators and government, lack of maintenance culture and lack of interest in ICT application and use on the part of students.

Adomi (2005), Adomi (2006) and Suithwood (2004) reported that more than 40 percent of the population of Africa is in areas not covered by telecom services. The schools located in such areas will experience ICT connectivity problems. Adomi and Kpangban (2010) research revealed that limited and poor information infrastructure ranks highest with 112 respondents (64 percent). He also reported that absence and inadequacy of ICT facilities in schools ranks second with 108 respondents (61percent). This finding is collaborated by Ndiku (2003) as cited by Wimas and Lawler (2007) who discovered that insufficient number of computers and peripheral devices inhibit deployment of ICT by teachers. Similarly, Plante and Beatrice (2004) found that inadequate ICTs were a challenge to the integration of technologies in Canadian schools.

Unavailability of some ICT components in the schools affected teachers use of ICTs and the problem may be due to underfunding as declared by Enakrire and Onyenemia (2007). (Adomi, 2006, Adomi, Omodeko and Otolw, 2004; Adomi, Okiy and Reteyan, 2003) were of the opinion that electricity failure has been a persistent problem militating against ICT application and use in Nigeria which makes it impossible for the schools with ICT facilities to use them regularly. Nigeria implemented its ICT Policy in April 2001 after the approval by the Federal Executive Council. The National Information Technology Development Agency (NITDA) was established as the implementing body. The policy empowers NITDA to enter into strategic alliances and joint ventures and it is to collaborate with the private sector to realize the vision of making Nigeria information society by the year 2005 through using IT as an engine for sustainable development and global competitiveness. This vision is yet to be fulfilled (Okiy and Reteyan, 2003).

Agagu (2006) stated that Nigeria has to intensify its efforts in providing stable electricity, encourage technical education and improve its efforts in poverty alleviation. He further stated that students and individuals should seize appropriate opportunities to make themselves ICT literate.

The University libraries in Nigeria are at present finding it difficult to acquire needed materials despite the increase in the number of students in our universities. Isehunwa (2004) rightly opined that inadequate funding constitutes one major problem affecting the application of ICT facilities in our universities libraries. Researchers have reported severally that the ICT facilities provided in these universities libraries are inadequate.

Researchers have also investigated hindrances to ICT utilisation and they were able to come up with the following hindrances to ICT integration in our education system. BECTA (2004) in Yusuf (2005b) stated the hindrances as lack of teacher's confidence and computer anxiety, lack of teacher's competency, lack of pedagogical training, lack of skills training, and lack of ICT focus in initial teacher training, lack of access to resources such as hardware and poor organization of resources, poor quality hardware and inappropriate software, lack of access to teachers and lack of adequate time in the utilisation of the available software and hardware due to time allocation, lack of technical support, lack of telecommunication and other infrastructure and lack of electricity supply. Other factors are lack of technological leadership schools at primary, secondary and tertiary institutions, lack of clear vision, lack of incentive for teachers as a source of encouragement and lack of training and retraining in order to discharge their duties effectively. Ajayi (2008) in his study on towards effective use of Information and Communication Technology (ICT) for teaching in Nigerian Colleges of Education discovered that epileptic supply of electricity, lack of support for the integration of ICT in teaching, inadequate ICT materials, lack of computers in the classrooms, lack of interest outlet in the classroom and the expensive nature of ICT are some of the most prominent problems of using ICT for teaching in colleges

of education.

The problem of funds to procure ICT facilities by the universities management is one of the problems confronted by the universities that have militated against efforts at making the campuses ICT driven. The universities in Nigeria depend mostly on government and corporate bodies through donations and philanthropic gestures in developing available ICT infrastructure in universities (Isehunwa, 2004).

The above observation could be supported with Igwe (2005) findings that the Federal University of Technology, Akure is an emerging ICT driven institution. The university received a donation of an ICT Centre from the Central Bank of Nigeria and Union Bank of Nigeria PLC equipped one of the computer rooms, while the acquisition of 322 computers, networking of academic and administrative departments are carried out from the internally generated revenue (IGR). Other universities such as Obafemi Awolowo University Ile-Ife, University of Ibadan and University of Lagos sought and obtained financial support from donor agencies such as Carnegie, Rockefeller, and other foundations.

The Mac Arthur Foundation awarded a grant to Bayero University for its ICT development. Ahmadu Bello University Zaria (ABU) also received a grant support from Mac Arthur Foundation which has helped her to upgrade ICT by increasing Internet bandwidth, purchase new computers and computerizing management reporting functions and institute a University-wide strategic planning process. Ekiti State University also received a donation of about 60 computers from the ETF in an effort to move with the ICT wave and another 50 work station computers were donated by Universal service provision Fund supervised by Nigerian Communication Commission (NCC).

It is highly sympathetic to discover that many of ICT-based education programs funded by the government and corporate bodies could not be sustained due to lack of fund to maintain the Internet. Also, there are other challenges that militate against ICT in Nigerian universities such as lack of well trained personnel who will serve as teachers to teach the students on how to effectively use the

available ICT facilities in the university libraries. Therefore, there is urgent need for the training and retraining of the lecturers, librarians and other staff who are connected with the handling of the ICT infrastructure in the application of ICT in education, both in theory and practical for maximum utilisation and maintenance of the ICT facilities. Erratic power supply has adverse effect on the effective utilisation of the computer networks.

Information Needs of the Society

All organization needs information on market products, education, health, politics, security, religions, economics, competition, and legislation to mention a few. Political leaders need information to make decision about community needs, define alternative ways to satisfy this needs and evaluate them. To make a sound decision on any subject at any level and in any circumstance, the availability of appropriate information for sound decision makings becomes more crucial in public affair, government, policy formulations and in making laws

The information on health is vital to the government in taking decision on how to provide effective health care delivery and adequate information on health condition of the people can be found in the libraries. Information on population could help government plan its population policy and to review it when necessary. Library also provides avenues for recreation to workers and other members of the society who uses the library

Information is a vital ingredient for a successful industrial and commercial enterprises and the most effective agency for collecting, documenting and disseminating such information is a good libraries. Library plays a vital role in enhancing the social well beings of Nigerians in various ways such as provision of materials for educational advancement and sustenance. It provides books and reading habit which is necessary in the development of a person and the nation. Library provides information that is useful to government and the society in decision making because it helps people to reduce the level of uncertainty while making the decision that affects the nation which will not be

regretted.

Geographical information is very valuable which can make indigene and foreigners to know which kind of Agricultural investment will be profitable in any part of Nigeria. Library provides tourism information by making available documentation of the tourism potential of a country and the facilities that can be placed at their disposal.

Library also makes available military information to expose the strength and weakness of the nation's enemies. The varieties of arms and ammunitions in their possession can also be revealed for necessary action. Information for industrialization can also be provided by the library by making known the government policy on industrial sources of raw materials and the potential market available for such materials

Information for Agriculture is also made available by creating awareness on high yielding varieties of seedlings, application of fertilizers and insecticides. How to preserve and process food can also be provided for the community. The library is developed for business and industries were designed to provide services for employees, to aid them in executing their regular duties appropriately.

It is disheartening to note that various governments in Nigeria have not shown adequate interest in the development of libraries in the country. This has been a major contributing factor to the low standard of education in most of the Nigerians school at present. It is pertinent to note that all the services rendered by the libraries mentioned above are towards the sustainable development of the nation.

Method

The study aimed at investigating the factors that inhibit the use of ICT facilities in Ekiti State University Library, Ado-Ekiti, Nigeria. The study covered the undergraduate students who were library users. The researcher designed a descriptive research survey to collect data as perceived by the respondents in the institution with 500 respondents.

The entire 500 copies of questionnaire were completed and returned representing 100% response rate. From the respondents 365 were males and the other 135 were females who

were randomly selected. Data were collected over a period of one month from March to April, 2017.

A questionnaire consisting of 22 items

was developed by the researcher for the study. The questionnaire was administered at the university library to have a wide range of respondents.

Result and Discussion

This chapter presents the results of the data analysed and the discussion.

Research Question 1: Do you use the following ICT facilities in the university libraries?

Table 1: Frequency Counts and Percentages Showing Utilisation of ICT Facilities by the Students.

S/N	Users of Facilities		Non - Users	
	Frequency	Percentage	Frequency	Percentage
1. CD-ROM	279	55.8	221	44.2
2. Computers	312	62.4	188	37.6
3. Internet	346	69.2	154	30.8
4. Printer	428	85.6	72	14.4
5. Digital Camera	104	20.8	396	79.2
6. Scanner	78	15.6	422	84.4
7. Multimedia Projector	120	24.0	380	76.0
8. Photocopier	450	90.0	50	10.0
9. OPAC	327	65.4	173	34.6
10. E-mail	303	60.6	197	39.4

Table 1 reveals that 279 (55.8%) of the respondents indicated that they used CD-ROM facilities while 221(44.2%) indicated non-use of CD-ROM facilities. 312(62.4%) indicated the use of computers while 188 (37.6%) were not using it.

Table 1 also reveals that 346 (69.1%) indicated that they used Internet while 154 (30.8%) agreed that they did not use Internet in the library. 428 (85.6%) indicated that they used printer while 72(14.4%) were not using printer. It also reveals that 104 (20.8%) indicated that they used digital camera while 396 (79.2%) were not using it. 78 (15.7%) indicated that they used scanner while 422 (84.3%) indicated that they were not using it. 120 (12.0%) indicated that they used multimedia projector while 380 (88.0%) were not using it.

450 (90.0%) indicated that they used photocopier while 150 (10.0%) indicated non-use of photocopier in the library, indicating that majority of the respondents were using photocopier machine. 327 (65.4%) indicated that they used Online Public Access Catalogue (OPAC) while 173 (44.6%) agreed that they

did not use Online Public Access Catalogue (OPAC). 303 (60.6%) indicated that they used e-mail while 197 (39.4%) did not use it.

With reference to the table 1 above, the implication is that (60.6%) of the students used the ICT facilities in the university libraries while (39.4%) were not using ICT facilities in the libraries. One can deduce from table 1 that the ICT facilities mostly used by students are photocopier, internet and printer, the reason for the high usage of these facilities is because they are available in the library and students have easy access to them while the usage of scanner, digital camera and multimedia projector is low .

Level of utilisation of ICT facilities in the EKSU library were of average and moderate based on the findings of this study.

Research Question 2: What are the inhibitions to utilisation of ICT facilities in the university library?

Table 2 : Factors inhibiting against the use of ICT facilities among Ekiti State University Students

S/N	Hindrances	Yes	Percentage	No	Percentage
1.	Inability to have access to ICT facilities	258	51.6%	242	48.4%
2.	Fluctuation of ICT server	345	69.0%	155	31.0%
3.	Lack of adequate skill	275	55.0%	225	45.0%
4.	Lack of conducive environment	248	48.0%	260	52.0%
5.	Lack of standby generator	235	47.0%	265	53.0%
6.	Lack of cooperation from the staff	123	22.8%	386	77.2%
7.	Inadequacy of the facilities	380	76.0%	120	24.0%
8.	Fees charged are exorbitant	245	49.0%	255	51.0%
9.	The opening hours are not adequate	255	51.0%	245	49.0%
10.	Inadequate staff to assist	278	55.6%	222	44.4%
11.	Lack of maintenance culture	273	54.6%	227	45.4%
12.	Erratic Power Supply	324	64.8%	176	35.2%

It was revealed that there were perceived hindrances among undergraduate students towards the use of ICT facilities in Ekiti State University Library, the respondents indicated that inadequacy of the facilities has been the greatest hindrances to the utilisation of ICT. This result was in line with Ajuwon (2003) that insufficient computer and internet use skill as factors inhibiting the use of

computer and the Internet among first class clinical and nursing students in Nigeria teaching hospitals. Inadequacy of the facilities, fluctuation of ICT server, erratic power supply, inadequate staff to assist, lack of adequate skills were also indicated by majority of the students as part of the problems they were confronted with while using ICT facilities.

H₀₁: There is no significant relationship between utilisation of ICT and perceived inhibitions of ICT among students.

Table 3: Correlation Summary Showing Relationship between Utilisation of ICT and Perceived inhibition of ICT among Students

Source	N	r-cal	r-tab	Result
Utilisation of ICT	500	0.915	0.198	Significant
Perceived Hindrance	500			

$P < 0.05$

From table 2 above, t-cal (0.915) is greater than t-tab (0.198). Therefore, the null hypothesis was rejected, which implies that there was significant relationship between the utilisation and perceived hindrances of ICT among students. Perceived hindrances affect the utilisation of ICT facilities among students.

It was revealed that there was significant relationship between utilisation of ICT and perceived inhibitions among students. The respondents considered that infrastructural constraint had been the greatest inhibition to the utilisation of ICT in the

university libraries. This result was in line with Ajuwon (2003) that insufficient computer and Internet use skill are factors inhibiting the use of computer and the Internet among first class clinical and nursing students in Nigerian teaching hospitals. Also, Cisse (2004) revealed that inability to access the equipment and difficulty encountered in using ICT hindered the use of electronic resources. Inability to have access to ICT facilities and inadequacy of the facilities were also indicated by majority of the students as part of the problems they were confronted with.

The findings also revealed that they

had regular electricity supply, though few of the respondents indicated that the electricity supply was not regular. This means that there is an improvement in the regularity of electricity in the university library when compared to previous study on regularity of electricity. Considering the previous study, majority of the researchers (Adomi, 2006, Adomi, Omodeko and Otolw, 2004; Adomi, Okiy and Reteyan 2003) were of the opinion that erratic power supply had been the major inhibition to the utilization of ICT facilities which is contrary to finding of this study. There was significant relationship between the utilisation and perceived hindrances of ICT among students. Perceived hindrances affect the utilisation of ICT facilities among students.

Conclusion

Library as the nerve centre of the university adopted the utilisation of ICT in order to be efficient and effective in discharging its services to reduce time wastage, for accuracy and effective library control. It appears that technological advancements have enabled students with advanced technologies to support teaching and learning. The utilisation of ICT will therefore, have a positive effect on teaching, learning and research in Ekiti State University. There was significant relationship between the utilisation and perceived hindrances of ICT among students. Perceived hindrances affect the utilisation of ICT facilities among students. The study identified inadequate facilities, fluctuation of ICT server, erratic power supply, inadequate staff to assist the students while using the available facilities, lack of adequate skills on the part of the students as problems inhibiting the use of ICT.

Recommendations

In view of the findings and conclusion of this study the following recommendations were made:

1. The Ekiti State University Library should provide adequate and relevant ICT facilities and services required by the students.
2. Internet connection and all other suitable conditions should be made available to enable the

undergraduate students to utilise the available information resources.

3. There should be an improvement in the regularity of electricity and that serves as hindrances to the utilisation of the ICT facilities in the university library.
4. There is need to retrain and re-orientate library personnel and users respectfully. User education and training will give room for effective application of the technological tools to library operations and services.
5. The University Management as a matter of urgency should provide adequate fund to the University Librarian to provide all the needed facilities to enable the students to use the resources and for effective performance of the libraries in our universities.
6. Nigeria Government should provide a common database for higher institutions and necessary innovation of ICT facilities should be effected in all the university libraries.

REFERENCES

- Adomi, E.E. (2005) Internet development and connectivity in Nigeria. *Program* 39 (3), 257-68.
- Adomi, E.E. (2006). Mobile phone usage patterns of library and information science students at Delta State University, Abraka, Nigeria. *Electronic Journal of Academic and Special Librarianship* 7 (1) . Available : <http://southernlibrarianship.icaap.org/v7n01/adomi-e01.htm>
- Adomi, E. E. & Kpangbani, E. (2010). Application of ICTs in Nigerian Secondary Schools. *Library Philosophy and Practice*. Available at <http://www.webpages.uidaho.edu/~mbolin/adomi-kpangban.htm>
- Adomi, E. E.; Okiy R. B. & Reteyan (2003). A Survey of Cyber Cafes in Delta State, Nigeria. *The Electronic Library* 21(5), 487-495

- Adomi, E. E.; Omodeko, F. S. & Otdo, P. U. (2004). The use of Cybercafé at Delta State University, Abraka, Nigeria. *Library Hi tech*, 22(4), 383-88
- Agagu A. A. (2006). *Information and Communication Technology: Some Challenges for Nigerian Professionals* in M. I. Alonge *et al* (eds) Information and Communication Technology (ICT) and Computer Applications. Ado-Ekiti-The University of Ado Ekiti Press.
- Ajayi, I. A. (2008). Towards effective use of Information and Communication Technology (ICT) for teaching in Nigerian Colleges of Education. *Asian Journal of Information and Technology*, 7(5)210-214
- Ajuwon, G (2003). *Computer and Internet use by first year clinical and nursing students in a Nigerian teaching hospital*. BMC Medical Informatics and Decision Making. 3.10 Retrieved October 21, 2010 from <http://www.biocentral.com/1472-6947/3/10>
- Association of African Universities (2000): *Report of Technical Experts Meeting on the use and application of ICT in higher education institutions in Africa*. Retrieved April 20, 2005 <http://www.org/english/document/s/aau-ictreport-4.htm>.
- Brakel, P. A. and Chisenga, J. (2003). Impact of ICT based distance learning. The African Story. *The Electronic Library*, 21(5), 476-486
- British Educational Communication and Technology Agency (BECTA, 2004). A review of the research literature on barriers to the uptake of ICT by teachers. Retrieved July 10, 2005 from <http://www.becta.org.uk>. cited in Yusuf, M. O. (2005b). An investigation into teachers' self-efficiency in the implementation of computer education in Nigerian Secondary Schools. *Meridian: A Middle School Computer Technologies Journal*, 8 (2). Retrieved November 21, 2005, from <http://www.ncsu.edu/meridian/su/m2005/index.html>
- Cisse, C (2004). Access to Electronic Information and Information Research. *SCALWA Newsletter*, 5(1), 14-17.
- Ehikharmenor, F. A. (2002). Internet Resources and Productivity in Nigerian Universities. *Journal of Information Science*, 29(2), 107-115 Electronkschool.Com/2001/09/0901 e-wires. Html//forum
- Enakrire, R. and Onyenenia, O. G. (2007). Factors affecting the Development of Information Infrastructure in Africa. *Library High Tech News*, 24(2), 15-20.
- Igwe, U. O. (2005). Harnessing Information Technology for 21st Century Library Education in Nigeria. *Library Philosophy and Practice*. 7(2) <http://un/ib.unl.edu/LPP/igwe.htm>.
- Ishinwa, S. O. (2004). Science, Engineering and Technology in Nigeria: problems and Prospect in Bello – Imam, I. B. & Obadan, M. I. (eds) *Democratic – Governance and Development Management in Nigeria's Fourth republic 1999-2003 Ibadan: Centre for Local Government and Rural Studies*.
- Mercelle, G. (2000). Gender, Justice and ICTs. <http://www.un.org/womenwatch/daw/scs/marcelle.html>.
- Ndiku, L. (2003). *The problem encountered by school personnel in the implementation of computer use in secondary schools in Uasin Gishu District*. Unpublished thesis, Moi University, Eldoret. Niser World Bank Report 2002, 150

- Okiy, R. B. (2006). Strengthening Information Provision in Nigerian University Libraries through Information Communication technologies. *The Electronic Library*, 23 (3)
- Plante, J. & Beattie, D. (2004). Connectivity and ICT Integration in Canadian Elementary and Secondary Schools: first Results from the Information and Communications Technologies in Schools Survey, 2003 -2004. Available: <http://www.stacan.ca/english/research/81-595-MIE200407.pdf>.
- Suithwood, R. (2004). African Telecom Indicators: What do they use and why? Available: <http://www.balanceimpactAfrica.com/news/back/balanceimpact147.html>
- Wimas, P. & Lawler, M. (2007). Investing in ICTs in educational institutions in developing countries: An evaluation of their impact in Kenya. *International Journal of Education and Development Using ICT*. Available:
- Yusuf, M. O. (2005). Information and Communication Technology and Education. Analysing the Nigerian National Policy for Information Technology. *International Education Journal*, 6(3), 316–321.



Computer Education Research Journal (CERJ)

Volume 5: Issue No. 1 pp 59-66, 2018

LOCATION DIFFERENTIAL AS A FACTOR IN THE PREDICTION OF COGNITIVE ACHIEVEMENT AND RETENTION IN PETROL ENGINE MAINTENANCE USING COMPUTER SIMULATION

BY

Udogu, Kingsley Chimezia

Department of Industrial Technical Education
University of Nigeria, Nsukka
kingsley.udogu@unn.edu.ng
+234-8068756096

&

Igwe, Ndukwe

Department of Industrial Technical Education
University of Nigeria, Nsukka
+234-8067394652

ABSTRACT

This paper investigated the effect of computer simulation teaching technique on students' cognitive achievement and cognitive achievement retention in Petrol Engine Maintenance in technical colleges in Enugu State, Nigeria. Two research questions guided the study while two null hypotheses formulated were tested at 0.05 level of significance. The study adopted quasi-experimental design. The study was carried out in Enugu State. The population for the study was 526 MVMW students in technical colleges in urban and rural areas of Enugu State. Kuder Richardson 21 (KR-21) was used to establish the stability of the cognitive achievement objective test. Cognitive achievement objective test was used to obtain data. Three experts validated the instrument for data collection. The correlation coefficient of stability of the cognitive achievement test was 0.82. Mean was utilized to answer the research questions while the hypotheses were tested using Analysis of Covariance (ANCOVA) tested at .05 level of significance. The study found that the effect of computer simulation teaching technique on students' cognitive achievement in Petrol Engine Maintenance is greater in urban students than rural students, while the effect of computer simulation teaching technique on students' cognitive achievement retention in Petrol Engine Maintenance is greater in rural area than urban area. It was also found that the difference was significant both in cognitive achievement and in cognitive achievement retention. Based on the findings, the recommendation made is that students of both rural and urban area should be guided properly in order to maximize their academic potentialities.

Keywords: Urban Area, Rural Area, Cognitive Achievement, Retention, Petrol Engine Maintenance, Computer Simulation

Introduction

There is a debate on the use of technology in rural and urban areas of the world. Some argue that urban students have access to digital technology, such as computer, over the rural students; therefore, there should not be any basis for comparison. It should be noted however, that most public school students are not divided according to economic status, rather according to their location. Pei-Yu (2013) stated

that the inconsistent quality of public school technology integration is one of the emergent issues in the digital divide. Public schools are often perceived to serve as the bridges to connect the haves and have-nots and ultimately to correct the social inequity. *Education Week Report (2007)* points out that for low achievers and for students in poor urban schools, technology is still typically introduced as a remedial tool involving skills-based software.

International ICT Literacy Panel (2002) opined that the term “digital divide” refers to the inequities among individuals who have access to technology and opportunities to learn ICT skills. Carvin (2009) discusses the link between access and cognitive achievement and contends that access alone is not the only factor we need to consider.

The author believed that we need to look at the digital divide, not only from the perspective of access to technology, but also from the perspective of ways in which technology is being integrated into the classroom and curriculum. *Education Week Report* (2007) refers to this as the pedagogical divide. International ICT Literacy Panel (2002) observed that many instructional technology reform efforts are the computer technology itself and not the effective infusion of technology into instruction. This study sought to find out the educational implication of the digital divide between the urban and rural areas. Is there any effect of digital divide on pedagogy divide? One of the technologies used in this study is the use of computer simulation in teaching both urban and rural students in Enugu State of Nigeria.

Computer simulation is a programme in the computer which imitates real life in order to reduce cost and danger. It makes seemingly impossible investigation of real life possible, and it also saves time. Hyunjeong, Jan, and Bruce (2006) defined computer simulations as interactive software programs in which individuals explore new situations and complex relationships of dynamic variables that model real life. Rigby (2015) defined a computer simulation as a program that embodies some model or an aspect of the world, allows the user to make inputs to the model, runs the model, and displays the results. Computer simulation has been used to reach cognitive achievement.

Cognitive achievement connotes attainment in a school subject as symbolized by a score or mark on a cognitive test. Cognitive achievement is achieved through cognitive testing. According to Fitzalan (2014), cognitive testing is a process of engaging in activities with a student that provides a broad sampling of his or her thinking abilities. A cognitive test measures a student's knowledge and academic skills in a standardized way, typically through multiple-choice questions. Cognitive

achievement tests are used for more than measuring a student's learning ability. They provide insight into teacher effectiveness, such as in their teaching strategies, quality of a school's academic programme and information on classroom progress. This information can be used for future class groupings and placement, school funding and teacher assessments, the author concluded. The scores obtained in the 40 multiple-choice questions in the Petrol Engine Maintenance, is used to measure cognitive achievement in the study. Therefore, the mean scores of a group of the students are used to compare the mean scores of the other group. A group having a greater score is referred here as having a greater cognitive achievement.

Retention of cognitive knowledge in automobile technology makes it possible for the students to use the knowledge, they acquired in the school, in the work place where they would work after graduation. Retention of cognitive knowledge also enables the students to excel in summative test, such as in the National Technical Certificate Examination. Driscoll (2000) stated that retention of learning is the ability to maintain the acquired knowledge so that it may be accessed for use at a later time. This implies that a learner who repeats an acquired piece of knowledge with less error is said to have retained the material learnt. This study included retention-test as one of the periodic review. The extension of evaluation beyond post-test or sectional tests are referred here as periodic review or retention-test. It is expected that when a student performs better in long-term memory test, all things being equal, the student would perform better in the summative test which is the form National Technical Certificate Examination take. One of the modules cognitive achievement can be reached is Petrol Engine Maintenance.

Petrol Engine Maintenance is a branch of automobile technology that deals in maintenance of automobile that uses petrol engine. According to National Board for Technical Education (NBTE) (2009), Petrol Engine Maintenance is one of the modules of Motor Vehicle Mechanics' Work. The goal of Petrol Engine Maintenance is to produce a petrol engine maintenance craftsman who should understand the basic principles of operation and carry out general maintenance

and reconditioning work on petrol engine. The general objectives are that the trainee (student) should be able to: Understand general safety precautions; understand the basic working principles of petrol engine and restore it to peak performance; Understand the working principles of valves; understand the working principles of the fuel system of the motor vehicle; Understand the operation of an ignition system and carry out repairs and adjustments; and Understand the working principles of engine cooling system and restore a faulty cooling system to acceptable standard of performance. The general purpose of the study was to determine the effect of cognitive simulation technology on students' cognitive achievement retention in petrol engine maintenance.

Research Questions

The following research questions guided the study:

1. What are the cognitive achievement scores of urban and rural students of Petrol Engine Maintenance taught using the computer simulation teaching technique?
2. What are the cognitive achievement retention scores of urban and rural students of Petrol Engine Maintenance taught using the computer simulation teaching technique?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance

1. There is no significant difference between the cognitive achievement mean scores of urban and rural students of Petrol Engine Maintenance taught using computer simulation teaching technique.
2. There is no significant difference between the retention mean scores of urban and rural students of Petrol Engine Maintenance taught using the computer simulation teaching technique.

Methods

In this study, quasi-experimental research design was adopted. According to Donald,

Lucy, Asghar and Chris (2006), quasi-experimental design is similar to randomized experimental designs in that they involve manipulation of an independent variable but differ in that subjects are not randomly assigned. Because the quasi-experimental design does not provide full control, it is extremely important that the researcher be aware of the threats to both internal and external validity and considers these factors in the interpretation. Gall, Gall and Borg (2007) added that this design is important where it is necessary not to disrupt the academic programmes of the school involved in the study. The design was found suitable for this study.

The study was conducted in Enugu State, Nigeria. Five hundred and twenty six NTC 1 (average of 16-17 years old) students of Motor Vehicle Mechanics' Work formed the population of the study; while 106 (49 in experimental group and 57 in the control group), students were purposively sampled from 4 schools. Cognitive achievement objective test was used to assess the cognitive achievement of the students in the study. The instrument was also used for retention after an interval of three weeks. The instrument for the collection of data was face validated. The content validation was also sought. The instrument was validated by three experts. The cognitive achievement instrument was tested for reliability using Pearson Product Moment Correlation which yielded 0.82.

The study involved two groups of subjects. They are the urban and the rural students. The groups were taught using computer simulation teaching technique. The study was conducted during the school lesson period. It followed the classes' time table of Motor Vehicle Mechanics' Work. The regular school Motor Vehicle Mechanics' Work teachers were used in the study. Pretest was administered to both groups before the commencement of the lessons. During the lessons, computer simulation teaching technique lesson plan was used to teach the students. The regular Motor Vehicle Mechanics' Work teachers who were involved in the study were trained on how to teach the selected topics using computer simulation. This was done before the pretests. After the training and pretests, then the treatment (that is actual teaching) commenced.

Each lesson lasted for a period of 45 minutes, two periods in a week and the lessons were a period of three weeks. A total of six lesson periods were therefore involved in the study. At the end of the lessons, post tests were

administered to both groups. The retention scores were obtained three weeks after post test. The data collected from the pretest and post test were used for further analysis.

Results: Mean was used to answer research questions while Analysis of Covariance (ANCOVA) was used to test null hypotheses at 0.05 level of significance. The answer to the research question 1 is provided in Table 1.

Table 1

Mean Scores of Pre-test and Post-test Cognitive Achievement Scores of Urban and Rural Students' Petrol Engine Maintenance taught using Computer Simulation Teaching Technique

Location	N	Pre-test \bar{X}	Post-test \bar{X}	Mean Gain
Urban	20	35.38	59.88	24.50
Rural	14	27.50	42.14	14.64

Table 1 shows urban mean score of 35.38 in the pre-test and mean score of 59.88 in the post-test; making a pre-test, post-test mean gain in the CST technique to be 24.50. The rural group taught had a pre-test mean score of 27.50

and a post-test mean score of 42.14; this shows a mean gain of 14.64. With these results, the CST technique is more effective in the urban students than in the rural students.

The answer to the research question 2 is provided in Table 2.

Table 2

Mean Scores of Post-test and Retention-test of Urban and Rural Students of Petrol Engine Maintenance taught using Computer Simulation Teaching Technique

Techniques	N	Post-test \bar{X}	Retention-test \bar{X}	Mean Gain
Urban	20	59.88	62.14	2.26
Rural	14	42.14	47.11	4.97

Table 2 shows that urban students taught Petrol Engine Maintenance using CST technique had a mean score of 59.88 in the post-test and a mean score of 62.14 in the retention-test; making a post-test, retention-test mean gain in the urban students to be 2.26. Meanwhile, rural students taught Petrol Engine Maintenance using CST technique had a mean score of 42.14 in the post-test and mean score of 47.11 in the retention-test; making a post-test, retention-test

mean gain in the rural students using CST technique to be 4.97. With this result rural students taught using CST technique had a higher mean cognitive achievement retention scores than urban students in Petrol Engine Maintenance retention-test. Thus, there is an effect attributable to location on the cognitive achievement retention of students taught Petrol Engine Maintenance using CST technique in favour of the rural students.

The data analysed for the hypothesis 1 is presented in Table 3.

Summary of Analysis of Covariance (ANCOVA) for Test of Significance between the Locations with respect to their Mean Scores on the Petrol Engine Maintenance Cognitive Achievement Test

Source of Variation	Type III Sum of Squares	Df	Mean Squares	F	Significance of F
Corrected Model	2589.414 ^a	1	2589.414	35.386	.000
Intercept	85710.003	1	85710.003	1.171E3	.000
Location	2589.414	1	2589.414	35.386	.000
Error	2341.652	32	73.177		
Total	98906.250	34			
Corrected Total	4931.066	33			

a. R Squared = .525 (Adjusted R Squared = .510)

The data presented in Table 3 shows that F-calculated value for location is 35.386 with a significance of F at .000 which is less than 0.05. The null hypothesis is therefore rejected at 0.05 level of significance. With this result there was significant difference between the mean

cognitive achievement scores of urban and rural students taught Petrol Engine Maintenance using computer simulation teaching technique. The data analysed for the hypothesis 2 is presented in Table 4.

Summary of Analysis of Covariance for Test of Significance between the Locations with respect to their Mean Scores on the Petrol Engine Maintenance Retention Test

Source of Variation	Type III Sum of Squares	Df	Mean Squares	F	Significance of F
Corrected Model	524.187 ^a	1	524.187	16.871	.000
Intercept	73007.732	1	73007.732	2349.780	.000
Location	524.187	1	524.187	16.871	.000
Error	994.241	32	31.070		
Total	79143.250	34			
Corrected Total	1518.429	33			

***significant at sig of F < .05**

The data presented in Table 4 shows that F-calculated value for location is 16.871 with a significance of F at .000 which is less than 0.05. The null hypothesis is therefore rejected at 0.05 level of significance. With this result there was significant difference between the mean cognitive achievement retention scores of urban and rural students taught Petrol Engine

Maintenance using computer simulation teaching technique.

Discussion

The findings as presented in Table 1 shows those urban students performed better than rural students in cognitive achievement scores of Petrol Engine Maintenance using computer simulation teaching technique. This is

in consonance with the results of Adepoju & Oluchukwu (2011) and Owoeye & Yara (2011) which revealed that urban students performing significantly better than the rural students in Computer Studies. The results agreed with the statement of Udofot (2005), that location (rural/urban) of a school in Nigerian secondary schools has its influence on students' academic excellence in so many ways. Students in urban areas seem to do better than those in the rural areas. This could be as a result of abundance of learning infrastructure and amenities, learning facilities, non proximity to market square, competent teachers and professional counsellors. Onyiliofor (2009) added that poor academic excellence of rural secondary school students can be attributed to evasion of school inspection and supervision by officials of the Ministry of Education and attitude of parents towards education. Rural schools are not inspected and supervised probably due to bad roads. Most parents of rural students are ignorant of the importance of education. Some parents turn their children especially girls to baby sitters, send them on unnecessary errands especially on market days. Most rural students engage in hunting, farming, fishing, masquerading and moonlight activities at the expense of their study time. They eventually appear to be habitual late-comers and truants thus perform badly in school. Sersion & Stevens (2012) also affirmed that students of urban secondary schools are exposed to information and communication technology, going on excursion and field trips, more than rural students.

Our rural areas are laden with social amenities, such as constant electricity deprivation, due to poverty. It is known that most schools in the rural area are poorly staffed, lack professionally qualified teachers and have poor learning condition (Adepoju & Oluchukwu, 2011). Owoeye & Yara (2011) added that uneven distribution of resources (which result in more limited curricula for rural schools), problem of qualified teachers refusing appointment or not willing to perform well in isolated villages, lack of good roads, poor communication, nonchalant attitude of some communities to schooling among others contribute to the poorer academic performance of the rural students. Again, a lot of coaching of

urban students is done to prepare students for public examinations thus promoting the spirit of competition and rivalry which may be lacking in the rural pupils, probably owing to limitations in exposure and experience.

The findings as presented in Table 2 shows that rural student performed better than urban students in cognitive achievement retention scores of Petrol Engine Maintenance using computer simulation. It could also be attributed to the life styles of the city/urban life during the midterm break (a period of break before the retention-test when other informal academic interferences must have taken place). Behrendt (2014) affirmed that most urban students are carried away by city life. Some abandon their studies and embrace watching of late night movies, hanging out with friends and surfing the web (internet) and engaging in internet social networking.

Analysis of Covariance explained null hypothesis in Table 3. It revealed that the calculated F-value for the cognitive achievement of urban students over the rural students stood at 35.386 with a significance of F at .000 which is less than 0.05. The null hypothesis is therefore rejected at 0.05 level of significance. With this result, there was a significant difference between the mean cognitive achievement scores of urban and rural students taught Petrol Engine Maintenance using computer simulation teaching technique. This result showed that the effectiveness of computer simulation teaching technique on students' cognitive achievement in Petrol Engine Maintenance does have a statistical significant difference on the level of location. Hence, there were differential effects of treatment over level of location (urban and rural) which implies that computer simulation teaching technique is more effective in improving urban students' cognitive achievement in Petrol Engine Maintenance. The significant difference between the students in urban and rural areas in Petrol Engine Maintenance as showed in Table 4 revealed the need for relearning. The students in rural areas must have relearned the material before going back to school when the retention tests were taken.

Conclusion

Based on the analysis of data, it is concluded that urban students performed better than the rural students when computer simulation was used to teach them Petrol Engine Maintenance. The rural students performed better than the urban areas in the cognitive achievement retention tests. The study also revealed a significant difference both in the cognitive achievement and retention of the urban and rural students.

Recommendations

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

1. Urban and rural students should be guided properly in order to maximize their academic potentialities.
2. Parents and Guardians should be involved in controlling their children or wards from spending so much time watching late night television, or on the social media as at the time they are expected to rest or study.
3. Teachers should be exposed to adequate re-training programmes that will improve their knowledge on the use of Information and Communication Technology to teach practical subjects like motor vehicle mechanics work etc.

REFERENCES

- Adepoju, T. L & Oluchukwu, E. E. (2011). A study of secondary school students' academic performance at the senior school certificate examinations and implications for educational planning and policy in Nigeria. *An International Multidisciplinary Journal, Ethiopia*. 5 (6) . DOI : <http://dx.doi.org/10.4314/afrrrev.v5i6.26>
- Behrendt, M. (2014). A review of research on school field trips and their value in education. *International Journal of Environmental & Science Education*. DOI: 10.12973/ijese.2014.213a on March, 3 2018
- Carvin (2009). *What digital divides impact learning*. Allyn & Bacon, an imprint of Pearson Education Inc. Retrieved from <https://www.education.com/reference/article/what-digital-divides-impact-learning/> on June 8, 2018
- Donald, A., Lucy, C. J., Asghar, R., & Chris, S. (2006). *Introduction to research in education*. Canada: Thomson Wadsworth
- Driscoll, M. P. (2000). *Psychology of learning*. Retrieved from <http://www.adlnet.org/wp-content/uploads/2014/12/learning-sciences-retention-and-sustainment-083013-FNL-V3-SG.pdf>. on September 17, 2017
- Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Educational research: an introduction*. Boston: Pearson Educational Inc.
- Fitzalan, G. (2014). *Cognitive testing vs. achievement testing*. Retrieved from <http://everydaylife.globalpost.com/cognitive-testing-vs-achievement-testing-3814.html> on January 14, 2018
- Hyunjeong, L., Jan, L. P., & Bruce, D. H. (2006). Optimizing cognitive load for learning from computer-based science simulations. *Journal of Educational Psychology*, 98 (4). DOI: 10.1037/0022-0663.98.4.902 on June 24, 2017
- International ICT Literacy Panel (2002). *Digital transformation: A framework for ICT literacy*. Princeton, NJ: Educational Testing Services. Retrieved from <http://dx.doi.org/10.5430/jct.v2n2p127> on June 8, 2018
- National Board for Technical Education (NBTE) (2009). *National technical certificate and advanced national technical certificate curriculum and module specification for vehicle mechanics' work*. Kaduna: NBTE
- Onyiliofor, F. N. (2009). Counselling skills for improving academic performance of

- secondary school students in Nsukka education zone of Nigeria. Retrieved from http://academicexcellencesociety.com/counselling_skills_for_improving_academic_performance.html on March, 3 2018
- Owoeye, J. S. & Yara, P. O. (2011). "School location and academic achievement of secondary school in Ekiti State, Nigeria". DOI:10.5539/ass.v7n5p170 on November 29, 2017
- Pei-Yu W. (2013). Examining the digital divide between rural and urban schools: Technology availability, teachers' integration level and students' perception. *Journal of Curriculum and Teaching*. DOI:10.5430/jct.v2n2p127
U R L : <http://dx.doi.org/10.5430/jct.v2n2p127> on June 8, 2018
- Rigby, K. T. (2015). Real-time Computer-based Simulation as an Intervention in Aerodynamics Education. *Journal of Aviation/Aerospace Education & Research*, 24(2). <http://dx.doi.org/10.15394/jaaer.2015.1634> on July 12, 2017
- Sersion, B. L. & Stevens, D. M. (2012). Technology access in an urban stem high school: The missing variable. Retrieved from <http://rube.asq.org/edu/2012/06/best-practices/student-technology-access-in-an-urban-stem-high-school-the-missing-variable.pdf> on December 12, 2017
- Udofot, M.A. (2005). *Ensuring qualitative teachers for sustainable Nigeria educational system*. Retrieved from <http://www.hrmars.com/admin/pics/331.pdf> on October 17, 2017



Computer Education Research Journal (CERJ)

Volume 5: Issue No. 1 pp 67-81, 2018

RISK ANALYSIS OF MALWARE PREVALENCE ON A CAMPUS NETWORK BASED ON BAYESIAN BELIEF SYSTEM

BY

Aliyu Mohammed; B. A. Kwembe; Patrick. A. Avong
Electrical/ Electronic Department
Federal Polytechnic, Nasarawa
PMB 001 Nasarawa
aliyubiu@gmail.com;08035897654

ABSTRACT

The network security management system is for providing clear guidelines on risk evaluation and assessment for enterprise networks. The risk evaluation is based on the relationships among the most critical assets, and threats that are likely to those assets and their vulnerability impacts. Threat and risk assessment are conducted for identifying the safeguards to be adapted in order to maintain system confidentiality, integrity, and availability through effective control strategies. In this paper, an integrated information security analysis and an articulated understanding of the risks due to malware propagation on the campus network are provided. A Bayesian Belief Network system with inference level indicator that allows the decision maker to understand and provide appropriate decisions was developed in this paper. This will provide for mitigation and control countermeasures for the organizations infrastructural assets being at risk. Experimentally, monitoring sensors were placed on the campus network to gives the threat alert priority levels and magnitude on the vulnerable information assets as a real scenario.

INTRODUCTION

Generally, all the available malicious software (adware and spyware) affect users' productivity, compromise their privacy, and modify (damage) system assets. A relationship between the infection distribution and status of the infected system was determined to estimate the general effect on the enterprise network. The Methodology presented within this paper determines and discusses the following concepts:

Infection and probability occurrence triggered by malware through mathematical modeling. Risk computation with uncertainty compensation of infection and recovery models based on Bayesian Belief Network.

The prevalence of malware propagation on the internet and the campus network has

caused loss of data and vital information estimated to be in the tune of some thousands of dollars for most enterprises. Ponemon Institute an independent privacy policy research center came up with a report that the annual cybercrime costs for affected organizations ranges between \$1 million to \$52 million(LLC, 2012). The second annual report of the "Cost of Cyber Crime Study center" indicates that most costly cybercrimes are caused by malicious code, DoS (denial of service), stolen devices, and Web-based attacks(Institute, 2012). Most of the attacks are as a result of malicious activities like stealing intellectual property, hijacking online bank accounts, and creating/distributing viruses on computers. It also includes aspects like posting confidential business information on the Internet and even disrupting critical national

infrastructure. Most organizations do not present the actual position of their compromised data, thus it makes it difficult to calculate the accurate damage and loss (Liyakasa, 2012). While tightening email security screws is useful, there is growing concern that cyber criminals will turn their focus on other popular technologies, example mobile products and social networking sites. Using the proliferation of social networking, mobile products, and location-based services, experts agree that the playing ground for cyber thieves has increased (Arabo & Pranggono, 2013; Eschelback, 2012). The increased high level of data on the network is the main reason." Think about individual Facebook profile and how many data the company has based on what have shared [and what others share about others]."

Bayesian Belief Network provides the understanding to enable for containing the propagation of the malware. The BBN has both the quantitative and qualitative ability to measure the prevalence of the malware risk factor on the vulnerable assets. The BBN based on decision support system is a tool that can relate and give the causal relationships that exist between risk factors, some risk key indicators with their associated operational attributes. The tool can effectively perform inference reasoning and predictions under some predefined scenarios. BBN is a probabilistic cause-effect model or probabilistic influence diagram that describe the probability distributions about sets of variables by indicating their conditional independence assumptions along with their conditional probabilities (Fenton & Neil, 2011).

The paramount question always asked is how can the magnitude of the malware propagation and prevalence on the network assets? How can a clear and understandable risk assessment to the decision maker be presented for easy decision? To find solution to these questions there is need to look at the inner operations of BBN. Enterprise risk assessment and evaluation with a view to understand the effects of malware prevalence on the network assets through mathematical modeling parameters (Atom & Otoom, 2016).

Risk assessment handles the valuation of recent risk factor status, considering their probability and consequence. This issue may be

used from the quantitative scoring method and also the probability presented by considering Bayesian network. The value of diagnostic reasoning is the facts that once the enterprise value level is high, inference on the prospective degree of factors that are mounting on the enterprise value. The greater it is an indicative of the long run direction of risk management. In comparison to traditional risk assessment techniques Fault trees, Bayesian Systems give a superior modeling way of dynamic risk analysis and assessment (Cao, 2016). The virtues of Bayesian Network model are its inference engine for upgrading the posterior possibility of enterprise value given new information or key risks is high. It suggests that Bayesian Network model allows the organization to have various choices in the network structure, even with the addition of an auxiliary node. This probability upgrading not just continuously cuts down on the data uncertainty, it offers the enterprise risk scenario with real-time and up-to-date analysis (Weber, Madina-Oliva, Simon & Iung, 2012). The qualities of risk data are for assessing the remaining assets against other network facilities to provide a unique system approach (Kondakci, 2008). However, there is an increasing curiosity about how the Bayesian Network (BNs) can be applied using both data plus some evidence information to understand the magnitude of malware propagation prevalence and damages to network infrastructure (Bernard, 2007). A good example of decision analysis of statistical distribution denial-of-service (DoS) flooding attacks is presented by Li et.al (L., & C., 2003). However, such approaches using BBNs towards the analysis of network security risk propagation are difficult to come by in the literature. The remainder of this paper is structured as follows. Section II discusses malware propagation and its parameter determination. We discuss placement of sensors and malware prevalence modeling on the network. Section III describes the basic principles of Bayesian Belief Network (BBN). This includes the probabilistic conditional inferences of BBN. Section IV considers use of Bayesian Belief Network and its application towards risk analysis. Finally, some concluding remarks in section V.

PROPAGATING MALWARE PARAMETER DETERMINATION

The question to ask when conducting a risk analysis on how to prevent information theft is, "What can happen to an information?" The answers are long but broadly classified to include the following (Touchette, 2016):

- (i) Virus infects server that stores the data and tries to corrupt the files
- (ii) Trojan horse copying sensitive and personally identifying information's to be transmitted to an attacker's FTP site.

- (iii) Staff leaving a backdoor in an application to steal or destroy information,
- (iv) Employee can lose a laptop with vital information,
- (v) Denial of service (DoS) attacks can affect key database and applications.

Enterprises must protect the privacy of information irrespective of how it is stored. This is depicted in Figure 1 for the campus network sensor placements with other articulated control measures and mitigation strategies that could be put in place (Snort: www.snort.org, 2007).

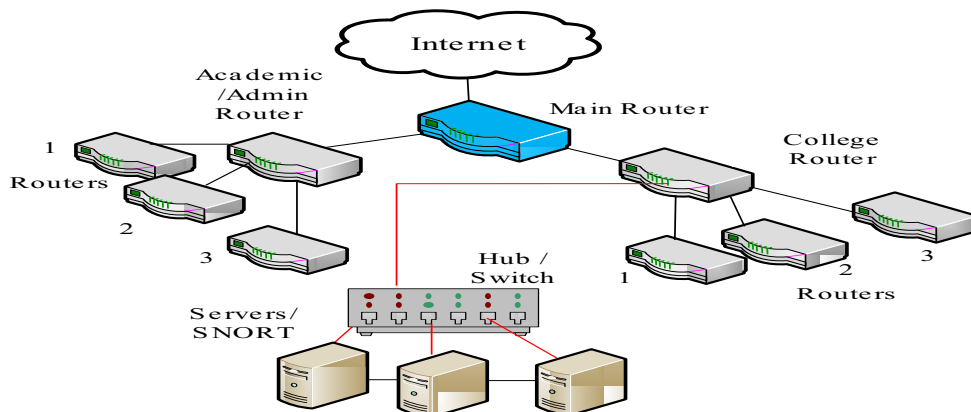


Figure 1. Tools Setting for Statistical Data Collection

Internet Connectivity means the chances that an end user is infected based on its link to a malicious server on the internet. This entails that the number of servers on the network that is compromised are a ratio of those that are not to give the probability of connectivity.

Thus, the ratio of the connected malicious server is $= \frac{m}{m+n} CCC +$ (1)

The factors m and n stand for malicious and non-malicious servers on the network.

If not connected to a malicious server, this is as indicated in Figure 2 and the ratio is

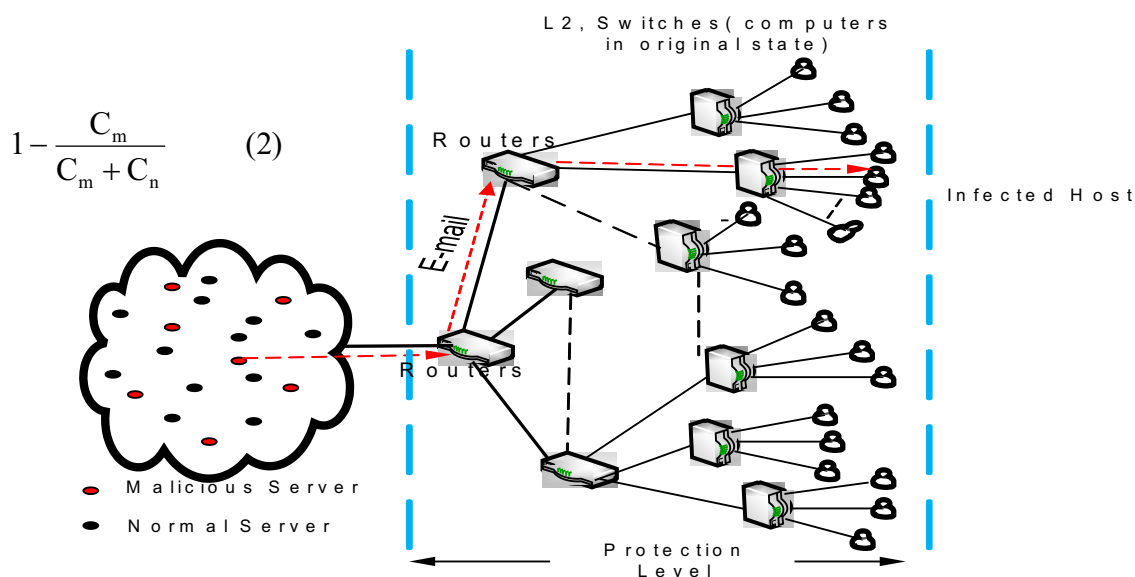


Figure 2. Internet Enterprise Connectivity

The characteristic of control entity is based on the availability of the measure in place. For instance, anti-virus software, the fact that it is available and applied for the desired control measure, its probability of occurrence is based on it being put in place. Thus, lack of it in place will be an indicator of no control. Meanwhile, risk event is a factor that is determined based on the effectiveness of any available control measure in an event of visiting any malicious

server on the Internet. This final consequence will be as a result of the compromised effect on the asset that leads to information loss or data stealing from the enterprise network. This scenario is depicted in the Bayesian Belief Network of Figure 3 and Figure 4. The consequence factor is shown in Figure 4 with given threats level parameters derived from monitoring sensor deployed on the network.

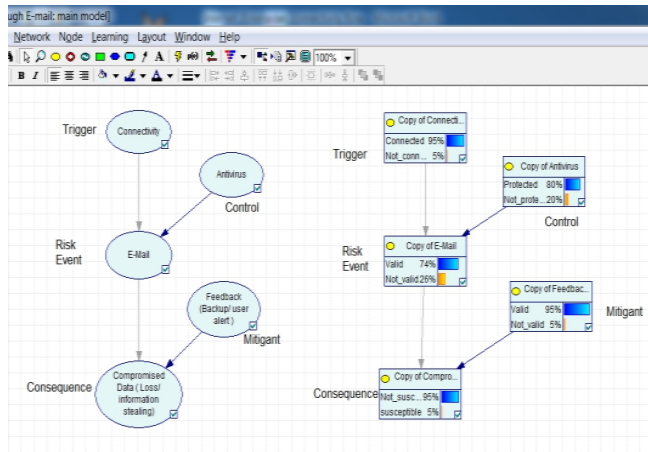


Figure 3 Connectivity through e-mail

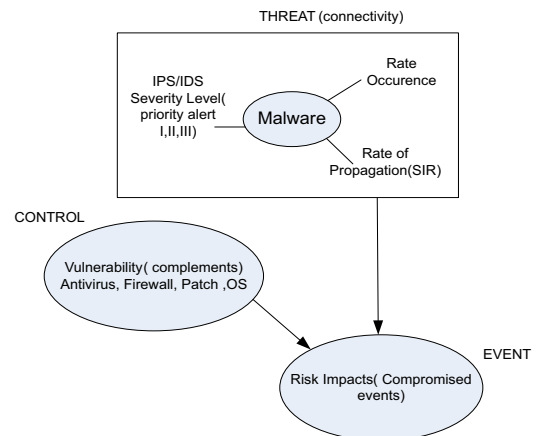


Figure 4 e-mail and its consequence

Client Server Connectivity Control

The effect of the placement of sensors on the network is to provide the infection alerts as a result of the malware propagation on the enterprise infrastructure network. The client server interaction protection is carried out on the network through both distributed and

centralized control system. The connectivity probability due to malicious and non-malicious servers on the client visiting links at prescribed period of time through the sensor alerts. In Figure 5, it shows the interaction of client *i* with malicious server on the network.

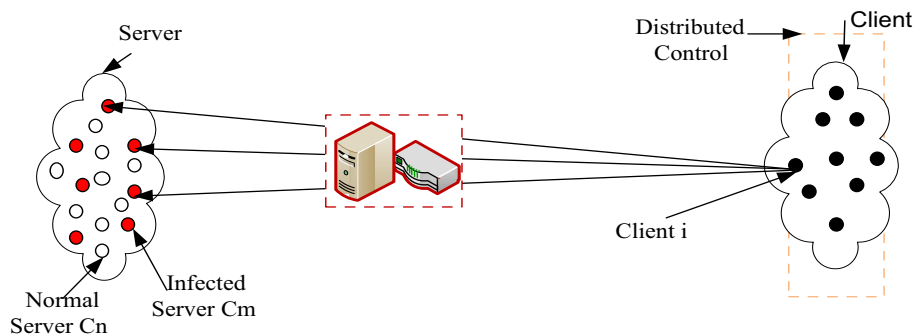


Figure 5. Client Server Connectivity

The probability for client *i* connecting to the malicious server at a given time t_k -

$$t_k = \frac{C_{mi}}{C_{mi} + C_{ni}} \quad (3)$$

At time t_i , assuming there are j numbers of clients, the probability of connecting to a malicious server at time t_i -

$$t_i = \frac{1}{j} \sum_{i=1}^j \frac{C_{mi}}{C_{mi} + C_{ni}} = \frac{1}{j} \left\{ \frac{C_{m1}}{C_{m1} + C_{n1}} + \frac{C_{m2}}{C_{m2} + C_{n2}} + \dots + \frac{C_{mj}}{C_{mj} + C_{nj}} \right\} \quad (4)$$

Given that C_{mi} and C_{ni} are the connected pairs (clients and servers) at time t_i . The pairs are obtained through net flow information Snort filtrations results / logs, and others.

Infection Rate Parameter determination:SI (Susceptible and Infectious) parameter modeling.

Table 1 Notation and explanation

Notation	Explanation
$S(t)$	Number of Susceptible hosts at time t
$I_m(t)$	Number of immune hosts at time t
$R(t)$	Number of removed hosts from the infectious population at time t
$I_n(t)$	Number of infected hosts at time t
N	Total number of hosts under consideration $N = I(t) + S(t) + R(t)$
γ	Recovery rate
β	Infection rate
t	Is a unit time

The analytical modeling based is started based on the simple SI model. For the SI model, there is an assumption that no hosts can recover. In anticipation, given a limited number of host's infection, the infection will spread to the other susceptible hosts until all hosts gets infected.

Looking at the case study as depicted

from Figure 6, at the time $t = 1$, two of the susceptible hosts become infected hosts. Thus these two susceptible hosts will start infecting neighboring hosts sequentially or at random. The Figure 6 shows a typical communication between infected hosts with its neighboring hosts.

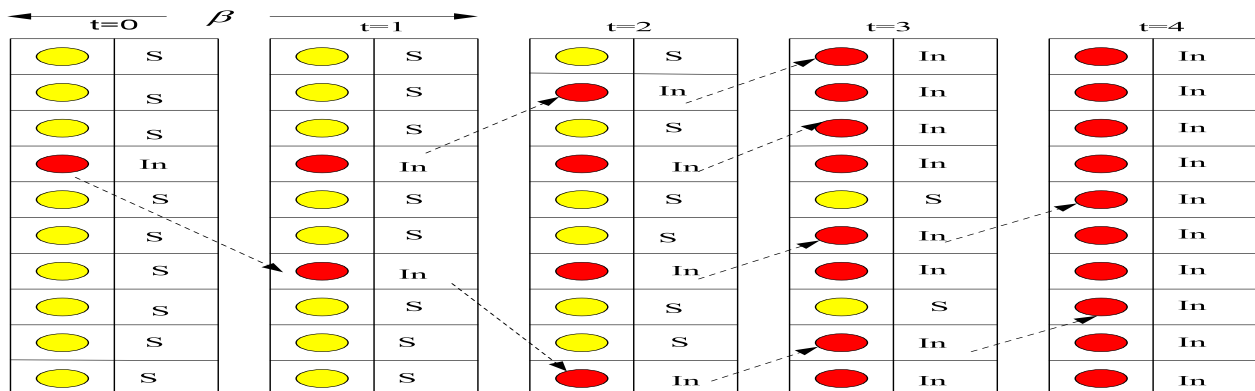


Figure 6. Malware infection rate propagation

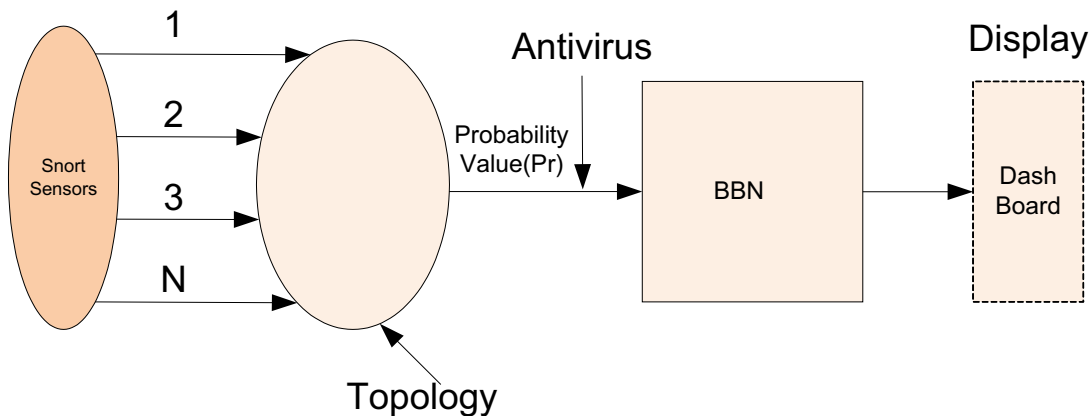


Figure 7. Malware infection rate and alert intensity aggregation.

The diagram in Figure 6 shows a typical communication between infected hosts with neighboring hosts. This is determined through

the aggregation process depicted in Figure 7. The propagated concept through Internet connectivity captured as shown in Figure 8.

	Time	Source	Destination	Protocol	Info
2049	-68.390625	00:00:00_00:00:00	00:00:00_00:00:00	0x1984	Netmon Train
168	0.468750	172.16.0.93	Broadcast	ARP	who has 172.16.1.60?
209	0.687500	172.16.0.29	Broadcast	ARP	who has 172.16.1.75?
217	0.781250	172.16.0.9	Broadcast	ARP	who has 172.16.0.94?
218	0.796875	172.16.0.9	Broadcast	ARP	who has 172.16.0.95?
229	0.859375	172.16.0.9	Broadcast	ARP	who has 172.16.0.96?
256	0.937500	172.16.0.9	Broadcast	ARP	who has 172.16.0.97?
282	1.000000	172.16.0.9	Broadcast	ARP	who has 172.16.0.98?
283	1.015625	172.16.0.9	Broadcast	ARP	who has 172.16.0.99?
317	1.093750	172.16.0.9	Broadcast	ARP	who has 172.16.0.101?
328	1.109375	172.16.0.9	Broadcast	ARP	who has 172.16.0.102?
364	1.140625	172.16.0.9	Broadcast	ARP	who has 172.16.0.103?
378	1.156250	172.16.0.9	Broadcast	ARP	who has 172.16.0.104?
389	1.171875	172.16.0.93	Broadcast	ARP	who has 172.16.1.55?
476	1.750000	172.16.0.9	Broadcast	ARP	who has 172.16.0.105?

Figure 8. Malicious hosts propagation

Taking the source host 172.16.0.9 as an example and in this snapshot the destinations hosts are 172.16.0.94 to 172.16.0.104 in Figure 8. The difference here would be the time difference between consecutive contacts of infected hosts

to the neighboring hosts. In this case, the destination hosts can be either immune hosts, susceptible hosts or other infected hosts.

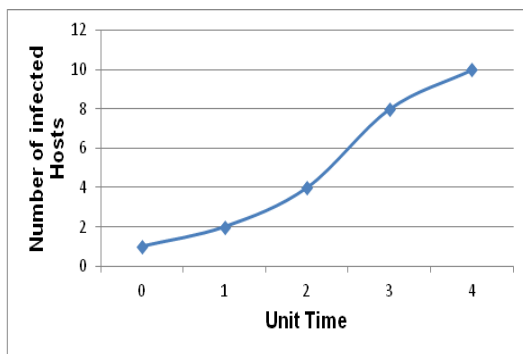
(Mohammed, Jamil, Nor, & Marsono, 2013)

Table 2. Transaction Time difference between infected hosts

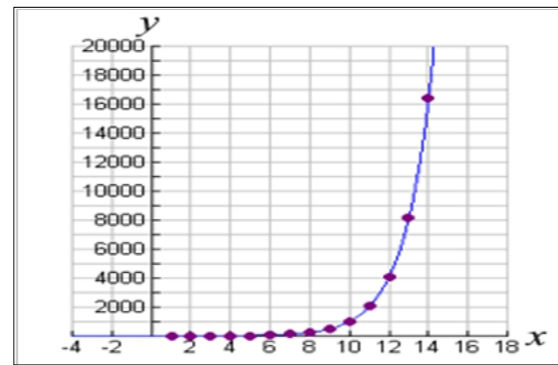
Absolute time (secs)	Difference	Infected host (starting time)	Propagation time	Destination Host
0.78125		0.781250	→	●
0.796875	0.015625	0.796875	→	●
0.859375	0.0625	0.859375	→	●
0.93751	0.078125	0.937500	→	●
1	0.0625	1	→	●
1.015625	0.015625	1.015625	→	●
1.09375	0.078125			
1.109375	0.015625			
1.140625	0.03125			
1.15625	0.015625			

The average difference is 0.041666667s and the median is 0.03125 as shown in Table 2. The actual contact time would be the starting time of the packet traversing the network path from source to destination host plus the propagation time. Even if the distance between hosts is 1 km apart, the propagation time is $1 / (3 \times 10^5)$ i.e. $3.3 \mu s$ which is very much less than the average time of each initiation of infected packet transmission. Thus, the average contact time can be taken as the average time between infected packet transmissions. Here, we can assume β to be 0.041666667sec. This implies

that every infected host will infect neighboring host at the rate of 0.041666667sec for each susceptible host. If there are 8 susceptible hosts, then the total time to infect is $0.041666667s \times 8$ i.e. after 0.333333336s, all 8 susceptible hosts will be infected. The smaller the value of β , the rate of infection will be faster. In the ideal case, the infected hosts grow exponentially following a geometric progression, $2^0, 2^1, 2^2, 2^3, \dots, 2^n$ with interval β . An example of an exponential graph and the infection rate are as shown in the figures below:



(a). Propagation Rate per unit time



(b) Exponential propagation rate

Figure 9

In reality, a more probabilistic approach has to be taken since within each interval, there will be hosts which are immune and hosts which are already infected.

Simulation of SI /SIR mathematical propagation model with Netlogo and Matlab

The current Netlogo virus propagation and

recovery model is based on the network virus model in the library. The default model is based on the probability of nodes having the chance to be in contact for the infection process to take place. The recovery and the virus spread chance are probabilistic with given threshold level.

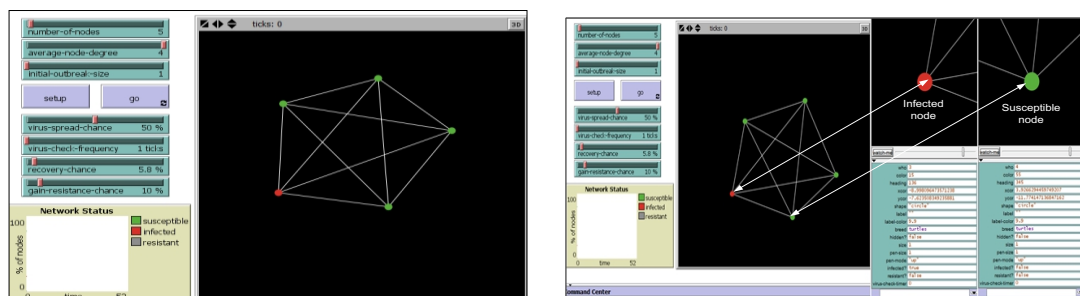
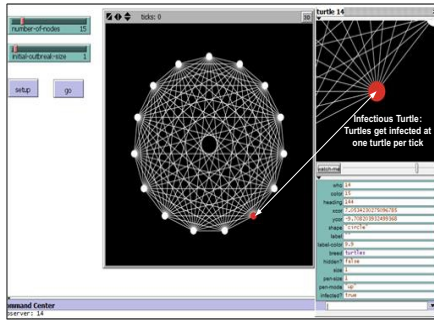


Figure 10 Netlogo node interaction

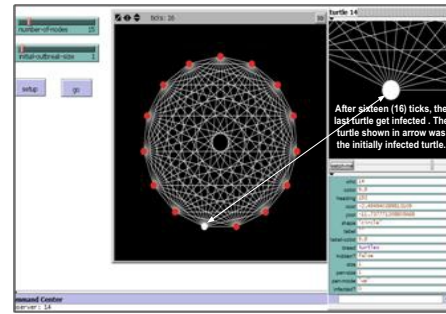
The figure 10 show a full 5 connected nodes that represents an actual scenario on the network. The virus spread on the network depends on the given threshold level that are available to enable for infection. The infection probability is dependent on the chances of being

above the threshold for infection to take place or on the otherhand below the threshold for not being infected.

To discuss this further, the figure 11 below shows the actual codes for the spread of virus i.e. infecting other susceptible nodes. (Wilensky, 1999).

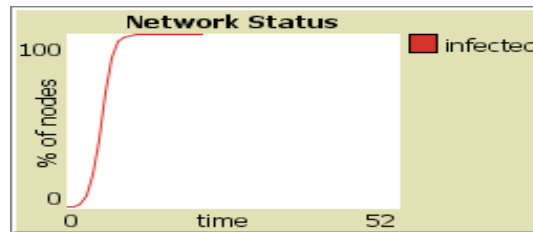


Before



After

(a) Node (turtle) infection at one node per tick for SI model



(b) Simulated wave form with Netlogo

Figure11 (a and b) Netlogo node interaction

It is observed that the characteristics based on Netlogo shown from Figure 11(a, b) are similar and have the same trend that is time dependent. The Netlogo simulation curve has a factor that is different after it has reached a saturation level. The infection rate grows steadily until the total number of percentage of nodes is reached. At this maximum level, the infection curve remains constant for any further time ticks. This can be attributed to the fact that

the infection is done randomly and continuously even for already infected nodes.

The SIR mathematical modeling based on the campus network with Matlab: The mathematical modeling of malware based on the campus network takes into consideration the various network segments. The segments form the total hosts' population on the network. The model equations are depicted below:

$$\frac{ds(t)}{dt} = -\beta s(t)i(t) \quad (5)$$

$$\frac{di(t)}{dt} = \beta s(t)i(t) - \gamma i(t) \quad (6)$$

$$\frac{dr(t)}{dt} = \gamma i(t) \quad (7)$$

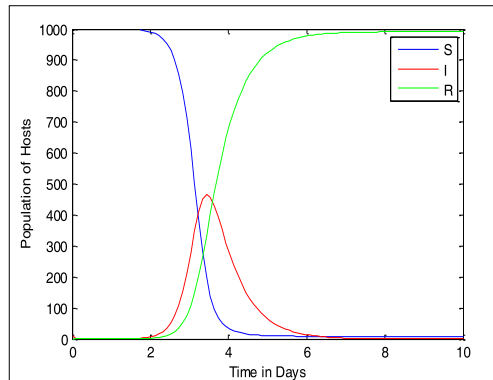
The model is computed based on Euler's method of analysis as result of the non-linearity nature of the equations:

$$S(n) = S(n-1) - \beta(S(n-1))i(n-1)\Delta t \quad (8)$$

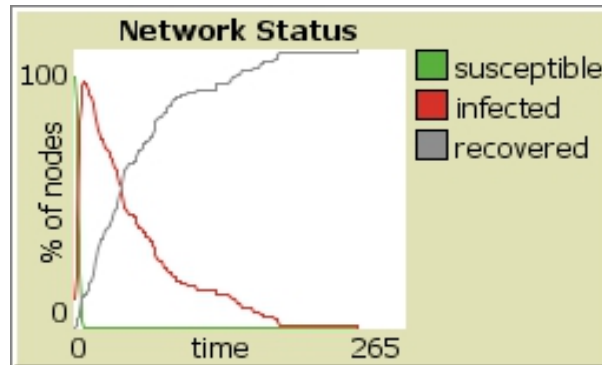
$$i(n) = i(n-1) + [\beta S(n-1)i(n-1) - \gamma i(n-1)]\Delta t \quad (9)$$

$$r(n) = r(n-1) + \gamma i(n-1)\Delta t$$

The propagating parameters are based on the total host population of $N=1000$, and the infection of $\beta = 6.5$ with recovery rate $\gamma = 1.5$



(a) Matlab



(b) Netlogo - initial outbreak of 10

Figure 12. The SIR Mathematical Modeling based on campus network

THE BAYESIAN BELIEF NETWORK CHARACTERISTICS

Decision theory complements reasoning under uncertainty by delivering a coherent framework to create the compliance while using preferences from the decision manager (Yap, Tan, & Pang, 2007). Decision described as irrevocable allocations of assets, as well as the preferences that dictate your decision process to represent the relative values the decision maker places on each possible outcomes of the decision. The aim is always to boost the expected utility or benefit triggered by a few decisions. Decision theories provide an axiomatic reason for preference graphically by decision trees and influence diagrams. The primary focus from the decision tree is about the procedural areas of an evaluation. The influence diagram includes probabilistic dependencies between variables, such as the Bayesian belief network. However, influence diagrams contain decision nodes that provide choices and value nodes that provide utility measures. Although influence diagrams and Bayesian belief systems resemble, they are on two different problems. Influence diagrams are employed just like a graphical assistance to measure the interaction between various areas of a problem, whereas Bayesian belief systems employed to infer

information from available data.

A Bayesian network consists of a graphical structure that encodes domain variables, where the qualitative and quantitative relationships between them provides for the encoding probabilities over the given variable (Pearl, 1988). The Bayesian Network can be considered to involve the process of decisions with value and / or utility functions which tend to describe the preferences or wishes of the decision-maker. This conceptual model is called Influence Diagram. According to D. Heckerman (Heckerman, 1997), Bayesian network considered set of variables $X = [X_1, \dots, X_n]$ that relates to network structure S that tries to encode a set of conditional independent factors about the variables in X , and a set of P being a local probability distributions associated with each set of the variable. All together this set of components tends to define the joint probability distribution around X . Thus, the network structure enclosed by S called a directed acyclic graph (DAG). The nodes in S corresponding directly to the variables X . The factor X_i is to denote both the variable and its corresponding node, and pa_i represents the parents of node X_i in S including the variables that correspond to those parents. Conditional independencies in S encodes that there are no arcs that relate them. In S the joint probability distribution for X can be depicted by the equation: -

$$p(x) = \prod_{i=1}^n p(x_i | pa_i) \quad (10)$$

The local probability distribution P is the term of the products in equation 5.1 above. It shows the pair of (S, P) are the joint distribution of $p(x)$. These define the Bayesian Network as follows: -

$$BN = (S, P) \quad (11)$$

$$S = \{(X_j, X_i) | X_i \in X, X_j \in pa_i\} \quad (12)$$

$$P = \{p(X_i | pa_i) | X_i \in X\} \quad (13)$$

The Bayesian Belief network represents components of complex probabilistic reasoning in an intuitive graphical format. These make understanding and communicating with the systems remarkably easy for the mathematically unsophisticated entities. The quantitative aspect of Bayesian Belief networks accommodates subjective judgments (expert opinions) as well as probabilities that typically based on objective data (). Another important factor of the BBN is that, the arrows presented in the network represent real causal connections and not just the flow of information that occurs during reasoning.

USING BAYESIAN BELIEF NETWORK SYSTEM APPROACH TO MODEL MALWARE RISK

The Bayesian Belief Network is an effective tool with adequate technique for modeling, measuring and to a certain extent managing the characteristics of malware propagation risk on the network environment of the campus information assets. This is achieved through the use of prior knowledge of the causal risk factors and the possible probabilistic reasoning concept of the systems. The scenario is typically represented in a form of an acyclic graph that consists of states of nodes and directed arcs. In a nut shell, the Bayesian Belief analysis is to allow for improving the prior determined factors values in the event of any additional information that is obtained about the variables in the network. This is for building the conditional probability table (CPT) to depict the situation in Figure 5. The conditional probability tables that are affixed to the random variables within the model might be estimated

from collected record information where they are readily available. When such similar information is not available, the tables could be built based on opinion results. Assets risk models might be readily developed utilizing a graphical Bayes Internet editor like the GeNIe application program (Decision System Laboratory, University of Pittsburgh, & Avenue, 2019). This type of model is as templates for the risk analysis engine since the risk model for the assets which are of the identical type with the new model analyzed similarly. Therefore, this system capacity allows the new tool to become flexible enough to accommodate changes occurring in components, technology, and environment; in addition to new threats that might arise once in a while. Meaning that the level of risk that prevails in any given situation determined both by the severity of the consequences arising from the occurrence of the risk event and the likelihood of its occurrence on the given asset (Juan, 2016).

Looking at a situation when a Trojan malware propagates through a network of nodes, a model is developed with the basic Susceptible Infection Rate (SIR). The basic SIR is based on the typical model for epidemic modeling. Thus, the epidemic models are used to explain the rapid outbreak that occurs in an environment within a given time of less than one year; while it becomes endemic if it could extend to a longer time. This leads to a renewal of the susceptible in the system through births or recovery due to possible temporal immunity. The thinking is that we are considering situation that the type of malware attack in the analysis is a single type. This is just for the sake of

simplicity of the analysis as it makes it easy to consider the rate of propagation and the possible recovery rate from the single malware type. The SIR (Susceptible, Infectious, and Recovered) nodes defines as; susceptible nodes are those hosts that their operating system; application and anti-virus not updated could be vulnerable to an attack by the virus; while infectious nodes are hosts that get infected when in an event of visiting malicious sites on the network and the malware is transferred to the host. Thus, the

recovery nodes are hosts that are safe from a particular malware type but can still be susceptible for other malware on the network.

Looking at the SIR model, with the Susceptible, Infectious, and Recovery host being at levels that are either high or low as indicated in the Figure5 with given weightings based on the particular scenario. The conditional probability tables for each of the variables are conceptually given without particular evidence.

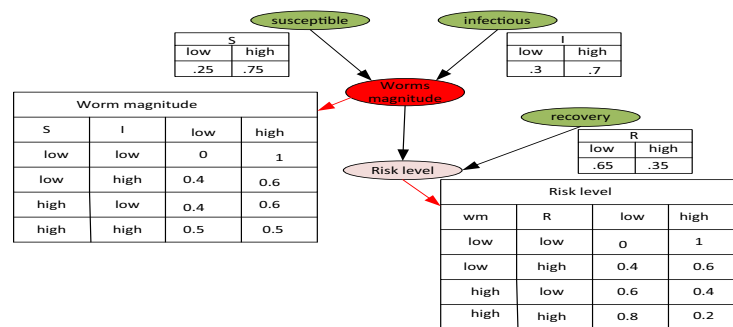


Figure 13. Conceptual Conditional Probability Table (CPT) for SIR model.

The SIR factors (Susceptibility, Infectious and Recovery rates) are measured per unit time; however, the measurement could be per seconds, minutes, hour or days. When specific value is assigned to the measurements, make it discrete, as against continuous entity.

Probability Factor Analysis

Based on the conditional probability distribution of the causal variables in the SIR model, the likelihood occurrence for the magnitude of malware is determined due to the

rate of infection and susceptibility when they are high given as 53%. Despite the fact that the recovery rate is low, the net effect of the risk has dropped to 51% yet is still high as indicated in Figure 6.

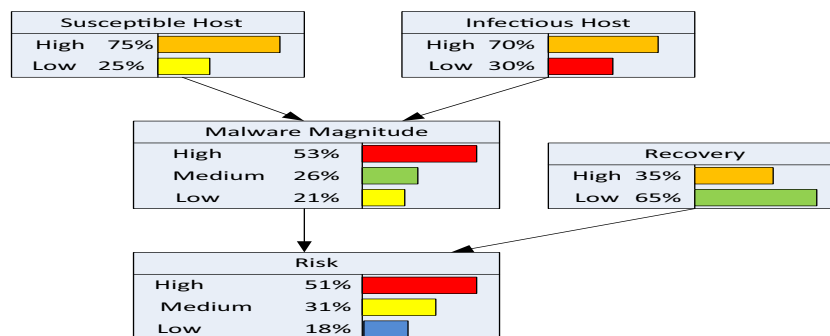


Figure 14. Conditional Probability Estimation (Decision Systems Laboratory et al., 2007; GeNIe, 2008)

Malware Risk Propagation as a factor of Threat, Vulnerability, and Cost

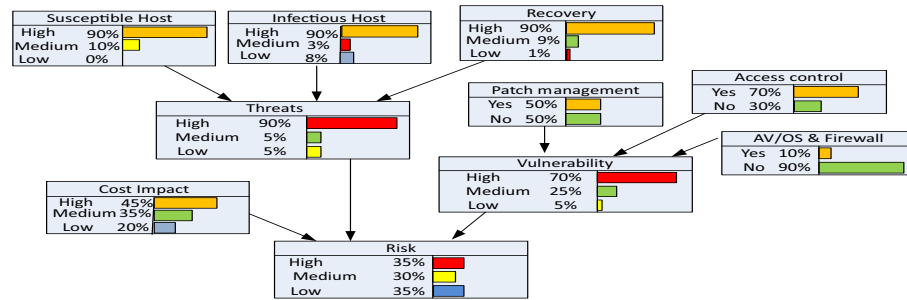


Figure 15. Conceptual illustration of Risk Analysis as a function of threat, vulnerability, and cost with inference belief (Decision Systems Laboratory et al., 2007; GeNIe, 2008)

With the given structure and the associated variables explained, the associated conditional probability tables CPTs are as indicated in the Figure 7. Applying the principles of Bayesian theory for making necessary inferences that will enable for determining states of the system variables (yes or no; low, medium, and high). Thereafter, we can observe the occurrence of the current system output based on BBN and use the trend for new evidence to update the probabilities in order to determine the *propagation patterns* of new causal effects generated (Atoum & Otoom,

2016). For instance, $P(X=\text{low} | Y=\text{low}, Z=\text{low}, T=\text{medium})$ signifies that the prospect of enterprise risk once the amounts of threat (Y), cost impact (Z), and vulnerability (T) are low, low, and medium, correspondingly. The other side of it is looking at the reverse diagnostic reasoning approach. When we know certain possibility of the enterprise risk, we will then infer the prospect of a risk factor. For instance, $P(Z=\text{medium} | X=\text{high})$ denotes that whenever the enterprise risk level is high, the prospect of cost impact is medium.

Malware risk propagation with real scenario characteristics modeling

Table 3 Malware Parameter determination based on Sensor alerts on the network

No.	Type of Malware	Infection Rate
1	[14082] BACKDOOR trojan agent.aarm runtime detection - spread via spam TCP 10.8.18.115 – 49180 – 84.200.70.131 – 9091,	$\beta = 5.837753 \text{ Sec}$
2	[1394] SHELLCODE x86 inc ecx NOOP TCP 10.8.18.- 62129 – 216.39.55.12 – 80,	$\beta = 2.8394444 \text{ Sec}$
3	ATTACK-ESPONSES 403 Forbidden TCP 207.171.189.81 – 80 – 10.8.4.6 – 53701,	$\beta = 4.4149699 \text{ Sec}$
4	[25471] MALWARE-CNC ZeroAccess Spiral Traffic TCP 10.8.4.27 – 53166 – 50.22.218.215 – 80,	$\beta = 11.27118 \text{ Sec}$
5	[17354] SPECIFIC-THREATS Apache Byte-Range Filter denial of service attempt TCP 10.8.18.172 - 7313 - 80.241.210.77 80.	$\beta = 7.58360 \text{ Sec}$
6	[18710] SPECIFIC-THREATS McAfee policy Orchestrator Framework Services buffer overflow attempt TCP 10.8.18.172 – 6712 – 37.220.3.194 - 8081	$\beta = 2.56220 \text{ Sec}$
7	[5760] SPYWARE-PUT Hijacker marketscore runtime detection TCP 10.8.18.39 -53157-209.247.226.38 – 80.	$\beta = 3.406177 \text{ Sec}$

The campus network is considered based on the levels of the segments and their weightings (impact) in terms of importance. The correlation is based on impact (cost) as against the previous effects of network topology control factors; this is shown in the Figure 16. The idea here is to look at the threat on the network due to the malware propagation parameters. These

parameters are the infection rate, severity level of the malware variants and the impact (cost) on the assets. The parameter weighting are based on the real data derived from the snort sensor on the network. This put the severity level into four levels and so also the impact that transit into the four network segments on the campus environment(Catherine 2013)

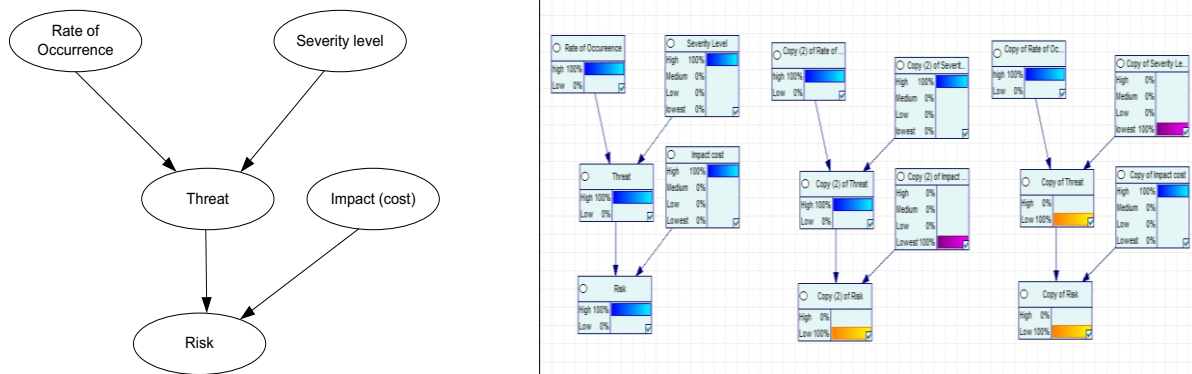


Figure 16. Malware Risk propagation based infection and cost magnitude

In the event of cost lost and information stealing due to the presence of malware prevalence on the network, it is shown that the risk varies based on the cost magnitude. Thus, the lower the asset cost the less the magnitude of the risk that will be recorded. The concept in Figure 8 is then propagated based on the asset cost levels with data from the servers as backbone of the network. Meanwhile

information assets from the student segment is tagged as the least in terms of cost. The propagated model outcome is shown in Figure 9(a, b). Therefore, the result calls for a varying control measures based on the importance and value of the asset or where the information asset is being kept on the network. This is a matter of priority from the network policy implementation.

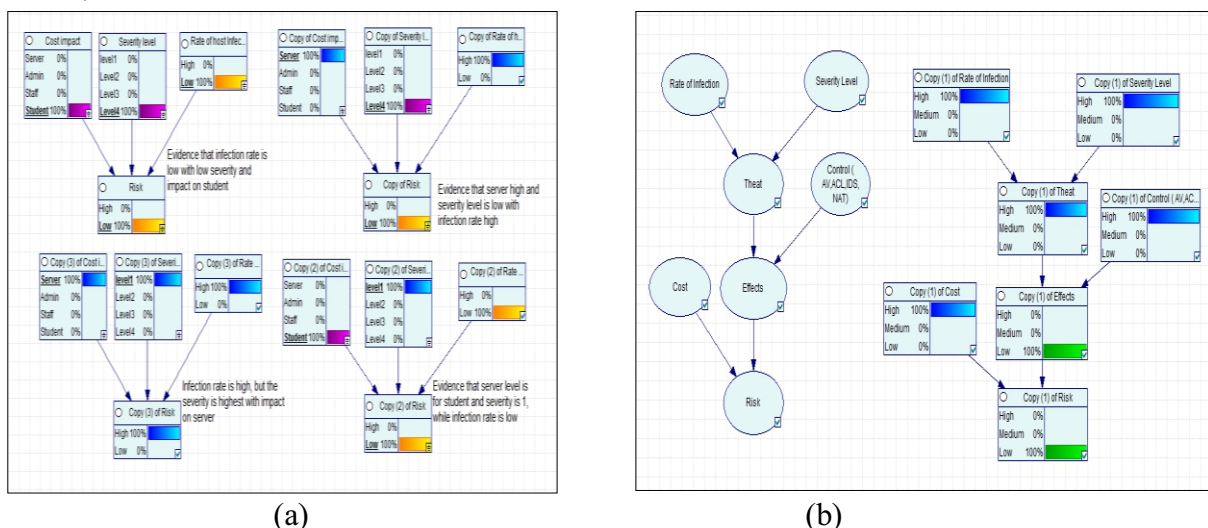


Figure 17. (a) Risk inference parameters propagation with evidence (b) Malware parameter propagation for risk determination with control

Using the propagation rate as the connectivity factor on the network, observation can be made about the effect of the malware infection and the consequences posed through the Bayesian Belief system. This is propagated by the tool Genie and depicted in Figure 9. It shows that the smaller the infection rate the faster the propagation and the higher the connectivity ratio on the network.

CONCLUSION

Threat analysis methods provide effective ways of differentiating between what are actual and perceived risk on the network. Therefore, risk evaluation is a kind of challengeable task and is truly a long term issue to enable for the running of robust campus networks infrastructure. The evaluation result goes a long way in helping the management to improve on the levels of information security system of the organization. Clear understanding of malware and virus and their associated propagation mechanism structure that forms the attacks channels is a critical part in recognizing how to protect against the overall threats and risks on the campus network environment. The security network management system based on Bayesian Belief decision support system provides a clear understanding ability to give information for management policy implementation and pave way for a better decision making.

This paper has shown through analysis, the ability to have a comparable concept of malware prevalence and impact through Bayesian Belief Network inference decision systems. The inference engines overall importance in measuring and understanding of threats and information security risk management as a view point of enterprise and academic computing environment. These consequences provide the enabling ground for effective control and mitigation strategies to be in place. With the clear concept, it will provide for a trust in the expected levels of security to ascertain whether organizational security investments paid off or not through a measure based on belief network inference decision. As an on-going research activity, the inference analysis will be extended with the campus network assets assessment results through a comprehensive network security decision framework. The framework is aimed at

providing an enabling ground for effective control and safeguards of the infrastructural assets on the network.

REFERENCES

- Arabo, A., & Pranggono, B. (2013, 29-31 May 2013). Mobile Malware and Smart Device Security: Trends, Challenges and Solutions. Paper presented at the Control Systems and Computer Science (CSCS), 2013 19th International Conference.
- Atoum, I., & Ootom, A. (2016). Effective Belief Network for Cyber Security Frameworks. *International Journal of Security and its Applications*, Vol.10, No.4, 221 - 228.
- Bernard, R. (2007). Information Lifecycle Security Risk Assessment: A tool for closing security gaps. *Science Direct- Computers and Security*.
- Cao, K. (2016). Research and Analysis on Network Security Modelling. *International Journal of Network Security and its Applications*, Vol.10, No. 4, 135 - 142.
- Catherine, P. (2013). Network Security Concepts and Policies. Retrieved from <http://www.ciscopress.com/articles>
- Decision Systems Laboratory, University of Pittsburgh, & Avenue, N. B. f. (2007). <http://dsl.sis.pitt.edu/> Decision Systems Laboratory & U. o. Pittsburgh.
- Eschelbeck, G. (2012). Security Threat Report 2012. Retrieved from <http://www.sophos.com/en-us/press-office/press-releases/2011/12/sopho>:
- Fenton, N., & Neil, M. (2011). The use of Bayes and causal modelling in decision making, uncertainty and risk. 3 Editorial. CEPIS UPGRADE: A Proud Farewell Nello Scarabottolo, President of CEPIS ATI, Novática and CEPIS UPGRADEDídac López-Viñas, President of ATI, 10.
- GeNIe. (2008). Graphical decision theoretical model. Retrieved from Available from: <http://genie.sis.pitt.edu/>:
- Heckerman, D. (1997). Bayesian Networks for Data Mining. *Data Mining and Knowledge Discovery*.
- Institute, P. (2012). Cost of Cyber Crime Study: United States. Retrieved from http://www.ponemon.org/local/upload/file/2012_US_Cost_of_Cyber_Crime_Study_FINAL6%20.pdf

- Janjic, A., Stajic, Z., & Radovic, I. (2011). A Practical Inference Engine for Risk Assessment of Power Systems based on Hybrid Fuzzy Influence Diagrams. Latest Advances in Information Science, Circuits and Systems.
- Juan, T. (2016). Risk Assessment of Computer Network Security in Banks. International Journal of Security and its Applications, Vol. 10, No.4, 1 - 10.
- Kondakci, S. (2008). A Composite Network Security Assessment. The Fourth International Conference on Information Assurance and Security, IEEE.
- L., M., & C., C.-H. (2003). Decision analysis of statistically detecting distributed denial-of-service flooding attacks. International Journal of Information Technology & Decision Making, Vol. 2, No. 3.
- Liyakasa, K. (2012). Cracking the Code on cyber crimes. Retrieved from
- LLC, P. I. (2012). Cost of Cyber Crime Study: United Kingdom Retrieved from
- Mohammed, A., Jamil, H. A., Nor, S. M., & Marsono, M. N. (2013). Malware Risk Analysis on the Campus Network with Bayesian Belief Network. International Journal of Network Security & Its Applications (IJNSA), 5.
- Pearl, J. (1988.). Probabilistic reasoning in intelligent systems. Morgan Kaufmann, San Mateo, CA,. Snort:www.snort.org. (2007)
- Snort. URL <http://www.snort.org/>.
- Touchette, F. (2016). The evolution of malware. Network Security, 2016(1), 11-14. doi:[http://dx.doi.org/10.1016/S1353-4858\(16\)30008-3](http://dx.doi.org/10.1016/S1353-4858(16)30008-3)
- Weber, P., G. Medina-Oliva, C. Simon, & B. Jung. (2012). Overview on Bayesian networks applications for dependability, risk analysis and maintenance areas. Elsevier - Engineering Applications of Artificial Intelligence.
- Wilensky, U. (1999). NetLogo. Bulletin d'Information des Geologues du Bassin de Paris.
- Yap, G., Tan, A., & Pang, H. (2007). Explaining Inferences in Bayesian Networks.



Computer Education Research Journal (CERJ)

Volume 5: Issue No. 1 pp 82-91, 2018

EFFECTIVENESS OF COMPUTER-BASED CONSTRUCTIVIST INSTRUCTION ON STUDENTS' ACHIEVEMENT AND INTEREST IN BASIC SCIENCE AND TECHNOLOGY IN NIGER STATE

BY

*GIMBA, R, W, **HASSAN A.M, & ***ADIO, T.J

*Science Education Department, University of Nigeria, Nsukka

**Industrial And Technology Education Department, Federal University of Technology Minna.

* +238032853603, ** +238035872654 & *** +238064378847

*ramatu.gimba@futminna.edu.ng **yabhassan@yahoo.com ***adio_ttaf2001@yahoo.com

ABSTRACT

This study investigated effectiveness of computer-based constructivist Instruction on students' achievement and Interest in basic science and technology in Niger State. Three objectives, three research questions and three hypotheses were set for the study. The population for the study was 1,552 students in Junior Secondary School II in Minna and Bida Local Government Areas of Niger State. The design for the study is Quasi-experimental using pretest posttest non-randomized control group with an intact class. The sample consisted of a total of 52 students, made up of 29 experimental group and 23 control group. Two instruments, Basic Science and Technology and Technology Achievement Test (BSTAT) and Basic Science and Technology Interest Inventory (BSTII) were used for collection of data. The instruments were subjected to validity and reliability test. The result obtained from trial testing was used to determine the reliability coefficient for BSTAT and BSTII using K-R20 (Kuder Richardson) and Cronbach alpha respectively. The reliability coefficient of BSTAT and BSTII is 0.73 and 0.77 respectively. The data collected were statistically analyzed using t-test. The results obtained showed that significant difference exists in the achievement and interest of subjects in Basic Science and Technology taught with web-based software teaching strategy. The application of Multiple Classification Analysis (MCA) showed that students taught with web-based learning strategy achieved and developed more interest significantly than those taught with lecture method. Based on the findings, web-based learning strategy is more effective in the enhancement of students' academic achievement and interest in Basic science and technology. The study recommended among others that the teaching of basic science and technology should be very flexible to incorporate new strategies.

Keywords: Computer-based constructivist instruction, achievement, interest, basic science and technology

Introduction

The main objectives of teaching and learning of Basic Science and Technology in Nigeria schools as stipulated by NERDC (2012) is that learners are expected to develop interest in science and technology; acquire basic knowledge and skills in science and technology; apply scientific and technological knowledge and skills to meet contemporary societal needs. Also take advantage of the numerous career opportunities provided by science and

technology; become prepared for further studies in science and technology; avoid drug abuse and related vices; and to be safety and security conscious. In order to achieve the objectives of Basic Science Technology, the thematic approach to content organization was adopted by NERDC for the holistic presentation of scientific and technological concepts, knowledge and skills to learners for better achievement.

Achievement in opinion of Ogundukun

and Adeyemo (2010) is the exhibition of knowledge attained or skills developed by students in a subject as determined by test scores of students, assigned by teachers. Achievement according to Abakpa (2011) is the measure of accomplishment in a specific field of study. The authors argued that achievement of students is the demonstration of their abilities to attain certain levels of instructional objectives outcome of their classroom instructions and experiences. The achievement of students in Basic Science and Technology cannot be compromised, because it is essential for the productive economic sector of our nation, for the production of labour force that is scientifically and technologically literate to bring about the desired changes for sustainable national development (Cyril, 2013).

Constructivism is a teaching strategy, which holds the view that scientific knowledge be personally constructed and reconstructed by the learner based on his or her experience. It is a model of instruction, which allows for interaction between students/students, students/teacher in the classroom. It is a problem-solving approach to learning that allows students to explore and work in groups, making meaning of tasks and setting out to solving problems that are perplexing to them (Hassan, 2016). There are several constructivist models, which are useful in helping learners reconstruct their knowledge based on their prior conception. They include: five phases of constructivist model (5E Model), five steps conceptual change model (PEDDA), four phases of constructivist model (IEPT), seven phases of constructivist model (7E Model), learning cycle model, Analogy and Negotiations.

Basic Science and technology Curriculum Study (BSTCS) cited in Mandor (2002) proposed that learning and teaching framework based on constructivism should consist of five phases namely engagement, exploration, explanation, elaboration and valuation.

Constructivism is an inquiry-based instructional approach that has been proven by many researchers such as Usman, Hassan, Maik& Musa (2015); Robert, Hassan and Nwankwu (2016); Ugwuanyi (2015); Mandor (2002); and Obeikwe (2008) to enhance achievement in science. It then becomes pertinent to explore its efficacy with the use of

computer-based learning and ascertain whether or not learning can be done more effectively.

Owodunni, Igwe and Hassan (2014) advocated giving the students the maximum control over learning and creating curricula that foster growth and development of their minds. This can be achieved through the unique nature of new technologies such as computer and its accessories where it is intended to serve as a teaching, learning and problem-solving tool, with the ultimate objective of providing a level of instruction equivalent to or better than that of a human teacher (Ezeudu, 2011). The human ability to guide, encourage and reinforce positively is still a necessary component of teaching with computer-based learning because programme learning is critically dependent on its effectiveness on the design of the questions.

However, some studies have been carried out by different authors such as Hassan, Kareem, Bala& Abba (2016), their study revealed that there was no significant difference in cognitive achievement of the students using computer-based learning strategy. Also, there is paucity of literature on the effects of computer-based constructivist instruction on students' achievement and interest in Basic Science and technology Curriculum Study (BSTCS) (Bani, 2010). Hence, the need for this study to determine whether the strategy would produce significant effect on the students' achievement and interest in Basic Science and technology.

In addition, Atadoga and Lakpini (2013) reported that persistent poor achievement of students and their lack of interest in science subjects could be attributed to their poor foundation created from poor instructional methods used by the science teachers from the beginning. Hassan, Gimba, Abdulkadir, Umar and Adio (2016) agreed that instructional method used by science teachers has a significant influence on achievement and interest of students. That is why NERDC (2012) recommended child-centered and culturally oriented instructional approaches for the teaching and learning of Basic Science and Technology. One of the approaches for teaching and learning of Basic Science and Technology that relates to the cultural heritage of students environment and their culture is ethno-science. Ethno-science is the study of different students combined with a particular strategy and

geographical areas as relates to science oriented subject. In this study, the researcher investigates the effects of computer-based constructivist instruction on Upper Basic II (UBII) students' achievement and interest in Basic Science and Technology, as one of the cultural oriented approaches using demonstration teaching method as a control variable to determine its effectiveness.

Interest can be defined as persistent tendency to pay attention and enjoy some activities or contents (Nworgu, 2006). Interest in Basic Science and Technology refers to students' reactions, feeling and impression about Basic Science and Technology contents and concepts as well as related tasks. This implies that, if students have positive interest towards Basic Science and Technology they will not only enjoy studying it but would also derive satisfaction from the knowledge and skills acquire from it. Students' achievement and interest in science have direct link with instructional methods. This means that methods of instruction are functions of students' achievement and interest in science.

Statement of the Problem

The objectives of teaching and learning BST is for the students to develop interest in science and technology, acquire basic knowledge and skills in applied science and technology in order to solve contemporary societal problems. These objectives have hardly been achieved over the years. This has been attributed to methods of instruction used by the science teachers which do not take care of the cultural background and the needs of the students (Ezeudu, 2011). As a result, students have been viewing science taught to them in schools as foreign, abstract, unreal and meaningless. As a result, students merely memorize the contents and concepts taught, to pass their examinations with little or no interest which results in persistent poor achievement.

Research Studies revealed that the effective utilization of ethno-science instructional approach influences students' achievement and interest in science. Most of the researchers' works like Ugwuanyi (2015) focused on Biology while some other researchers focused in the areas of Woodwork, Electrical, Building, Metalwork, Technical Drawing, Chemistry, and Mathematics and Physics using computer-based constructivist instruction.

Much is yet to be done on Basic Science and Technology which is considered as foundation for students' acquisition of scientific and technological knowledge and skills for sustainable national development. The foregoing in mind necessitated the researchers to investigate effectiveness of computer-based constructivist instruction on achievement and interest of Basic Science and Technology Students.

Purpose of the Study

The purpose of this study is to determine the effectiveness of computer-based constructivist instruction on achievement and interest of JSS II Basic Science and Technology Students in Niger State. Specifically, the study sought to determine:

1. The difference between the mean Basic Science and Technology achievement scores of students exposed to computer-based constructivist instruction and those not exposed to it as measured by the Basic Science and Technology Achievement Test (BSTAT).
2. The gender difference between the mean Basic Science and Technology achievement scores of Students exposed to Computer-Based Constructivist instruction and those not exposed to it as measured by Basic Science and Technology Achievement Test (BSTAT).
3. The difference between the mean Basic Science and Technology interest scores of Students exposed to Computer-Based Constructivist instruction and those not exposed to it as measured by Basic Science and Technology Interest Inventory (BSTII).

Hypotheses

This study was guided by the following hypotheses and tested at 0.05 level of significance.

H₀₁: There is no significant difference between the mean Basic Science and Technology achievement scores of Students exposed to Computer-Based Constructivist instruction and those not exposed to it as measured in the Achievement Test (BSTAT).

H₀₂: Gender has no significant influence on the mean Basic Science and Technology achievement scores of Students exposed to Computer-Based Constructivist instruction and those not exposed to it as measured by Basic

Science and Technology Achievement Test (BSTAT).

H₀₃: There is no significant difference between the mean Basic Science and Technology interest scores of Students exposed to Computer-Based Constructivist instruction and those not exposed to it as measured by Basic Science and Technology Interest Inventory (BSTII).

Research Method

This study adopted a quasi-experimental research design which is a non-equivalent pre-test post-test control group design. This is considered appropriate because, according to Hassan, Kareem, Bala and Abba (2016), there will be no randomization of the subjects into treatment and control groups. Intact classes were used to avoid disturbing the normal classes in terms of classroom schedule.

The study was carried out in Bida and Minna in Niger State, the target population for this study consists of all the 1,552 JSS II Students in the Junior Secondary schools in Bida and Minna Niger State, the sample for this study was made up of 52 Students. The study adopted multi-stage sampling technique to select the sample for the study. Multi-stage sampling technique was used- first, by sampling of the educational zone: purposive sampling was used to select two out of seven educational zones in the state (Bida and Minna zones). Secondly, purposive sampling technique was also used to select two co-educational JSS schools from Bida and Minna Niger State. The technique was used based on the criteria that:

- The school was a public school
- The teachers possessed the same professional qualifications.

Thirdly, simple random sampling technique was used to assign the schools to either the experimental group or the control group. Two instruments were used in collecting data for the study: Basic Science and Technology Achievement Test (BSTAT) and the Basic Science and Technology Interest Inventory (BSTII). The instruments were used for the pre-test and the post-test. However, the items used for the post-test were reshuffled.

BSTAT is a teacher made achievement test constructed from the Basic Science and

Technology curriculum for JSS II. The test items were generated by the researcher. The BSTAT is a Thirty (30) item multiple choice.

Face and content validity was established for BSTAT by presenting it to five experts in Science Education Department and industrial and Technology Education Department Federal University of Technology Minna. After validation, trial testing was carried out and the result obtained was used to determine the reliability coefficient for BSTAT. The reliability coefficient of BSTAT was calculated to be 0.73 using the K-20 (Kuder Richardson) method. In order to establish the coefficient of stability, the instrument was re-administered to the same 20 Students, Scores from the two tests were correlated using Pearson Product Moment Correlation Coefficient technique. The coefficient of stability computed was 0.69. This was considered good enough. The test of stability became necessary since the BSTAT would be used for both pre-test and post-test in view of the research design.

For the Basic Science and Technology Interest Inventory (BSTII), Cronbach Alpha reliability method was used to test the internal consistency. An internal consistency reliability of 0.77 was obtained. This was considered high enough. Pre-test on both BSTAT and BSTII was administered to the students in the experimental and the control groups prior to the commencement of treatment. That was done by the class teachers in charge. The scores of the pre-test served as a covariate to the students' post-test scores. The Post-test on BSTAT and the post-test on BSTII were administered to the experimental and control groups immediately after the teaching exercise.

The data collected from the administration of the tests were analyzed in line with the research questions and hypotheses using Mean, Standard Deviation and Analysis of Covariance. The Mean and Standard Deviation were used in answering the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses at $P < 0.05$ level of significance.

RESULTS

The results of the study are presented in line with the research questions and hypotheses that guided the study.

Research Question One

What is the difference between the mean Basic Science and Technology achievement scores of Students exposed to Computer-Based Constructivist Instruction and those not exposed to it as measured by the Basic Science and Technology Achievement Test (BSTAT)?

Table 1: Students' Basic Science and Technology Achievement Pre-test and Post-test Mean Scores and Standard Deviation

Experimental Condition	N	Pre-Test \bar{X}	SD	Post-Test \bar{X}	SD	Mean Gain Score
Experimental Group	27	23.37	12.57	43.04	21.77	19.67
Control Group	25	12.36	6.26	17.44	10.69	5.08
Total	52	18.08	11.40	30.73	21.40	12.65

Table 1 shows that students exposed to Computer-Based Constructivist instruction had a pre-test mean score of 23.37, with a standard deviation of 12.57 while the post-test mean score was 43.04 and a standard deviation of 21.77. The mean gain score between the pre-test and the post-test in experimental group was 19.67.

The students in the control group had a pre-test mean score of 12.36 with a standard deviation of 6.26 and a post-test mean score of 17.44 with a standard deviation of 10.69. The mean gain score for the control group was 5.08. The difference of the mean gain scores of the

experimental and control groups was 12.65. This suggests that the students who were exposed to computer-based constructivist instruction achieved more than those who were not exposed to it.

Hypothesis One

H₀₁: There is no significant difference between the mean Basic Science and Technology achievement scores of Students exposed to Computer-Based Constructivist instruction and of those not exposed to it as measured in BSTAT.

Table 2: Summary of the 2 Way Analysis of Covariance (ANCOVA) of Students' Post-test mean Basic Science and Technology Achievement Scores

Source	Type III Sum Of squares	df	Mean square	F	Sig.	Decision at 0.05 level
Correlated model	14848.747 ^a	4	3712.187	20.532	.000	
Intercept	080.933	1	808.933	4.474	.040	
Pre-test	5575.851	1	5575.851	30.840	.000	
Treatment	1691.231	1	1691.231	9.354	.004	S
Gender	47.525	1	47.525	.263	.611	NS
Treatment* Gender	99.520	1	99.520	.550	.462	NS
Error	8497.483	47	180.798			
Total	72454.000	52				
Correlated Total	23346.231	51				

a. R squared = .636 (Adjusted R Squared = .605)

The data in Table 2 indicate that Computer-Based Constructivist instruction, which is treatment, as a main factor has a significant effect on students' achievement in Basic Science and Technology. The calculated F-value of 9.354 is significant at 0.004 at 0.05 levels of significance. This implies that Computer-Based

Constructivist instruction significantly enhanced students' achievement in Basic Science and Technology. The null hypothesis of no significant difference in the mean achievement scores of the experimental and control groups is, therefore, rejected.

Research Question Two

What is the influence of gender on the mean Basic Science and Technology achievement scores of Students exposed to Computer-Based Constructivist Instruction as measured by BSTAT

Table 3: Means and Standard Deviation of Students' Pre-test and Post-test Scores in Basic Science and Technology Achievement Test by Gender

Gender of	N	Pre-test		Post-test		Mean gain score
		\bar{X}	SD	\bar{X}	SD	
Males	16	18.21	11.84	29.72	22.51	11.52
Females	11	17.91	11.08	32.00	20.33	14.09
Total	27	18.08	11.40	30.73	21.40	12.65

Results in Table 3 indicates that male students had a pre-test mean Basic score of 18.21 and a post-test mean score of 29.72. The mean gain score of male students is 11.52. The female students had pre-test and post-test mean scores of 17.91 and 32.00 respectively. The females have a mean gain score of 14.09. Also at pre-test, male and female students' standard deviations were 11.84 and 11.08 respectively while at post-test, male and female Students' standard deviations were 22.51 and 20.33 respectively. However, the female Students had a higher mean gain score than the males.

A corresponding hypothesis formulated to further address research question two is H_{02} . This hypothesis stated that Gender has no significant influence on the mean Basic Science and Technology achievement scores of Students exposed to Computer-Based Constructivist Instruction and those not exposed to it as measured by Basic Science and Technology

Achievement Test (BSTAT). Hence the result here conform with the hypothesis.

In addition, result in Table 2 indicates that there is no significant differences in the post-test mean Basic Science and Technology achievement scores of male and female Students. This is shown by the F-value of .263 in respect of gender as a factor in the study which is significant at .611 levels. This indicated that at 0.05 levels, the F-value of .611 was not significant. The null hypothesis of no significant influence of gender on the mean Basic Science and Technology achievement score of Students exposed to Computer-Based Constructivist Instruction still stands. This implies that the female Students did not achieve significantly better than the male Students in BSTAT. Therefore, gender is not a significant factor in Basic Science and Technology achievement of Students. The null hypothesis is therefore not rejected.

Research Question Three

What is the difference between the mean Basic Science and Technology interest scores of Students exposed to Computer-Based Constructivist instruction and of those not exposed to it as measured by Basic Science and Technology Interest Inventory (BSTII)?

Table 4: Students' Basic Science and Technology Interest Pre-test and Post-test Mean Scores and Standard Deviation

Experimental Condition	N	Pre-Test		Post-Test		Mean Gain Score
		\bar{X}	SD	\bar{X}	SD	
Experimental Group	27	18.52	8.38	53.48	7.19	34.96
Control Group	25	15.80	3.95	49.20	6.06	23.40
Total	52	17.21	6.71	51.42	6.95	34.21

Table 4 indicate that the pre-test and post-test interest mean scores of Students exposed to Computer-Based Constructivist instruction were 18.52 and 53.48 respectively with the standard deviation of 8.38 and 7.19 respectively. The mean interest gain score for the experimental group is 34.96. The pre-test score and post-test interest mean scores of Students in the control group were of 15.80 and 49.20 respectively with standard deviation of 3.95 and 6.06 respectively. The mean interest gain score for the control group is 23.40. This,

therefore, suggests that Students exposed to self- instruction strategy had more interest in Basic Science and Technology than those not exposed.

H₀₂: There is no significant difference between the mean Basic Science and Technology interest scores of Students exposed to Computer-Based Constructivist Instruction and of those not exposed to it as measured by Basic Science and Technology Interest Inventory (BSTII).

Table 5: Summary of 2-Way Analysis of Covariance (ANCOVA) of Students' Post-test mean Basic Science and Technology Interest Scores

Source	Type sum of squares	Df	Mean square	F	Sig	Decision at 0.05 Level
Correlated Model	435.030 ^a	4	108.757	2.521	.053	
Intercept	17106.047	1	17106.047	396.508	.000	
Pre-Test	54.194	1	54.194	1.256	.268	
Treatment	390.396	1	390.396	9.049	.004	S
Gender	149.201	1	149.201	3.458	.069	NS
Treatment* Gender	11.439	1	11.439	265	.609	NS
Error	2027.662	47	43.142			
Total	139968.000	52				
Correlated Total	2462.692	51				

Results in Table 5 indicate that Computer-Based Constructivist Instruction, which is the treatment, as a main factor has a significant effect on students' interest in Basic Science and Technology. This is shown by the F-value of 9.049 which is significant at .004 and 0.05 levels. This implies that the null hypothesis of no significant difference in the mean interest score of students exposed to computer-based constructivist instruction in Basic Science and Technology and those not exposed is rejected. This suggests that there is a significant difference in the mean interest scores of students exposed to self- instruction strategy in Basic Science and Technology and those not exposed.

Discussion of the Findings

The result of the study indicates that Computer-Based Constructivist Instruction has a significant effect on students' achievement in Basic Science and Technology. Students who were taught Basic Science and Technology

using Computer-Based Constructivist instruction achieved significantly higher than those taught without using the strategy. The finding of this study is in line with the findings of some earlier studies on the positive effect of different learning strategies with respect to Students' achievement in Basic Science and Technology. The studies conducted by Obiekwe (2008), Usman, Hassan, Maik and Musa (2015); Mandor (2002); Cyril (2013) provide credence for the present study. These studies showed that there is a significant difference in the Basic Science and Technology achievement of Students in the treatment group that used self-instruction strategies than in the achievement of Students in the control group. The enhancement in Students' achievement in Basic Science and Technology could be due to the Students' understanding of the self- instruction strategy. The finding of this study suggests that Computer-Based Constructivist instruction help Students to actively be in-charge of the learning process and to monitor the progress in

learning exercise. As students are deeply involved in active learning, they are able to learn the processes involved in solving BSTAT problems.

The result of this study showed that male and female students in the experimental group performed better than their counterparts in the control group in Basic Science and Technology achievement. An important finding is that the female students in the experimental group had higher mean achievement scores than their male counterparts. However, the analysis of covariance (ANCOVA) for gender as main effect indicates that gender has no significant influence on the Basic Science and Technology achievement of students. This means that gender is not a significant factor in the use of the learning strategy. The finding is in consonance with the studies conducted by Atadoga and Lakpini (2013), Ezeudu (2011) and Mandor (2002) which also showed that there is no significant difference in the performance of males and females in Basic Science and Technology achievement using learning strategies.

These findings, however, contradict some earlier findings which portray gender as a significant factor in Basic Science and Technology achievement (Akalonu, 2001; Etukudo, 2002; Eraikhuemen, 2003; and Ongundokun & Adeyemo, 2010). The results obtained indicate that male students had higher mean scores than the females in Basic Science and Technology Achievement Test. The findings of this study could be explained in line with the view of Ezeudu (2011) who stated that gender has no direct effect on Basic Science and Technology achievement. Exposing students to computer-based constructivist instruction may have removed the differences that existed between the two genders. This implies that both male and female students benefited significantly from the strategy. However, the non-significant difference in Basic Science and Technology achievement of male and female students could also be attributed to effective use of Computer-Based Constructivist Instruction which ensured students' active participation in the learning process.

The results of this study show that Computer-Based Constructivist Instruction significantly enhanced the interest of students in Basic

Science and Technology. Those in the treatment group had a significantly higher mean interest rating in Basic Science and Technology interest inventory than those in the control group. The finding of this study is in line with the findings of some earlier studies which indicated that interest determines the level of learning outcomes. Harbour- Hassan (2016), Ezeudu (2011), Ogundokun and Adeyemo (2016) found that students develop more competence in subjects they are interested. In effect, the interest students show in an activity or in an area of knowledge predicts how much they will attend to it and how well they process, comprehend and remember it (Atadoga & Lakpini, 2013; Stipek, 2002). As the students practice and realize some positive outcomes and success, they gain greater confidence in their ability to succeed in Basic Science and Technology. Their interest and urge to do more also increases. This could be the reason for the higher interest in learning Basic Science and Technology as demonstrated by students in the experimental group.

Conclusion

This study indicated that using computer-based constructivist instruction for teaching basic concepts in Basic Science and Technology enhanced students' achievement and at the same time increase their level of interest in the subject. Male and female students taught Basic Science and Technology content with computer-based constructivist instruction achieved equally and exhibited the same level of interest in the subject. This implies that gender has no significant influence in the achievement and interest of students exposed to Computer-Based Constructivist Instruction in Basic Science and Technology. Equally, the interaction effect of teaching Basic Science and Technology content with Computer-Based Constructivist Instruction and gender was not significant in the achievement and interest of Students.

Recommendations

Based on the findings of this study and the educational implications, the following recommendations were made:

- Teachers should be encouraged to adopt pupil-centred strategy like Computer-Based

Constructivist Instruction rather than teacher-centred way of teaching. This will go a long way to help improving the students' achievement and interest.

- Students on the other hand should be well exposed to Computer-Based Constructivist Instruction since the findings of this study indicate that it has a facilitative effect on their achievement and interest in Basic Science and Technology irrespective of gender.
- Evidence from the study indicates that the Computer-Based Constructivist Instruction remains the best strategy that can be used to facilitate effective teaching of Basic Science and Technology students for easy and timely coverage of the syllabus.
- Conferences, workshops, seminars and enlightenment programmes should be constantly organized by the federal, state and local government for their teachers in order to improve their knowledge and skills on the use of Computer-Based Constructivist Instruction. If this is done, students of Basic Science and Technology would have their performance well improved.
- Teachers should ensure that Students are actively involved in the learning activity by allowing them to take active participation in every learning situation.

REFERENCES

- Abakpa, B. O. (2011). Effects of mastery learning approach on senior secondary school students' achievement and interest in geometry. Unpublished PhD thesis; University of Agriculture, Makurdi, Nigeria. Ahmadu Bello University, Zaria, 11th – 15th June, 2013.
- Akalonu, G. C. (2001). Effects of Female Gender Friendly Curriculum Materials on Students' Achievement and Interest in Integrated Science. Unpublished M.E'd thesis, Faculty of Education, University of Nigeria, Nsukka.
- Atadoga, M. M., & Lakpini, M. A. (2013). A comparison of numeracy achievement of primary school pupils taught using whole class and varied classroom organization instructions. Proceedings of Multicultural African Conference, Held at Faculty of Education,
- Cyriel, M. U. (2013). Effects of individualized, demonstration and discovery methods of teaching mechanical craft practice in technical colleges in Adamawa state. *Nigerian Vocational Association Journal*, 18(2), 79-86.
- Ezeudu, F. O. (2011). *Fundamentals of science education for colleges and universities*. Enugu: City and Company.
- Federal Government of Nigeria (2013). *National policy on education*. Lagos: NERDC Press,
- Hassan, A.M. (2016). Effects of e-learning on students achievement and interest in science and technology for sustainable development in Niger State. National conference for institute of education, University of Nigeria, Nsukka.
- Hassan, A.M, Gimba R.W, Abdulkadir, M, Umar, B.K & Adi, T.A. (2016) Effect of blended Information and Communication Technology on the interest of junior secondary school students in basic science and technology for sustainable development. 4th International conference proceedings. 21st century global changes in education: implication for sustainable development 4th – 7th October, 2016 pp. 94 – 102
- Hassan, A.M, Kareem, W.B, Bala, M.M & Abba, U. (2016). Effects of Information and Communication Technology (ICT) on achievement and interest of junior secondary school students in basic science and technology. Pp 363-368. 57 annual conference of science teachers association of Nigeria
- Mandor AK (2002). Effects of constructivist-based instructional model on acquisition of science process skills among junior secondary students. Unpublished M.ed thesis, Faculty of education, University of Nigeria, Nsukka.

- Nigerian Educational Research and Development Council, (2012). 9-year basic education curriculum: Basic Science for Upper Basic Education 7-9: NERDC PLC.
- Obiekwe, C. L. (2008). Effects of constructivist instructional approach on students' achievement and interest in basic-ecological concepts in biology. Unpublished masterthesis: University of Nigeria Nsukka.
- Ogundokun M. O., & Adeyemo D. A. (2010). Emotional intelligence and academic achievement: the moderating influence of age, intrinsic and extrinsic motivation. *The African symposium*, 10(2), 127-141.
- Owodunni, A.S, Igwe, C.O & Hassan, A.M (2014) Assessment of the metacognitive awareness and its implication on technical college students academic achievement in Niger State. *Journal of Information, Education, Science and Technology (JIEST)* Vol. 1 No.1. incomplete details
- Robert, O.O, Hassan, A.M & Nwankwo, F.C (2016) Requisite for workshop equipment and materials management in technology education workshops in Higher Institution of learning in Minna metropolis, Niger State. *Journal of Information, Education, Science and Technology (JIEST)* Vol. 3 No.1 incomplete details
- Ugwuanyi, E. C. (2015). Effects of an ethno-science based instructional model on students' academic achievement and interest in the senior secondary school biology. Unpublished master thesis: University of Nigeria Nsukka.
- Umar, I.Y, Idris, A.M & Hassan, A.M (2016) Enhancing School-to-work transition of technology education graduates for industrial development in Niger State, Nigeria. *Indian Journal of Vocational Education*. India Central Institute of Vocational Education. Incomplete details
- Usman G.A, Hassan, A.M, Maik, B. M & Musa, S.A (2015) Effects of cooperative learning and peer-teaching on secondary school students achievement in basic science and technology in Minna, Niger State. *Journal of Information, Education Science and Technology (JIEST)* 2 (2), pages not included?



Computer Education Research Journal (CERJ)

Volume 5: Issue No. 1 pp 92-100, 2018

FACTORS INFLUENCING SUCCESSFUL ADOPTION OF CLOUD-BASED LEARNING: A CASE STUDY OF UNIVERSITY OF NIGERIA

BY

Agbo, G. C., Osondu, S. I. and Chiamogu, C. C.

Department of Computer and Robotics Education,

University of Nigeria, Nsukka, Enugu State, Nigeria.

chibuike.agbo@unn.edu.ng, stellaify2006@yahoo.com and Charles.chiamogu@unn.edu.ng
+234-8133887609, +234- 8056493321 and +234-8035408893

ABSTRACT

Information technology and the emergence of the Internet have enabled learning to be carried out in a more effective and efficient way. This research takes an in-depth study of adoption of cloud-based learning and factors influencing its successful adoption in Nigerian Universities.

Population of the study was 220 respondents which were made up of Lecturers and instructors randomly selected from all the 16 faculties of University of Nigeria, Nsukka. A structured questionnaire of 25 items was developed to collect data. Three experts validated the instrument and Cronbach alpha method was used to determine the reliability co-efficient which yielded 0.79. Data collected was analyzed using descriptive statistics to answer research questions and t-test statistic to test the null hypothesis. The findings of the study revealed that there was no significant difference ($p > 0.05$) among the Lecturers and Instructors on the technologies that were required for adoption of cloud-based learning. Poor awareness, Unstable power supply, high cost of Internet bandwidth, cost of moving legacy systems, Loss of data, cost uncertainty, Vulnerability, weakness of cloud systems, weak agreements and virus attack were identified as limitations to the successful adoption of cloud-based learning, while collaborative learning platform, easy access to learning material, self learning, low cost of learning, analytical insight, reduced downtime and increased focus on core course content were identified as factors that are required for its successful adoption were also identified.

This research was used to gain better understanding of the technologies that are required and the factors that limits as well those that will enhance the successfully adoption of cloud-based learning, respectively. This is most important because, the gap between developed and developing countries needs to be bridged if the developing countries are to experience the benefits associated with cloud-based learning. It was recommended among others that Nigerian government in general ought to address the problems of poor infrastructural provision in the education sector as well as the epileptic supply of electricity, so that learners will be encouraged to embrace cloud-based learning.

Keywords: Cloud-based learning, University of Nigeria, Adoption, Technologies and developing countries

Introduction

The emergence of Internet has made teaching and learning to be more friendly and conducive for learners. Today learning takes place anywhere, on the road, market place, home, schools and work places. This is only possible with the help of technology like cloud-based learning. Adoption of cloud-based learning technology in schools has created new opportunities for education. Cloud computing is

a metaphor used to describe networks (Vouk, 2008). According to Ibrahim (2015), cloud computing means everything relating to delivery of service over the Internet.

So, cloud-based learning can be said to be the delivering of learning over the Internet, rather than classrooms. Venter and Davis, (2012) stated that some of the factors that necessitates for the acceptance and usage of cloud based learning in most institutions in

developing countries include the technological infrastructure, high cost of technology, instructional efforts, graduate competencies, technology satisfaction. Others factors are management support, methodology, resource accessibility and availability, culture of education and learning styles, intellectual investment, design of assistive tools, and global business (Ndume and Twaakyondo, 2008).

The emergence of cloud-based learning in University of Nigeria, Nsukka can be traced back to the e-learning project that commenced in 2008. Eke (2011) noted that the e-learning project in University of Nigeria, Nsukka commenced in 2008, where a squad was formed to execute the programme and a total of sixty staff were selected for the initial training on the adopted Learning Management System chosen. The author also pointed that it was intended to reach students and learners in another dimension that could offer more interactive, friendliness and closeness in a seemingly far environment. Currently, a center that encompasses distance learning, e-learning and cloud-based learning has been established under the care of the university's ICT/innovations center. More so, a turn-it-in cloud-based learning platform has been currently introduced to enable the conduct of learning as well as assignments and examination submission.

There are service layers through which cloud-based learning can be established to ensure efficiency and effectiveness of its use. Awosan (2014) stated that the three service layers of cloud-based learning are Platform as a Service (PaaS), Infrastructure as a Service (IaaS) and Software as a Service (SaaS). PaaS has to do with team of network, database, and system management experts that are needed to database servers and its resources up and running, IaaS has to do with virtual computers, servers, storage devices, whereas SaaS has to do with the computer applications that are delivered through the Internet as a service, Instead of installing and maintaining software, you simply access it via the Internet, freeing yourself from complex software and hardware management, such as e-vision, dropbox, blackboard learn, Google Docs. These three platforms make up cloud-based technology in any university.

There are numerous advantages inherent in cloud-based learning, as well as over increasing use and acceptance of cloud-based learning in universities. According to Siritongthaworn and Krairit (2006), cloud-based learning is an innovative approach to education delivery via electronic forms of information that enhances the learner's knowledge, skills, or other performance. However, there are still impending barriers militating against its successful adoption, and which should be known and considered when developing curriculum. According to Shonola and Joy (2014) the barriers to cloud-based teaching and learning are learners, teachers, curriculum and school. In this regard, the learners lack the interest and dedication to cloud-based learning as a result of teacher's insufficient practical knowledge in the use of cloud-based resources for teaching, as provided by the curriculum, while schools lack its full implementation. The authors further stressed that overcoming these barriers needs more cooperation of related factors like curriculum developers, teachers, technological specialist as well as virtual and actual interaction among learners.

Research has shown that although many universities in Nigeria have functional websites, most of these websites are used only for advertisement; student and staff profile management and other managerial functions. In support of this, Manir (2009) noted that some of the universities in Nigeria have websites just only for advertisement of their courses but not for leaning activities. The universities' presence on the Internet is for information dissemination and communication to students and staff rather than supporting learning activities by providing learning content and materials. The author concluded that the inability of some universities' to develop content rich learning portals is due to lack of sufficiently trained ICT staff and faculty members, but the issue is not the same in all universities, as some universities are not deficient in that area, thus, the problem varies according to universities.

It can therefore be argued that a school website or database system that is not been used for learning purpose is not fully and effectively utilized. According to Farahat (2012), the user adoption and use of information system such as e-learning or cloud-based

learning is an important factor that predicts achievement or failure of the system. This means that when users such as students sufficiently use and adopt cloud-based learning, it shows that cloud-based learning records a high degree of success in the school system, however, when there is lack of use and adoption of cloud-based learning by users, it then shows that cloud-based learning has recorded some failures in meeting the objectives for which it was set.

This research sought to establish the technologies required, the limitations and factors that are required for successfully adoption of cloud-based learning technology in developing countries. Consequent, this will help to integrate three factors viz; technologies, human factors and challenges surrounding the adoption of cloud-based learning. This in turn will help in closing the gap between developed and developing countries in the adoption of cloud-based learning in university system, so that the developing countries like Nigeria can experience the benefits associated with cloud-based learning.

Statement of the Problem

University of Nigeria and indeed most of the universities in developing countries are yet to fully and successfully implement cloud-based learning, notwithstanding the wide use of information and communication technology in university classroom teaching and research. This has indeed affected the study pace of students in many developing nations as opposed to developed countries. It has also contributed in low web metric ranking of many universities internationally.

In Nigeria for instance, traditional methods of learning like the use of classroom, chalkboards, field works and many others are still in practice, with little or no knowledge of cloud-based learning platforms. Awosan (2014) stated that the extent of adoption of cloud-based learning in Nigeria is low. Zemsky and Massy (2004) also noted that research on cloud-learning adoption has not reached its full potential in developing countries. This is as a result of lack of facilities and requisite manpower needed for its full adoption. In this information age, therefore, a lot more need to be done in cloud-based learning in developing countries like Nigeria, so that

teaching and learning can be on individual pace and its resources made more available and accessible for every learner everywhere and at anytime.

Although, a lot of studies have tried to discover the barriers behind the adoption of cloud computing in Nigeria and factors that would help in adopting cloud-based learning in separate ways, however, there has been no single study within the researchers reach that tried to explore the technologies needed, factors that hinders and those that would necessitate its successful adoption.

This research therefore aims to explore the technologies needed, factors that hinders and those that would necessitate the successful adoption of cloud-based learning. This would help to discover how the three factors would influence the adoption of cloud-based learning, so as to improve its use.

Purpose of the Study

The main purpose of this research is to explore the factors influencing successful adoption of cloud-based learning in Nigerian Universities.

Specifically, the study sought to;

1. Identify the technologies that are required for adoption of cloud-based learning in Nigerian Universities
2. Identify the factors that limit the successful adoption of cloud-based learning in Nigerian Universities
3. Identify the factors that are required to successfully adopt cloud-based learning in Nigerian Universities

Research Questions

The following research questions will guide the study

1. What are the technologies that are required for adoption of cloud-based learning in Nigerian Universities?
2. What are the factors that limit the successful adoption of cloud-based learning in Universities in Nigerian Universities?
3. What are the factors that are required for successful adoption of cloud-based learning in Nigerian Universities?

Hypothesis

- Ho₁: There is no significant difference between the mean responses of Lecturers and Instructors on the technologies that are required for adoption of cloud-based learning in Nigerian Universities
- Ho₂: There is no significant difference between the mean responses of Lecturers and Instructors on the factors that limit the successful adoption of cloud-based learning in Nigerian Universities
- Ho₃: There is no significant difference between the mean responses of Lecturers and Instructors on the factors that are required for successful adoption of cloud-based learning in Nigerian Universities

Methodology

This is a quantitative research carried out in all the 16 faculties of University of Nigeria, Nsukka, namely: Faculty of Agriculture, Arts, Biological Sciences, Business Administration, Education, Engineering, Dentistry, Environmental Studies, Health Science and technology, Law, Pharmaceutical Sciences, Physical Sciences, Social Sciences, Medical Sciences Veterinary Medicine and Vocational and Technical Education.

In order to identify with the individual experiences of each of the staff in relation to the key factors influencing the successful adoption of cloud-based learning; the primary data were collected with the help of questionnaire which were distributed to the lecturers and instructors selected for this study. Information gathered covered various areas that are directly related to technologies that are required, limiting factors, as well as factors that necessitate successful adoption of cloud-based learning. 1175

The population of the study comprised of 3600 respondents which were made up of 2350 Lecturers and 1250 Instructors from the above

listed 16 faculties of the University of Nigeria, Nsukka. Data were collected from 220 respondents, comprising of 140 lecturers and 80 instructors from the faculties selected for this study. Random sampling technique was used due to the large size of the entire population. The instrument for data collection was a 30 items researcher's designed questionnaire titled: factors influencing the successful adoption of cloud-based learning. The questionnaire was arranged in two sections; section A borders on demographic data of the respondents while section B focused on the 30 items that are carefully organized in three clusters which addresses the research questions as follows: cluster A identifies the technologies that are required for adoption of cloud-based learning, Cluster B identifies the factors that limit the successful adoption of cloud-based learning in Universities, while Cluster C identifies the factors that are required for successful adoption of cloud-based learning technology in developing countries. The items were placed on a four point rating scale with options of very large extent; large extent; low extent and very low extent for all clusters. Options are weighted on 4, 3, 2, and 1 point(s) respectively. Three experts validated the instrument and were requested to check the language, relevance and accuracy of the items in addressing the research questions as well as the purpose of the study. The validates were also requested to study the observation schedule and scrutinize in line with research questions and advice on the suitability of the instruments. Their corrections, suggestions and comments were used to modify the instruments.

A criterion means score of 2.50 was employed. This implied that all mean scores below 2.50 was rejected as a factor that influences the successful adoption of cloud based learning in university of Nigeria, Nsukka. The null hypothesis was tested using t-test statistics at 0.05 level of significance.

Presentation and analysis of data

Research Question 1: What are the technologies that are required for adoption of cloud-based learning?

Table 1: Mean ratings and standard deviation of respondents on the technologies that are required for adoption of cloud-based learning

S/N	Items	N	\bar{X}	Std.	t-cal	P-value	Remarks	
							RQ	Ho
1	Cloud-based Servers	220	3.13	0.83	0.44	0.53	SA	S
2	Uninterrupted power source	220	3.43	0.49	1.76	0.15	SA	S
3	Strong and Steady Internet facilities	220	3.47	0.62	0.42	0.22	SA	S
4	Information Technology experts	220	3.60	0.73	-0.40	0.34	SA	S
5	Functional Website	220	3.13	0.83	-2.90	0.22	SA	S
6	Updated software	220	3.43	0.49	-2.00	0.34	SA	S
7	Storage space in the server	220	3.47	0.62	2.20	0.53	SA	S
8	Available computers connected to each department and units	220	3.60	0.73	1.71	0.34	SA	S

The Data presented in Table 1 shows that the mean ratings of the responses of the respondents on the 8 identified items had mean values ranging from 3.13 to 3.60 which are all greater than the cut-off point of 2.50 on a 4-point rating scale. Therefore, the data shows that the respondents strongly agreed that all the 8 items are technologies that are required for adoption of cloud-based learning. The value of standard deviation for the 8 items ranges from 0.49 to

0.83 which showed that the respondents were not far from each other in their responses and also that their responses were not far from the mean.

Table 1 also showed that the p-values of all the 8 items, ranged from 0.15 to 0.53 which were greater than 0.05 level of significance. This showed that there was no significant difference ($P > 0.05$) between the mean responses of Lecturers and Instructors on the items.

Research Question 2: What are the factors that limit the successful adoption of cloud-based learning in Universities?

Table 2: The mean ratings and standard deviation of respondents on the factors that limit the successful adoption of cloud-based learning in Universities

Factors that limit the successful adoption of cloud-based

S/N	Items	N	\bar{X}	Std.	t-cal	P-value	Remarks	
							RQ	Ho
1	Poor awareness of cloud computing	220	2.60	0.48	0.79	0.79	SA	S
2	Unstable power supply	220	2.53	0.49	2.04	0.33	SA	S
3	Unreliability and high cost of Internet bandwidth	220	2.57	0.50	1.16	0.29	SA	S
4	Costly to move legacy systems	220	2.58	0.50	1.13	0.33	SA	S
5	Loss of data as a result of misuse and unwanted access	220	3.29	0.50	1.18	0.55	SA	S
6	Comparative cost uncertainty	220	3.82	0.60	-0.30	0.59	SA	S
7	Vulnerability, susceptibility and weakness of cloud systems	220	3.46	0.38	2.19	0.96	SA	S
8	Weak agreements between provider and school administration	220	3.82	0.64	0.92	0.84	SA	S
9	Security threat as a result of virus attack in the server	220	3.63	0.38	1.80	0.72	SA	S

The Data presented in Table 2 above shows that the mean ratings of the responses of the respondents on the 9 identified items had mean values ranging from 2.53 to 3.82 which are all greater than the cut-off point of 2.50 on a 4-point rating scale. Therefore, the data shows that the respondents strongly agreed that items 1, 2 and 4 - 9 are factors that limit the successful adoption

of cloud-based learning in universities, while they agreed that item 3 which is Unreliability and high cost of Internet bandwidth also limit the successful adoption of cloud-based learning. The value of standard deviation for the 9 items ranges from 0.38 to 0.64 which showed that the respondents were not far from each other in their responses and also that their responses were not

far from the mean. The Table also showed that the p-values of all the 8 items, ranged from 0.72 to 0.96 which were greater than 0.05 level of significance. This showed that there was no significant difference ($P>0.05$) between the mean responses of Lecturers and Instructors on

the factors that limit the successful adoption of cloud-based learning.

Research Question 3: What are the factors that are required to successfully adopt cloud-based learning technology in developing countries?

Table 3: The mean ratings and standard deviation of respondents on the factors that are required to successfully adopt cloud-based learning technology in developing countries

Factors that are required to successfully adopt cloud-based learning								
S/N	Items	N	\bar{X}	Std.	t_cal	P_value	Remarks	
							RQ	Ho
1	Establishment of collaborative learning platform	220	3.91	0.28	-1.72	0.72	SA	S
2	Existence of learning materials that are easily accessible	220	3.64	0.48	1.13	0.83	SA	S
3	An environment for learning to be carried out anywhere at any time	220	3.73	0.44	0.15	0.82	SA	S
4	Learning is to be on individual pace	220	3.46	0.64	-1.50	0.96	SA	S
5	Low cost of learning which may be at home	220	3.82	0.38	1.08	0.84	SA	S
6	Provision of platform for analytical insight	220	3.63	0.48	-1.99	0.72	SA	S
7	A reduced downtime	220	3.91	0.28	-0.19	0.72	SA	S
8	Increased focus on core course content	220	3.64	0.48	-0.58	0.83	SA	S

The Data presented in Table 3 above shows that the mean ratings of the responses of the respondents on the 8 identified items had mean values ranging from 3.46 to 3.91 which are all greater than the cut-off point of 2.50 on a 4-point rating scale. Therefore, the data shows that the respondents strongly agreed that all the 8 items are the factors that are required to successfully adopt cloud-based learning technology in developing countries. The value of standard deviation for the 8 items ranges from 0.28 to 0.64 which showed that the respondents were not far from each other in their responses and also that their responses were not far from the mean.

The table also showed that the p-values of all the 8 items, ranged from 0.72 to 0.96 which were greater than 0.05 level of significance. This showed that there was no significant difference ($P>0.05$) between the mean responses of Lecturers and Instructors on the items.

Discussion of the Findings

In exploring the key factors influencing

the successful adoption of cloud-based learning, this research takes an in-depth look at the technologies that are required for adoption of cloud-based learning, the factors that limit the successful adoption of cloud-based learning in Universities and the factors that are required for successful adoption of cloud-based learning technology in developing countries.

Table 1 shows that the respondents strongly agreed that the following 8 identified items: cloud-based servers, uninterrupted power source, steady and strong Internet facilities, information technology experts, functional website, updated software, storage space in the server and available computers connected to each department and units are technologies that are required for adoption of cloud-based learning. This is because they all have mean ratings ranging from 3.13 to 3.60 which are all greater than the cut-off point of 2.50 on a 4-point rating scale. More so, the p-values in table 1 ranges from 0.15 to 0.53 level of significance, which were greater than 0.05. This shows that there was no significant

difference ($P>0.05$) between the mean responses of Lecturers and Instructors on the items.

Table 2 shows that the respondents strongly agreed that all the following 9 identified items: poor awareness of cloud computing, unstable power supply, costly to move legacy systems, unreliability and high cost of Internet bandwidth, loss of data as a result of misuse and unwanted access, comparative cost uncertainty, vulnerability, susceptibility and weakness of cloud systems, weak agreements between provider and school administration and security threat as a result of virus attack in the server are factors that limit the successful adoption of cloud-based learning in Universities. This is because they all have mean ratings ranging from 2.53 to 3.82 which are all greater than the cut-off point of 2.50 on a 4-point rating scale. More so, the p-values ranged from 0.29 to 0.96 which were greater than 0.05 level of significance, which showed that there was no significant difference ($P>0.05$) between the mean responses of Lecturers and Instructors on the items.

Finally, Table 3 shows that the respondents strongly agreed that all the following 8 items: establishment of collaborative learning platform, existence of learning materials that are easily accessible, an environment for learning to be carried out anywhere at any time, learning is to be on individual pace, low cost of learning which may be at home, provision of platform for analytical insight, a reduced downtime and increased focus on core course content are factors that are required for successful adoption of cloud-based learning technology. This is because they all have mean values ranging from 3.46 to 3.91 which are greater than the cut-off point of 2.50 on a 4-point rating scale. More so, the p-values ranged from 0.72 to 0.96 which were greater than 0.05 level of significance, which showed that there was no significant difference ($P>0.05$) between the mean responses of Lecturers and Instructors on the items.

Conclusion

Emergence of the Internet and ever growing acceptance of technology have led to lots of innovations in education which continue to promote cloud-based learning and students in

developed countries are increasingly using cloud based tools for learning anywhere and anytime. In the interim, teachers in developing countries like Nigeria are faced with more and more difficulties in identifying, adopting and sustaining the necessary technologies that are required for adoption of cloud-based learning. In solving this problem, this research has identified cloud-based servers, uninterrupted power source, steady and strong Internet facilities, information technology experts, functional website, updated software, storage space in the server and available computers connected to each department and units as technologies that are required for successful adoption of cloud-based learning.

In view of the above listed technologies that are required for successful adoption of cloud-based learning, there are still a lot of factors that limit its adoption in developing countries like Nigeria, such as poor awareness of cloud computing, unstable power supply, costly to move legacy systems, loss of data as a result of misuse and unwanted access, comparative cost uncertainty, vulnerability, susceptibility and weakness of cloud systems, weak agreements between provider and school administration and security threat as a result of virus attack in the server.

On the other hand, if the above pointed challenges of cloud-based learning can be defeated, cloud-based learning will undoubtedly enhance learning and improve the quality of education in Nigeria and developing nation in general, as it provides the required supplement to what is obtainable in the classroom system of learning. In this regard, adoption of cloud-based learning approach is considered to be very interesting option and a novel learning paradigm whose impact will be a positive one to the development of education in Nigerian.

Finally, in the existence of cloud-based delivery through a learner-centered approach in schools, learning will tend to be more and more efficient and effective, therefore, cloud based learning has to be increasingly extended across Nigeria Universities.

Recommendation

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

1. In order to ensure the availability of technologies required for effective adoption of cloud-based learning in Nigeria, the ministry of education and Nigerian government in general ought to address the problems of poor infrastructural provision in the education sector as well as the epileptic supply of electricity, so that learners will be encouraged to embrace cloud-based learning.
2. To ensure full control of the factors that limit the adoption of cloud based learning in Nigeria, school administrators, government, private and cooperate school owners are encouraged to continually increase the number of cloud-based learning services, so as to attract and sustain cloud-based learners, and as well widen the awareness of cloud-based learning opportunities and decrease issues of inaccessibility of learning resources which may be caused by wide geographical locations between learners and cloud-based learning resources.
3. In order to ensure the sustenance of the factors that promote the successful adoption of cloud-based learning, adequate funds should be provided by the government to Universities in order to develop and sustain their cloud-based learning facilities as well as carry out research on ways of improving the existing ones. Such provision will not only improve knowledge delivery through cloud-based learning, but as well impact positively on the university's global web-metric ranking.
4. There should be routine training and retraining of learners by school administrators and cloud providers on the use of learning tools through the provision of online resources to promote the adoption and use of cloud-based learning and also ensure cooperation of learners and every relevant stakeholders in curriculum development, so as to reflect the development of skills of the learners rather than making it an ordinary communication medium.

References

- Awosan, R. K. (2014). Factor Analysis of the adoption of cloud computing in Nigeria. Nigeria: *African Journal of Computing and ICT*, 5(16): 68-77.
- Bradshaw, S., Millard, C., and Walden, I. (2011). Contracts for clouds comparison and analysis of the terms and conditions of cloud computing services. UK: *International Journal of Law and Information Technology*. 9(14): 112-125.
- Eke, Helen Nneka, (2011) Modeling LIS Students' Intention to Adopt E-learning: A Case from University of Nigeria, Nsukka. Lincoln: Library Philosophy and practice e-journal paper. Retrieved November 3, 2016 from <http://digitalcommons.unl.edu/libphilprac>
- Grobauer, B., Walloschek, T., and Stöcker, E. (2011). Understanding Cloud Computing Vulnerabilities. London: *Journal of IEEE on Computer and Reliability Societies*, 13(4): 1668-1677.
- Han, Y. (2011). Cloud Computing: Case Studies and Total Costs of Ownership. UK: *Journal of Information Technology and Libraries*. 11(2): 187-193.
- Ibrahim, J. S. (2015). Adoption of cloud computing in higher education institution in Nigeria: *International journal of innovations in engineering research and technology [ijert]*. 6(18): 82-96.
- Kim, A., McDermott, J., and Kang, M. (2010). Security and Architectural Issues for National Security Cloud Computing. London: *Journal of IEEE on International Conference on Distributed Computing Systems Workshops*. Retrieved September 3, 2016 from <http://www.ieee.com/conferences>
- Laudon, K. C., and Laudon, J. P. (2012). *Management Information Systems*. UK: Pearson Education Limited.

- Lehman, T. J., and Vajpayee, S. (2011). We've Looked at Clouds from Both Sides Now. *Annual SRII Global Conference*. Retrieved October 11, 2012 from http://www.srii.com/global_conferences
- McAfee, A. (2011). What Every CEO Needs to Know About The Cloud. London: *Harvard Business Review*.
- Michael A., Armando F., Anthony D., Randy K., Andy K., Gunho L., David P., Ariel R., Ion S., and Matei Z. (2010) A View of Cloud Computing. *Communications of the ACM*. Retrieved August 18, 2016 from <http://toce.acm.org>
- Ndume, V., Tilya, F. and Twaakyondo, H. (2008), Challenges of adaptive e-learning at higher learning institutions: A case study in Tanzania. Tanzania: *International Journal of Computing and ICT Research*.
- Shonola S.A. and Joy M. (2014). Barriers to M-learning in higher education institution in Nigeria. Spain: Proceedings of ICERI2014 conference
- Venter, P., Rensburg, Van M. J. and Davis, A. (2012). Drivers of learning management system use in a South African open and distance learning institution. Australia: *Australasian Journal of Educational Technology*.
- Xu, D. (2010). Cloud Computing: An Emerging Technology. Asia: *International Conference on Computer Design and Applications*.
- Zemsky, R. and Massy, W. (2004). *Thwarted innovation: what happened to e-learning and why*. The Learning Alliance at the University of Pennsylvania. Retrieved February 5, 2017 from <http://www.irhe.upenn.edu/weatherstation.html>



Computer Education Research Journal (CERJ)

Volume 5: Issue No. 1 pp 101-110, 2018

ROBOT-ASSISTED AIDE (RAA): AN INSTRUCTIONAL DELIVERING APPROACH TO COMPUTER PROGRAMMING IN UNIVERSITIES IN ENUGU STATE, NIGERIA

BY

B. I. Onah, Asogwa, Uchechukwu U., Uzoegwu Chigozie

ifeomaonah@unn.edu.ng, uchechukwuasogwa@yahoo.com, Chigozie.uzoegwu@unn.edu.ng
(+234) 07030610025, (+234) 08038048796, (+234) 08103137329

ABSTRACT

Robots are becoming an integral component of our society and have great potential in being utilized as an educational technology. Over the years, research has shown that programming has proved to be a challenging task to many students. Due to this, several instructional delivery tools have been developed to aide in teaching and learning computer programming. This study aimed at determining ways to improve instructional delivery approaches in computer programming using Robot-Assisted Aide(RAA) in universities in Enugu State, Nigeria. A structured questionnaire on robot-assisted aide: an instructional delivering approach to computer programming was administered to 22 lecturers and 13 instructors. A descriptive analysis was performed, where weighted mean was used to answer the research questions and t-test was used to test the formulated hypothesis at 0.05 level of significance. Results revealed that instructional resources, platforms and frameworks if adequately provided will help lecturers and instructors in constructing Robot-assisted aide which in-turn improve the academic achievements of students and their interest in computer programming language.

Key Words– Robot, Robot-Assisted Aide, educational robotics, educational robots, computer programming.

INTRODUCTION

Background of the Study

Teaching and learning is the core business of every school and other centers of learning. Schools always ensure that children and young people have the highest quality learning experiences and to help learners achieve their fullest degree. These teaching and learning aims lie at the very heart of curriculum for

excellence. According to Boyd (2008), curriculum for excellence is intended to help children and young people gain the knowledge, skills and attributes needed for life in the 21st century, including skills for learning, life and work. Curriculum for excellence is designed to achieve a transformation in education by providing a coherent, more flexible and enriched curriculum. The term curriculum is understood to

mean everything that is planned for children and young people throughout their education, not just what happens in the classroom (James, 2007). According to Ehren and Visscher (2008), curriculum has two stages: the broad general education and the senior phase. The broad general education has five levels (early, first, second, third and fourth). The senior phase is designed to build on the experiences and outcomes of the broad general education using instructional delivery tools like computer aided instruction, robot, among others.

A robot is a machine designed to execute one or more tasks automatically with speed and precision (Rouse, 2016). Using robots to support teaching and learning in the universities have become a popular research topic in recent years (Klassner, 2002; Klassner & Anderson, 2003; Ryu, Kwak, & Kim, 2008). One approach to learning known as constructionism, as opposed to the traditional style of instructionism allows students to learn how to construct their own knowledge from experience. One of the constructionism approaches is the use of robot in teaching and learning. There are as many different types of robots as there are tasks for them to perform. Robots that resemble humans are known as androids (Johnson, 2003); however, many robots aren't built on the human model. Industrial robots, for example, are often designed to perform repetitive tasks that are not facilitated by a human-like construction. A robot can be remotely controlled by a human operator, sometimes from a great distance. A telechir (remotely-controlled robot) is a complex robot that is remotely controlled by a human operator for a telepresence system, which gives that individual the sense of being on location in a remote, dangerous or alien environment and the ability to interact with it. Telepresence robots, which simulate the experience and some of the capabilities of being physically present, can enable remote business consultations, healthcare, home monitoring and childcare, among many other possibilities (Chang, Lee, Chao, Wang, and Chen, 2010). An autonomous robot acts as a stand-alone system, complete with its own computer (called the controller). The most advanced example is the smart robot, which has a built-in artificial intelligence (AI) system that can learn from its environment and its experience and build on its capabilities based on that knowledge. According to Rouse (2016), robots

are sometimes grouped according to the time frame in which they were first widely used. First-generation robots date from the 1970s and consist of stationary, nonprogrammable, electromechanical devices without sensors. Second-generation robots were developed in the 1980s and can contain sensors and programmable controllers. Third-generation robots were developed between approximately 1990 and the present. These machines can be stationary or mobile, autonomous or insect type, with sophisticated programming, speech recognition and/or synthesis, and other advanced features. Fourth-generation robots are in the research-and-development phase, and include features such as artificial intelligence, self-replication, self-assembly and nanoscale size (physical dimensions on the order of nanometers, or units of 10^{-9} meter) (Mubin, Stevens, Shahid, Al Mahmud, and Dong, 2013). Some advanced robots are called androids because of their superficial resemblance to human beings. Androids are mobile, usually moving around on wheels or a track drive (robots legs are unstable and difficult to engineer). The android is not necessarily the end point of robot evolution. Some of the most esoteric and powerful robots do not look or behave anything like humans. Furthermore, the use of robots is not limited to traditional uses but is distributed across a variety of arts and science courses. The use of robotics by non-engineering, non-technical instructors has been termed a robotic revolution (Hendler, 2000).

Robotics is the branch of mechanical engineering, electrical engineering and computer science that deals with the design, construction, operation, and application of robots, as well as computer systems for their control, sensory feedback, and information processing. These technologies deal with automated machines that can take the place of humans in dangerous environments or manufacturing processes, or resemble humans in appearance, behaviour, and or cognition. Many of today's robots are inspired by nature, contributing to the field of bio-inspired robotics (Han, 2012). The concept of creating machines that can operate autonomously dates back to classical times, but research into the functionality and potential uses of robots did not grow substantially until the 20th century (Nocks, 2007). Throughout history, it has been frequently assumed that robots will one day be able to mimic human behavior and manage tasks in a human-

like fashion. Today, robotics is a rapidly growing field, as technological advances continue; researching, designing, and building new robots serve various practical purposes, whether domestically, commercially or militarily (Ruzzenente, Koo, Nielsen, Grespan, and Fiorini, 2012). Many robots are built to do jobs that are hazardous to people such as defusing bombs, finding survivors in unstable ruins, and exploring mines and shipwrecks. Further, robots are also extensively used in teaching and learning STEM (Science, Technology, Engineering, and Mathematics) particularly as an instructional delivery aide.

Instructional delivery can be defined as a process in which teachers apply a repertoire of instructional strategies to communicate and interact with students around the academic content and to support students' engagement in order to achieve the desired goal (Akudolu, 2000). Instructional delivery is an instructor's personal approach to teaching based on his or her own professional identity helping to create a unique classroom culture (NAIT, 2016). Instructional delivery combines the complexities of teaching with institutional expectations and student demand for quality instruction. Instructors should take into account best practices and their own style when making delivery choices. The instructor not only models the behaviors that will be expected of them in classroom but also cultivates a positive, safe, learning rich environment where students are engaged with the content. The use of any instructional aide must be planned, based on its ability to support a specific point in a lesson. A simple process can be used to determine if and where instructional aides are necessary. Instructional aides should be simple and compatible with the learning outcomes to be achieved. Since aides are normally used in conjunction with a verbal presentation, words on the aide should be kept to a minimum. In many cases, visual symbols and slogans can replace extended use of verbiage. Instructional aides should appeal to the student and be based on sound principles of instructional design. When practical, they should encourage student participation. They also should be meaningful to the student, lead to the desired behavioral or learning objectives, and provide appropriate reinforcement. Instructional aides that involve learning a physical skill should guide students

toward mastery of the skill or task specified in the lesson objectives. Instructional aides have no value in the learning process if they cannot be heard or seen (Huang, Huang, and Tschoop, 2010). Recordings of sounds and speeches should be tested for correct volume and quality in the actual environment in which they will be used. The effectiveness of aids and the ease of their preparation can be increased by initially planning them in rough draft form. Revisions and alterations are easier to make at that time than after their completion. The rough draft should be carefully checked for technical accuracy, proper terminology, grammar, spelling, basic balance, clarity, and simplicity. Instructional aides should also be reviewed to determine whether their use is feasible in the training environment and whether they are appropriate for the students. Some of the most common and economical aids are chalk or marker boards, and supplemental print materials, including charts, diagrams, and graphs. Other aids, which are usually not common are projected materials, video, computer-based programs, models, robot-assisted aids, among others.

Robot-Assisted Aide (RAA) here is the act of using robots to teach computer programming language. Weinberg and Yu (2003) described three factors (unique learning experience, cost, and plug-and-play feel) to demonstrate that robots will successfully support education. Robots are the mechanical devices embodied of computations and provide unique experiences for the learner. They provide a wide design space for students to explore, to make guess about how things work, and to conduct experiments to validate their beliefs and assumptions. Students can receive strong, instinctive feedback from physically experiencing their work. An important example is the work by Turkle and Papert (1992) where a small mobile robot called Logo Turtle was developed, and children were shown how to use it to solve simple problems in an environment of play and the main aim is to improve the way children think and solve problems. This project led to the development of several platforms for educational robots. The second factor described by Weinberg and Yu is cost. Over the last decade, the cost of computation has dropped exponentially. As a result, robot controllers have been designed and marketed at prices that are accessible to schools with even modest budgets (Marin, Mikhak, Resnick,

Silverman, & Berg, 2000). The third important factor is the plug-and-play feel of the new robot platforms. The multidisciplinary nature of robots has previously relegated their study to larger research institutions that have the range of prerequisite knowledge for engineering complex systems. Robot controllers, such as the Handy Board and the Mindstorm RCX, have mitigated this need by making it relatively simple to plug in motors and sensors and use well-known or simple programming environments. The development of educational robots is still in the initial stages. Robot technologies bring new developments to education. The literature includes many studies that have tried to use robots to support teaching and learning, especially in mathematics and science. However, there are still few papers that discuss the use of robots to improve computer programming instructional delivery in the universities (Gyebi, Marc, and Grzegorz, 2016).

Computer programming (otherwise called programming) is a process that leads from an original formulation of a computing problem to executable computer program. Programming involves activities such as analysis, developing understanding, generating algorithms, verification of requirements of algorithms including their correctness and resources consumption, and implementation (commonly referred to as coding) of algorithms in a target programming language (Shaun, 2014). Source Code is written in one or more programming languages. A programming language is a formal computer or constructed language designed to communicate instructions to a machine, particularly a computer. Programming languages can be used to create programs to control the behavior of a machine or to express algorithms. The purpose of programming is to find a sequence of instructions that will automate performing a specific task or solving a given problem (Chun-Jen, 2012). The process of programming thus often requires expertise and facilities. The potential benefits of using robots for teaching and learning of computer programming, optimal design of computer programming robots, and any limits and challenges in using robots need to be addressed. Therefore, this study aimed at exploring ways of using robots to improve instructional delivery approaches in teaching and learning of computer programming in universities in Enugu State.

Statement of the Problem

Computer programming is a very useful skill and it is fundamental in computer education. However, students consider computer programming courses to be very difficult, especially for the beginners. It is experienced that college of education students shy away from learning QBASIC programming language due to the abstract nature of the course. On the other hand, lecturers also find it difficult to teach QBASIC programming language due to the technicalities involved. Furthermore, there are inadequate facilities to practice QBASIC programming language. This results in students' inability to write/develop simple QBASIC programs and this has become a situation of concern which needs to be tackled.

It is therefore pertinent to introduce a new approach that would increase students' interest in computer programming and also permit more practice. Hence, this study tends to determine the ways of improving instructional delivery approach in teaching and learning Computer Programming using Robot-Assisted Aide (RAA) in universities in Enugu State.

Purpose of the Study

The major purpose of this study is to determine ways of improving instructional delivery approach in computer programming using Robot-Assisted Aide (RAA) in universities in Enugu State. Specifically, the study sought to determine:

1. availability of instructional resources for enhancing computer programming instructional delivery using robot-assisted aide.
2. appropriate hardware frameworks required to set up robot-assisted aide.
3. appropriate software platforms required to set up robot-assisted aide.

Research Question

The following research questions were formulated to guide the study;

1. What are the available instructional resources for enhancing computer programming instructional delivery using robot-assisted aide?
2. What is the appropriate hardware frameworks required to set up robot-assisted aide?

3. What is the appropriate software platforms required to set up robot-assisted aide?

Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance.

H_{01} : There is no significant difference in the mean ratings of lecturers and instructors on the appropriate hardware frameworks required to set up robot-assisted aide.

H_{02} : There is no significant difference in the mean ratings of lecturers and instructors on the appropriate software platforms required to set up robot-assisted aide.

METHODOLOGY

The design for the study was descriptive survey. The study was carried out among universities in Enugu state, Nigeria. The population for the study consists of lecturers and instructors of department of Computer Education of University of Nigeria Nsukka (UNN) and department of Computer Education of Enugu State University of Science and Technology (ESUT). The two universities were chosen because they are the only public universities in Enugu State. A total of 35 respondents were used in this study. The respondents were made up of 22 computer education lecturers from the aforementioned universities and 13 computer education instructors from the same universities. The entire population was studied because of its small size and was considered adequate for the study. A structured questionnaire containing 27

items in two clusters was used to collect data for the study. The instrument was faced validated by three experts in the field. The data collected were analyzed using weighted mean for the research questions and t-test statistics to test the hypotheses of no significant difference at 0.05 level of significance and relevant degree of freedom.

Research question one was answered using percentage (%) to determine the availability of instructional resources for enhancing computer programming instructional delivery using robot-assisted aide. Research questions two and three were answered using mean scores. Mean score that was within the real limit of 4.00 - 3.50 was adjudged highly required (HR) and 3.49 - 2.50 was adjudged required (R) while 2.49 - 1.50 was considered averagely required (AR) and 1.49 - 1.00 was considered not required (NR) for appropriate hardware frameworks as well as software platforms to set up robot-assisted aide respectively.

Results

The result of the study was obtained from the analysis of the data collected and null hypotheses formulated to guide the study.

Research Question One: What are the available instructional resources for enhancing computer programming instructional delivery using robot-assisted aide?

The data for answering research question one was presented in Table 1.

Table 1: Percentage of the available instructional resources for enhancing computer programming instructional delivery using robot-assisted aide.

S/NO	ITEM STATEMENTS	Available (%)	Not Available (%)
1	Software libraries	0.0	100
2	Digital cameras and Video recorder	8.0	92
3	Hardware descriptions	0.0	100
4	Technical documentation	0.0	100
5	Integrated development environment (dedicated software environment, high-level language support and simulators)	0.0	100
6	Quality and variety of tutorials and lesson plans	0.0	100
7	Robotic kits (Lego Mind Storms)	0.0	100
8	Free wireless/internet connections	0.0	100
9	Computer accessories (Scanners, Projectors, Interactive whiteboard, etc)	28.6	71.4
10	Multimedia computer systems	22.9	77.1

The data presented in Table 1 revealed that, almost all the instructional resources for enhancing computer programming instructional delivery using robot-assisted aide are not available. However, items statement number 2, 9 and 10 revealed 92%, 71.4% and 77.1% not available respectively, which shows inadequate availability of those instructional resources in the universities in Enugu State.

Research Question Two: What is the appropriate hardware frameworks required to

set up robot-assisted aide?

Hypothesis One: There is no significant difference in the mean ratings of lecturers and instructors on the appropriate hardware frameworks required to set up robot-assisted aide.

The data for answering research question two and testing hypothesis were presented in Table 2.

Table 2: Mean ratings and t-test analysis of the responses of lecturers and instructors on the appropriate hardware frameworks required to set up robot assisted aide.

S/NO	ITEM STATEMENTS	\bar{X}_I	\bar{X}_L	\bar{X}_G	S_I	S_L	P-Value	RQ	DEC
1	A flexible architecture: mechanical, electrical and software interfaces must allow instructors to assemble systems into a variety of operational units	3.00	3.33	3.20	1.04	0.66	0.25	R	NS
2	There is a need for a layered architecture that allows interfacing to the system at all levels from motors to advanced behaviors	3.36	3.24	3.29	0.63	0.54	0.56	R	NS
3	The system must have a variety of basic components to allow for construction of basic mobility systems, sensory modules such as odometers, ranging (sonar or laser), processing power and control computer system	3.21	3.38	3.31	0.80	0.59	0.48	R	NS
4	Easy configuration: a standard set of components should allow for simple modular setup to facilitate tailoring to courses in the different disciplines	3.64	2.52	2.97	0.63	0.51	0.00	AR	S
5	There is need for LEGO like, but more flexible and powerful modules to be used for the construction of systems	3.71	3.29	3.46	0.47	0.56	0.02	R	S
6	Scalable performance that allows the system to be used from simple setups to sophisticated platforms with complex behaviours	3.71	3.71	3.71	0.47	0.46	1.00	HR	NS
7	Flexible and diverse interfaces to accommodate different disciplines and allow a minimal learning curve	3.79	3.57	3.66	0.43	0.51	0.20	HR	NS
8	Interfaces to be used with standard educational tools such as MATLAB, Virtual Lab and Java are particularly desirable	2.07	3.10	2.69	1.00	1.00	0.01	R	NS
9	A complementary software library of standard modules for navigation, detection of obstacles, basic trajectory so as to allow different instructors to focus on different parts of the system	2.71	3.76	3.34	1.12	0.44	0.00	R	S
10	A comprehensive suite of documentation to allow simple use of the system and also a quick start to get it going	3.64	3.52	3.57	0.50	0.51	0.50	HR	NS
CLUSTER MEAN		3.27	3.34	3.32	0.26	0.14	0.41	R	NS

Keys: \bar{X}_G Grand Mean, \bar{X}_I Mean of Instructors, \bar{X}_L Mean of Lecturers, S_I Standard deviation of Instructors, S_L Standard deviation of Lecturers, NS Not Significant, HR Highly Required, R Required, S Significant, AR Averagely Required, RQ Research Question.

The result in Table 2 revealed a mean cluster ($X = 3.27$) which was within the limit of $3.49 - 2.50$ indicating that the appropriate hardware frameworks required to set up robot-assisted aide is required. The Table 2 specifically revealed that out of ten (10) appropriate hardware frameworks required to set up robot-assisted aide that were suggested in the instrument, items statement number 6, 7 and 10 were within the real limit of $4.00 - 3.50$, while items statement number 1, 2, 3, 4, 5, 8, 9 were within the limit of $3.49 - 2.50$. This indicated that the appropriate hardware frameworks required to set up robot-assisted aide is required from the responses of the respondents.

The result in Table 2 also show that the cluster mean on the appropriate hardware frameworks required to set-up robot-assisted

aide had its p-value as 0.41 which is greater than 0.05 indicating that there was no significant difference in the mean ratings of the responses of lecturers and instructors on the appropriate hardware frameworks required to set-up robot-assisted aide

Research Question Three: What is the appropriate software platforms required to set up robot-assisted aide?

Hypothesis Two: There is no significant difference in the mean ratings of lecturers and instructors on the appropriate software platforms required to set up robot-assisted aide.

The data for answering research question three and testing hypothesis were presented in Table 3.

Table 3: Mean ratings and t-test analysis of the responses of lecturers and instructors on the appropriate software platforms required to set up robot-assisted aide.

S/NO	ITEM STATEMENTS	\bar{X}_I	\bar{X}_L	\bar{X}_G	S_I	S_L	P-Value	RQ	DEC
1	Thymio II	3.23	3.27	3.26	0.73	0.70	0.87	R	NS
2	Scribbler 2	3.38	3.27	3.31	0.65	0.55	0.59	R	NS
3	Jasmine	3.15	3.45	3.34	0.80	0.60	0.21	R	NS
4	AERobot	3.77	3.18	3.40	0.44	0.50	0.31	R	NS
5	Lollybot	3.69	3.41	3.51	0.48	0.50	0.11	HR	NS
6	Microbot	3.77	3.68	3.71	0.44	0.48	0.59	HR	NS
7	Kilobot	3.77	3.59	3.66	0.44	0.50	0.30	HR	NS
CLUSTER MEAN		3.54	3.41	3.46	0.23	0.12	0.08	R	NS

Keys: \bar{X}_G Grand Mean, \bar{X}_I Mean of Instructors, \bar{X}_L Mean of Lecturers, S_I Standard deviation of Instructors, S_L Standard deviation of Lecturers, NS Not Significant, HR Highly Required, R Required, AR Averagely Required, RQ Research Question.

The result in Table 3 revealed a mean cluster ($X = 3.46$) which was within the real limit of $3.49 - 2.50$ indicating that the appropriate software platforms required to set up robot-assisted aide is required. The Table 3 specifically revealed that out of seven (7) appropriate software platforms required to set up robot-assisted aide that were stated in the instrument, items statement number 5, 6, 7 were within the real limit of $4.00 - 3.50$, while items statement number 1, 2, 3, 4 were within the real limit of $3.49 - 2.50$. This indicated that the appropriate software platforms to set up robot-assisted aide are required from the responses of the respondents.

The result in Table 3 also show that the cluster mean on the appropriate software platforms required to set-up robot-assisted aide

had its p-value as 0.08 which is greater than 0.05 indicating that there was no significant difference in the mean ratings of the responses of lecturers and instructors on the appropriate software platforms required to set-up robot-assisted aide

Discussion

The findings of this study were organized according to the research questions and the hypothesis tested.

Table 1 addresses the available instructional resources for enhancing computer programming instructional delivery using robot-assisted aide. It is clear from the result in Table 1 that most of the instructional resources to enhance computer programming instructional delivery using robot are not available. This agreed with Mason and Cooper

(2013) who stated that there is need to ensure that the instructional materials and activities to facilitate learning of fundamental programming concepts by novices should be in place. Since there is need for instructional materials, facilities like electricity, hardware, among others are paramount.

Table 2 addresses the appropriate hardware frameworks required to set-up robot-assisted aide. The findings have shown that appropriate hardware frameworks to set-up robot-assisted aide are necessary and required. This agreed with Wagner, Hohmann, and Gerecke (2004) who affirmed that to use robots efficiently in education, a number of requirements have to be met to satisfy both teachers' and students' needs. These findings also agreed with Alimisis (2012) who stated that platforms which come equipped with detailed tutorials can support teachers with little or no previous experience in educational robotics which may encourage others to participate in such initiatives to make them sustainable. Moreover, hardware cannot work without software.

Table 3 addresses the appropriate software platforms required to set-up robot-assisted aide. The findings have shown that appropriate software platforms to set-up robot-assisted aide are very important and required for a robot-assisted aide to function properly. This study supports Gyebi, Hanheide, and Cielniak (2015) who affirmed that to use robots efficiently in education, a number of software platforms needs to be provided to satisfy both teachers' and students' desire in teaching and learning of computer programming.

The way Forward

The issue of improving instructional delivery in computer programming using an autonomous robot also engages the issues of real-world problem solving, multidisciplinary teamwork, and creative and critical thinking. Building an actual robot, rather than programming a simulation, requires lecturers and instructors to immediately confront the non ideality of real-world devices, and provides immediate feedback about the success or failure of their ideas. By having computer education lecturers and instructors work in teams, the course will encourage them to pool their individual expertise, allows them to

specialize on specific subtasks, and gives them experience in developing the interpersonal skills to articulate and defend their views, but ultimately reach a consensus that is best for the group as a whole.

In summary, robotics would be an excellent tool for teaching computer programming language and would be a welcome idea if it is been tried out in this part of south-East geopolitical zone in Nigeria. However, the art, science, and pedagogy of teaching practical robotics is still in its infancy, and we are all pioneers in this field.

Recommendation

1. The findings of this study should be used by the university administrators as guide to provide all the instructional resources, software platforms and hardware frameworks to enhance computer programming delivery. This is to enable lecturers and instructors in constructing robot for effective delivery.
2. School administrators should ensure that adequate instructional facilities are provided to every computer laboratory to enable students learn and master sound programming skills.
3. Parents, host communities and other major stake holders of our education should assist our universities by donating some of the instructional facilities required for constructing robot-assisted aide.
4. Robotics education needs to be integrated into computer education undergraduate curriculum to set the stage and establish a pipeline for a truly technology-savvy future for our future generation.

References

- Akudolu, L.R. (2000). Evaluation of primary school teachers' use of ICT for Curriculum Integration. *Journal of the Curriculum Organization of Nigeria*, 11(2), 154–159.
- Alimisis, D. (2012). Integrating robotics in science and technology teacher training curriculum. In *Proc. of Int. Workshop Teaching Robotics Teaching with Robotics*. Riva del Garda, Italy.

- Boyd, B. (2008). *Curriculum Architecture – a Literature Review, Report for the Scottish Executive Education Department*, University of Strathclyde, Glasgow.
- Chang, C. W., Lee, J. H., Chao, P. Y., Wang, C. Y., & Chen, G. D. (2010). Exploring the possibility of using humanoid robots as instructional tools for teaching a second language in primary school. *Education Technology & Society*, 13(2), 13-24.
- Chun-Jen, T. (2012). *Programming Languages*. National Chiao Tung University. Hsinchu, Taiwan.
- Cooper, M., Keating, D., Harwin, W., & Dautenhahn, K. (1999). Robots in the classroom: Tools for accessible education. In Buhler, C. & Knops, H. (Eds.), *Assistive Technology on the Threshold of the New Millennium* (pp. 448–452). Amsterdam: IOS Press.
- Education Technology Division (2006). *Project-Based Learning Handbook*. Putrajaya, Malaysia: Ministry of Education.
- Ehren, M. and Visscher, A. (2008). The relationship between school inspections, school characteristics and school improvement", *British Journal of Educational Studies*, Vol.56(2), pp. 205–22.
- Goh, H. and Aris, B. (2012). Using Robotics in Education : Lessons Learned and Learning Experiences. *1st International Malaysian Educational Technology Convention*.
- Gyebi, B., Hanheide, M. and Cielniak, G. (2015). *Affordable mobile robotic platforms for teaching computer science at African universities*. In: *6th International Conference on Robotics in Education*, 20-22, May, 2015, Yverdon-les-Bains, Switzerland.
- Han, J. (2012). Emerging technologies – Robot assisted language learning. *Language Learning & Technology*, 16(3), 1-9.
- Hendler, J. (2000). Robots for the rest of us: Designing systems out of the box. In A. Druin & J. Hendler (Eds.), *Robots for kids: Exploring new technologies for learning*, San Mateo, CA: Morgan Kaufmann.
- Hilal, A. R. and Wagdy, K. M. (2012). A survey on commercial starter kits for building real robots. In *Proc. of Int. Workshop Teaching Robotics Teaching with Robotics* Riva del Garda, Italy.
- Huang, W. H., Huang, W. Y., & Tschopp, J. (2010). Sustaining iterative game playing processes in DGBL: The Relationship between motivational processing and outcome processing. *Computers & Education*, 55(2), 789-797.
- James, M. (2007). *Improving Learning How to Learn - classrooms, schools and networks*, Routledge, Abingdon.
- Johnson, J. (2003). Children, robotics and education. *Artificial life and robotics*, 7, 16-21.
- Khanlari, A. (2013). Effects of robotics on 21st century skills. *European Scientific Journal*, vol. 9(27), 27–36.
- Klassner, F. (2002). A case study of LEGO MINDSTORMS' suitability for artificial intelligence and robotics courses at the college level, In *Proceedings of the 33rd SIGCSE Technical Symposium on Computer Science Education* (pp. 8–12). New York: ACM Press.
- Klassner, F., & Anderson, S. (2003). LEGO MindStorms: Not just for K–12 anymore. *IEEE Robotics and Automation Magazine*.
- Marin, F., Mikhak, B., Resnick, M., Silverman, B., & Berg, R. (2000). To mindstorms and beyond: Evolution of a construction kit for magical machines. In A. Druin & J. Hendler (Eds.), *Robots for kids:*

- Exploring new technologies for learning* (pp. 9–33). San Mateo, CA: Morgan Kaufmann.
- Mason, R. and Cooper, G.(2013). Mindstorms robots and the application of cognitive load theory in introductory programming. *Computer Science Education*, 23(4), 296-314.
- Mataric, M.J. (2004). Robotics Education for All Ages. *Proceedings, AAAI Spring Symposium on Accessible, Hands-on AI and Robotics Education*, Palo Alto, CA.
- Mubin, O., Stevens, C. J., Shahid, S., Al Mahmud, A., and Dong, J. J. (2013). A review of the applicability of robots in education. *Journal of Technology in Education and Learning*, vol. 1, 56 – 78.
- NAIT (2016). Instructional delivery. Northern Alberta Institute of Technology, 11762-106 street, Edmonton, Alberta, Canada, T 5 G 2 R 1 . U R L : <http://www.nait.ca/100923.htm>
- Nocks, L. (2007). *The robot: the life story of a technology*. Westport, CT: Greenwood Publishing Group.
- Rouse, M. (2016). Definition of Robot. Accessed on 11th October, 2016. URL: <http://whatis.techtarget.com/definition/robot-insect-robot-autonomous-robot>
- Ruzzenente, M., Koo, M. , Nielsen, K., Grespan, L., and Fiorini, P. (2012). A review of robotics kits for tertiary education. *In Proc. of Int. Workshop Teaching Robotics, Teaching with Robotics*, Riva del Garda, Italy.
- Ryu, H. J., Kwak, S. S., & Kim, M. S. (2008). Design factors for external form of robots as elementary school teaching assistants. *The Bulletin of Japanese Society for Science of Design (JSSD)*, 54(5), 58 – 67.
- S h a u n , B . (2 0 1 4) . W h a t i s programming. Accessed on 11th October, 2 0 1 6 . U R L : https://en.wikipedia.org/wiki/Computer_programming
- Turkle, S., & Papert, S. (1992). Epistemological pluralism and the revaluation of the concrete. *Journal of Mathematical Behavior*, 11(1), 3–33.
- Wagner, B., Hohmann, P. and Gerecke, U. (2004). *Technical Framework for Robot Platforms in Education*. International Conference on Engineering Education and Research. Olomouc, Czech Republic.
- Weinberg, J.B., & Yu, X. (2003). Robotics in education: Low cost platforms for teaching integrated systems. *IEEE Robotics & Automation Magazine*, 10(2), 4–6.



Computer Education Research Journal (CERJ)

Volume 5: Issue No. 1 pp 111-119, 2018

OUTSOURCING UNIVERSITIES' DATABASE SYSTEMS: A THREAT TO INFORMATION SECURITY

BY

¹Eze, B. N., ¹Nwosu, O. F. and ¹Onyemachi, C. O.

¹Department of Computer and Robotics Education, University of Nigeria, Nsukka

²Department of Science Education, Ebonyi State University, Abakiliki

blessingngozi26@gmail.com, fidelia.nwosu@unn.edu.ng & chinedu.onyemachi@unn.edu.ng

+234-8038973227, +234-8131239598 & and +234-8035900719

ABSTRACT

Information security in universities has become an issue of great concern since the emergence of online information storage and the common practice of outsourcing universities' database systems, such as student's record keeping in the portal and storage of books in the e-libraries. This research takes an in-depth study into the threats posed on information security as a result of outsourcing universities' database systems. Population of the study was 200 respondents which were made up of 40 ICT staff, comprising database developers and operators, who were randomly selected from Enugu state University of Science & Technology, Enugu; Ebonyi state University, Abakiliki; Federal University of Technology, Owerri; Nnamdi Azikiwe University, Awka and University of Nigeria, Nsukka, respectively. A structured questionnaire of 35 items was developed to collect data. Three experts validated the instrument and Cronbach alpha method was used to determine the reliability co-efficient which yielded 0.81. Data collected was analyzed using descriptive statistics to answer research questions and t-test statistic to test the null hypothesis. The findings of the study revealed that there was no significant difference ($p > 0.05$) among the universities on the 5 factors identified as threats to the outsourcing of database systems by universities to private firms. This research helped to better understand that universities need to be in control of their database systems if the security of their information is to be maintained, by outlining the perceived threats of outsourcing database systems. This study also discussed among others, how the findings of the study will help universities to build up their own database systems as a replacement for outsourcing them to private companies that might lead to vulnerability.

Keywords: Outsourcing, Database Systems, Information Security, University and Information & Communication Technology

Background of the study

Outsourcing is the use of contractors or external service providers by organizations and institutions like universities in carrying out some of their activities. According to Hollenbeck & Wright (2003), outsourcing simply means contracting with an outside vendor to provide a product or service to the firm, as opposed to producing the product using employees within the firm. Outsourcing has

become a widespread practice in the last couple of years. According to Ukeije & Nwaoma (2015), the practice of outsourcing is fast becoming part of the operational strategies of public universities in Nigeria. In the past, some areas like Information Systems, human resource management and landscaping had dominated the outsourced work. Nevertheless, a major part of outsourced services today has to do with Database Systems. Willcocks (2008) stated that

in recent years, outsourcing has been one of the Information and database Services that has grown the most. Outsourcing is described as an inter-organisational relationship that is established between an outsourcing and an outsourced organisation based in different locations, to enable IT/Software development that takes place primarily in the premises of the outsourced organisation (Sahay 2000). Presently, the rate at which outsourcing is affecting many universities all over the world is alarming. Carr (2005) observed that in challenging economic circumstances, universities have often followed the dominant business model by subcontracting their routine work to a variety of firms. Indeed, database systems of Universities, especially Nigeria Universities, which are ought to be managed by dedicated IT experts employed by the university, are been outsourced to private & cooperate IT firms, who are left at the mercy of the universities' confidential information and documents. Researchers argue that outsourcing allows the reduction of unnecessary costs and stress involved in employing many hundreds of workers. Wills (2014) argue that while outsourcing can save money, it has unintended negative impacts on university life, because as universities relinquish control, it makes most prominent workers on campus less invested in the organization. This is true because many functions been outsourced by universities are mostly the major sensitive part of the university administration like the Database systems.

Database outsourcing is the process of leveraging the resources and services of the database of an organization to contractors or vendors. According to Enrique, Reyes, José and Juan (2008) database or Information Systems outsourcing means that the physical and human resources related to one organization's database or Information Technologies (ITs) are supplied and administered by an external specialized provider. Although database outsourcing in universities is a recent occurrence in Nigeria, with recurrent, challenges, it is not an unfamiliar phenomenon to some developed countries where outsourcing has been practiced in more than a decade ago. Despite the challenges, universities are expected to provide quality education to their students whose population has been growing

rapidly. In view of this, Laudon and Laudon (2012) noted that it is because of this situation that some universities in a bid to carefully manage their expenditure have considered outsourcing as an option in the effort to cut costs, improve efficiency and meet the demands for greater accountability

Many researchers and university administrators have justified outsourcing on the basis of cost reduction and the opportunity for the university to concentrate on teaching and research. On this note, Giroux (2002) stated that there is no-brainer to outsourcing because it saves so much money; however, there are still arguments and pessimisms on the impending implications of outsourcing some sensitive functions, to the likes of database systems.

Nevertheless, the major challenge is that the regular workers are still in the employment of the universities with full pay. So, the regular workers are now redundant and idle but still earn their full pay. Some universities, for example, University of Nigeria Nsukka who currently outsource their database systems to a private firm called Tenece Professional service still have a lot of capable IT staff who are fully paid and could have managed their database services. Indeed, most of the universities in Nigeria have in one way or the other outsourced their database systems to private firms. The reasons for this are to improve service delivery, reduce cost, save time and many others. More so, most of the universities lacked the internal skills in providing database management services for their daily operations. However, the situation poses a security challenge as a totally outsourced database system in the universities may affect online exams, assignment computation and submission, online payments, result grading and computation. This is because, the contractors or external service provider's employees are always more interested in making money and can manipulate database records for monetary gains, such as resgistering courses for students even when the registration deadline has elapsed and many others. Thus, there is perceived tendency of compromising standards by the company's employees who are out to do anything just to get richer by the day.

Statement of the problem

Various universities in Nigeria have undergone different kinds of policy reforms in recent times due to lapses that are intrinsic in the operations of education industries. As an element of economic liberalization plan, many tertiary institutions have in recent times embarked on commercialization and privatization of certain services aimed at enhancing the service delivery and generally operational standards of the institutions. For the institutions that could not be commercialized or privatized, the outsourcing policy was allowed to some level. The policy affected various areas of universities, and owing to competition and the need to enhance the quality of service delivery of the institutions, the management of most public universities have outsourced some of its functions such as, transportation, security, hostel accommodation, cleaning, , canteen services, database management among others. For this reason, sensitive services like, online exams, payment solutions, student portal, course registration platform, staff profile and a host of others have been left to the mercy of the private service provider.

Although outsourcing policy has been justified on the basis of the advantages it offers to the universities, however, it is not without apparent challenges. Some of these challenges are, threat to information security, the qualification of staff working for the provider company, the possible opposition of the universities' own IT staff, the uncertain relation between costs and benefits involved in this decision, the terribly strong dependence on the provider, the provider's reluctant and incapacity to adapt to new technologies, the fact that the decision is irreversible once it has been made, the hidden costs that may be incurred in the contract, or the loss of basic knowledge in the client organization. In support of this, Ukeije & Nwaoma (2015), the outsourcing challenges faced by universities have come in form of resistance by the affected workers whose conditions of services have changed, threat by the host communities whose members are affected by outsourcing policy, security issues and lots more.

Sequel to the above factors, several reasons appear against universities' database systems outsourcing. This research aims at

investigating the information security threats posed by outsourcing on the database systems of the university, with a view to establish possible solutions that would help reduce the rate by which the database systems of universities are been outsourced.

The main purpose of this research is to investigate the impact of outsourcing on the information security of universities' database systems. Specifically, the study seeks to;

1. Identify the extent to which different database management services of universities have been outsourced
2. Identify reasons for outsourcing database management systems of universities
3. Find out different ways through which the outsourced database management services act as threats to information security of universities.
4. Find out the ways through which database management outsourcing can be prevented in the universities.

The following research questions will guide the study

1. To what extent has the databasemanagement service of universities have been outsourced?
2. What are the reasons for outsourcing database management systems of universities?
3. What are the ways through which the outsourced database management services act as threats to information security of universities?
4. What are the ways through which database management outsourcing can be prevented in the universities?

The following hypothesis guided the study:

1. There is no significant difference between the mean responses of database developers and operators on the extent to which database management services of universities have been outsourced.

2. There is no significant difference between the mean responses of database developers and operators on the reasons for outsourcing database management systems of universities.

3. There is no significant difference between the mean responses of database developers and

operators on the ways through which the outsourced database management services act as threats to information security of universities

4. There is no significant difference between the mean responses of database developers and operators on the ways through which database management outsourcing can be prevented in the universities

METHODOLOGY

This is a quantitative research carried out in the following five selected universities in Nigeria; Ebonyi state University, Enugu state University of Science & Technology, Federal University of Technology Owerri, Nnamdi Azikiwe University Awka and University of Nigeria Nsukka, respectively. These universities were chosen because of its proximity to the researcher and their involvement in database outsourcing. Data were collected from selected data operators and database developers of the Management Information Systems Unit of the various Universities involved and any other units or departments of the Universities which have been assigned to handle some part of the Database systems tasks.

In order to identify with the individual experiences of each of the staff in relation to the Universities' outsourcing decisions; the primary data were collected with the help of

questionnaire which were distributed to data operators and database developers of the selected universities. Information gathered covered various database areas/functions that the institutions' administrations have completely or partly outsourced.

The population of the study comprised 200 respondents which were made up of 40 ICT staff (data operators and database developers) who were randomly selected from the selected universities.

The instrument for data collection was a 35 items researchers' designed questionnaire titled: outsourcing universities' database systems. The questionnaire was organized in two sections: section A which borders on demographic data of the respondents while section B focused on the 35 items that are carefully organized in three clusters which addresses the research questions formulated for the study. The questionnaire items were placed on a four point rating scale with options of very large extent; large extent; low extent and very low extent for all clusters. Options are weighted on 4, 3, 2, and 1 point(s) respectively. Three experts validated the instrument for relevance and accuracy. Their corrections, suggestions and comments were used to modify the instruments. The null hypothesis was tested using t-test statistics at 0.05 level of significance.

Presentation and analysis of data

Research Question 1: What are the extents to which database management services of universities have been outsourced?

Table 1: The Mean Ratings and Standard Deviation of Respondents on the extent to which Database Management Services of Universities have been outsourced. N = 20

S/N	Items	Mean	Std deviation	P-value	Remarks	
					RQ	Ho
1	CBT exams	3.42	0.56	0.53	VHE	S
2	Provision of servers	3.47	0.62	0.15	VHE	S
3	Online payments	3.43	0.49	0.03	VHE	NS
4	Books and journals online	3.13	0.73	0.22	VHE	S
5	Students portal	3.13	0.83	0.34	VHE	S
6	Staff portal	3.42	0.56	0.53	VHE	S
7	Student's result	3.47	0.62	0.15	VHE	S
8	E-mail provision through google	3.43	0.49	0.03	VHE	NS
9	Support to end users	3.13	0.73	0.22	VHE	S

Key: VHE = Very high extent, Ho = Hypothesis, N = Numbers, S = Significance, NS = Not Significance

The Data presented in Table 1 above shows that the mean ratings of the responses of the respondents on the 9 identified items relating to the extent to which database management services of universities have been outsourced had mean values ranging from 3.13 to 3.47 which are all greater than the cut-off point of 2.50 on a 4-point rating scale. The data in the table shows that the respondents agreed that all the 9 different areas of database management services have been outsourced in the universities to a very high degree. The value of standard deviation for the 9 items ranges from 0.49 to 0.73 which showed that the respondents were not far from each other in their responses

and also responses were not far from the mean. The table also showed that the p-values of the items 1,2,4,5,6,7 and 9, ranged from 0.15 to 0.53 which were greater than 0.05 level of significance except items 3 and 8. This showed that there was no significant difference ($P>0.05$) between the mean responses of database developers and data operators with regards to the extent to which database management services of universities have been outsourced.

Research Question 2: What are the reasons for outsourcing database management systems of universities?

Table 2: The Mean Ratings and Standard Deviation of Respondents on the Reasons for Outsourcing Database Management Systems of the Universities. N = 20

S/N	Items	Mean	Std deviation	P-Value	Remarks	
					RQ	Ho
1	Desire for Improved Database efficiency	3.13	0.83	0.34	Agree	S
2	Elimination of constant breakdown of University portal	3.42	0.56	0.53	Agree	S
3	Reduction of cost in employing permanent ICT staff	3.45	0.54	0.15	Agree	S
4	Improved flexibility of the ICT Unit	3.52	0.59	0.22	Agree	S
5	Desire for more competent staff	3.42	0.49	0.34	Agree	S
6	Reduction of cost of purchasing database servers & other technology devices	3.09	0.74	0.54	Agree	S
7	Providing alternatives to in-house ICT staff	3.45	0.59	0.15	Agree	S
8	Better access to innovative technology and reduced technological obsolescence risk	3.52	0.57	0.22	Agree	S

Key: RQ = Research question, **Ho** = Hypothesis, **N** = Numbers, **S** = Significance

The Data presented in Table 2 above shows that the mean ratings of the responses of the respondents on the 8 identified items relating to the reasons for outsourcing database management systems of universities had mean values ranging from 3.09 to 3.52 which are all greater than the cut-off point of 2.50 on a 4-point rating scale. The data in the table shows that the respondents agreed that all the 8 different items are the reasons for outsourcing database

management systems of universities. The value of standard deviation for the 8 items ranges from 0.49 to 0.74 which showed that the respondents were not far from each other in their responses and also their responses were not far from the mean. The table also showed that the p-values of items 1 to 8 ranged from 0.15 to 0.54 which were greater than 0.05 level of significance. This showed that there was no significant difference ($P>0.05$) between the mean responses of

database developers and data operators with regards to the reasons for outsourcing database management systems of universities.

Research Question 3: What are the extent through which the outsourced database management services act as threats to information security of universities?

Table 3: The Mean Ratings and Standard Deviation of Respondents on the extent through which the Outsourced Database Management Services Act as Threats to Information Security of Universities. N = 20

S/N	Items	N	Mean	Std deviation	P-value	Decision RQ	Decision Ho
1	Mutilation of CBT Exam grades	200	3.45	0.84	0.18	VHE	S
2	Manipulation of online payments	200	3.52	0.59	0.01	VHE	NS
3	Unauthorized access to books and journals online	200	3.42	0.49	0.46	VHE	S
4	Change of student's grades	200	3.09	0.73	0.10	VHE	S
5	A possible opposition from university ICT staff	200	3.16	0.85	0.33	VHE	S
6	Change of the outsourcing contract documents to adapt to new changes	200	3.45	0.54	0.25	VHE	S
7	Loss of critical skills and competences of University ICT staff to handle the database in the future	200	3.64	0.70	0.13	VHE	S
8	Risk of having a uniform portal with other universities who also outsourced their portal to same contractors	200	3.52	0.59	0.17	VHE	S
9	The desire to alter the database and help student with the aim of making money by the contractors employee	200	3.42	0.49	0.47	VHE	S

Key: VHE = Very high extent, RQ = Research question, Ho = Hypothesis, N = Numbers, S = Significance, NS = Not Significance

The Data presented in Table 3 above shows that the mean ratings of the responses of the respondents on the 9 identified items relating to the reasons for outsourcing database management systems of universities had mean values ranging from 3.09 to 3.64 which are all greater than the cut-off point of 2.50 on a 4-point rating scale. The data in the table shows that the respondents agreed that all the 9 different items are the extent through which the outsourced database management services act as threats to information security of universities. The value of standard deviation for the 9 items ranges from 0.10 to 0.47 which showed that the respondents were not far from each other in their responses

and also that their responses were not far from the mean. The table also showed that the p-values of items 1 to 9 ranged from 0.15 to 0.54 which were greater than 0.05 level of significance. This showed that there was no significant difference ($P > 0.05$) between the mean responses of database developers and data operators with regards to the extents through which the outsourced database management services act as threats to information security of universities.

Research Question 4: What are the ways through which database management outsourcing can be prevented in the universities?

Table 4: The Mean Ratings and Standard Deviation of Respondents on the Ways Through which Database Management Outsourcing can be Prevented in the Universities

S/N	Items	Mean	Std deviation	P-Value	Remark	
					RQ	Ho
1	Employment of ICT experts to manage university database systems	3.43	0.49	0.34	Agree	S
2	Design & management of state-of-the-art portal to avoid constant breakdown	3.13	0.73	0.53	Agree	S
3	Access to modern database servers of the contractors that would help to improve database efficiency	3.42	0.56	0.15	Agree	S
4	Encouragement of team work among staff to improve flexibility	3.47	0.62	0.22	Agree	S
5	Training & re-training of staff to improve competency	3.43	0.49	0.34	Agree	S
6	Employment of minimal but competent numbers of staff to reduce cost	3.13	0.73	0.53	Agree	S
7	Role & access level definition among staff to verify manipulations	3.45	0.54	0.25	Agree	S
8	Constant service & update of technological tools to reduce technological obsolescence risk	3.64	0.70	0.13	Agree	S

Key: RQ = Research Question, Ho = Hypothesis, N = Numbers, S = Significance

The Data presented in Table 3 above shows that the mean ratings of the responses of the respondents on the 8 identified items relating to the reasons for outsourcing database management systems of universities had mean values ranging from 3.13 to 3.64 which are all greater than the cut-off point of 2.50 on a 4-point rating scale. The data in the table shows that the respondents agreed that all the 8 different items are the extents through which the outsourced database management services act as threats to information security of universities. The value of standard deviation for the 8 items ranges from 0.49 to 0.73 which showed that the respondents were not far from each other in their responses and also that their responses were not far from the mean. The table also showed that the p-values of items 1 to 8 ranged from 0.15 to 0.53 which were greater than 0.05 level of significance. This showed that there was no significant difference ($P > 0.05$) between the mean responses of database developers and data operators with regards to the reasons for outsourcing database management systems of universities.

Discussion of the Findings

The findings of this study shows that the following database management services of universities have been outsourced to a very high extent; CBT exams, Provision of servers, Online payments, Books and journals online, Students

portal, Staff portal, Student's result, E-mail, provision through google and Support to end users. This finding agrees with the findings of Ikeije and Nwaoma (2015) that today, most public universities are outsourcing some of its operations like transportation, canteen services, cleaning and ICT which hitherto were some of the traditional functions that supported academic activities. This is in line with, Kirp (2008) agreed that too frequently, colleges and universities are contracting out some of their basic functions. Kirp further stated that institutions today run the risk of eviscerating the very things that make academic commons more than a market place, and in so doing privatize their soul.

The analysis of data in table shows that the mean ratings of the responses of the respondents on all the identified items relating to outsourcing universities' database system had mean values ranging from 3.09 to 3.64 which are all greater than the cut-off point of 2.50 on a 4-point rating scale. The data in the table indicated that the respondents agreed that all the items could be the factors influencing database outsourcing. The standard deviation values for all the items ranged from 0.49 to 0.85 which showed that the respondents were not far from one another in their responses and that their responses were not far from the mean. The table also showed that the p-values of all the items (except 1 and 2 of table 1 and item 2 of table 2)

ranged from 0.10 to 0.54 which were greater than 0.05 level of significance. This showed that there was no significant difference ($P > 0.05$) between the mean responses of database developer and data operators. This finding is in line with that of McIvor (2005) who stated that although organization outsource their services to contractors, effort should be made to formulate internal strategy to gain competitive advantage from its internal resources, by employing competent internal staff to take charge of those services been outsourced to contractors and outside vendors.

Conclusion

Outsourcing has become a common practice among universities in Nigeria and across different working areas and capacities, such that areas like; farm labours, attendants, cleaning jobs, security jobs, messenger jobs, database management, among others, have been outsourced by many tertiary institutions. The strong reason behind this is that most universities lacked the internal competence in providing some of the services which they outsource, while some see it as a measure to improving service delivery, such as uninterrupted access to database systems as so on.

However, the outsourcing situation poses a great threat to the information security of the universities' database systems, which is indeed the technology behind every universities' information warehouse in this digital era. This hitherto poses a great challenge as a totally outsourced database system in any university may affect grading and result compilation, leakage of CBT Exams, Manipulation of online payments, unauthorized access to books and journals online, registration of fake students and change of student's grades as some of the exams are computer based, like in university of Nigeria where all the general courses are written online. Thus, there is the tendency of compromising standards and other ill vices that may arise in the future.

Moreover, there is the fear of loss of contract by outsourced employees thereby always interested in ways of making quick and illegal money to the detriment of the university.

Therefore, outsourcing of such sensitive jobs like database management in the universities should be avoided and competent in-house

fulltime university staff employed and adequate facilities provided for day to day management of the database.

Recommendation

From the findings of this research, it is highly recommended that for universities to make certain that database systems outsourcing is avoided, managing universities' database systems should be better handled by in-house experts, so as to curtail outside interference. Although, outsourcing has become a common means for schools to manage their database systems and almost all the universities in Nigeria have outsourced their database systems to private IT firms. However, outsourcing this most vital aspect of the university administration has constituted a lot of security threats leading to leakage of CBT Exams, manipulation of online payments, unauthorized access to books and journals online, registration of fake students and change of student's grades. Therefore, universities are encouraged to employ permanent & fulltime in-house experts to develop the database of the university, as well as purchase affordable but modern database servers to improve database efficiency, encourage team work among staff to improve flexibility, train & re-train staff to improve competency, employ minimal but competent numbers of staff to reduce cost and ensure constant upgrade of technological tools to reduce technological obsolescence risk.

References

- Carmel, E. (2003). Taxonomy of new software exporting nations. *Electronic Journal of Information Systems in Developing Countries*. Retrieved January 12, 2017 from www.ejisdc.org/ojs2/index.php/ejisdc/article/download/77/77.
- Carmel, E. and Abbott, P. (2007). Why Nearshore means that distance matters. *Communications of the ACM*. Retrieved November 2, 2016 from <http://dl.acm.org/citation.cfm?id=1290959>
- Carr, N. G. (2005). *The End to Corporate Computing*. London: MIT Sloan Management Review.
- Dibbern, J., Goles, T., Hirschheim R. and

- Jayatilaka B. (2004). Information systems outsourcing: a survey and analysis of the literature. *Communications of the ACM*. Retrieved January 12, 2017 from <http://dl.acm.org/citation.cfm?id=1035236>.
- Gartner (2004). *Gartner on Outsourcing*. Stamford. Gartner Inc. Retrieved January 21, 2012 from www.gartner.com/newsroom
- Giroux H. A (2001). Theory and Resistance in Education: Towards Pedagogy for the Opposition**. Canada: Western University of Canada.
- Ikeije & Nwaoma (2015). The outsourcing policy in the Nigerian public universities: issues & challenges. Nigeria: *Epra international journal of economics and business review*. Retrieved October 10, 2016 from <http://www.epratrust.com>.
- Kirp, D. (2008). *Outsourcing the soul of the university*. Nigeria: EPRA TRUST. Retrieved September 3, 2016 from www.waberconference.com/index.php.
- Lacity, M. C. and Willcocks, L. P. (2001). *Global Information Technology Outsourcing*. Chichester: Wiley & Sons.
- Laudon, K. C., and Laudon, J. P. (2012). *Management Information Systems*. UK: Pearson Education Limited.
- Lee, J., Huynh, M.Q., Kwok, R. C., & Pi, S. (2003). *IT outsourcing evolution—past, present, and future*. *Communications of the ACM*. Retrieved September 3, 2016 from <https://books.google.com.ng/books?isbn=1605667714>
- McIvor, R. (2008), What is the right outsourcing strategy for your process? *European Management Journal*, Vol. 26, pp.24-34
- McCarthy, J. C. (2002). 3.3 million US services jobs to go offshore. USA: Forrester Research, WholeView TechStrategy Research. Retrieved December 8, 2016 from <https://fas.org/sgp/crs/misc/RL32292.pdf>
- McCarthy J.C. (2004). *Near-term growth of offshoring accelerating*. USA: Forrester Research, Retrieved December 8, 2016 from <https://www.researchgate.net>
- Mol, M. J. (2007) *Outsourcing: Design, Process, and Performance*. Cambridge, Cambridge University Press.
- Omeje, G. M. (2014). *Outsourcing and human resource utilization in tertiary institutions in Nigeria: a case study of university of Nigeria, Nsukka*. Master of Science thesis. Retrieved February 3, 2017 from <https://www.unn.edu.ng>.



Computer Education Research Journal (CERJ)

Volume 5: Issue No. 1 pp 120-126, 2018

AWARENESS AND USAGE OF E-BOOKS AMONG PRE-SERVICE SCIENCE AND TECHNOLOGY EDUCATION TEACHERS IN COLLEGE OF EDUCATION, MINNA NIGER STATE

BY

¹Usman, Z. N., ²Chado, A. M., ³Gimba, R. W., ¹Abdulrahman, M. A & ³Chado, M. I. D

¹Department of Educational Technology, ²Department of Science Education
School of Science and Technology Education, Federal University of Technology Minna

³Department of Metalwork Technology, Niger State College of Education, Minna

usmanzaliha06@gmail.com; lchadoamina@gmail.com HYPERLINK "mailto:chadoamina@gmail.com" ²2&ramatu.gimba@futminna.edu.ng ³
[+234-813-318-5852](tel:+2348133185852); [+234-803-596-5345](tel:+2348035965345); [+234-803-285-36033](tel:+23480328536033)

ABSTRACT

This study examined awareness and usage of e-book among pre-service Science and Technology Teachers in College of Education, Minna Niger State. Two research questions were formulated and answered in the study. The study adopted a descriptive survey design. A simple random sampling technique was used to select 300 pre-service teachers. Instrument used for data collection was Awareness and Usage of e-book Questionnaire (AUeQ) developed by the researchers. Items in the instrument were subjected to face and content validity and a reliability coefficient of 0.71 was obtained using Cronbach's alpha formula. Data collected was analyzed using mean and standard deviation Findings from the study revealed that pre-service teachers in College of Education Minna are aware of the existence of e-books but have negative attitudes towards its usage. It was, however, recommended that institutions of higher learning should equip their libraries with modern technological tools and ICT devices necessary such as the computer hardware, software and applications like the e- books and reliable internet services to support optimal usage of e-books.

Key words: Awareness, Usage, e-books, Pre-service science and technology teachers

Introduction

The emergence of Information and Communication Technology (ICT) has led to the growth and improvement in education today, thereby changing the needs and aspirations of library users. With the advent of ICT, libraries are now shifting from traditional printed resources to the use electronic resources and individuals no longer visit the library but

access information in the comfort of their offices, homes and recreation centers through electronic resources especially among pre-service science and technology teachers in tertiary institutions (Nnadozie & Nwosu, 2016; Okazie, 2016). Electronic resources are systems in which information is stored electronically and made accessible through electronic systems and computer networks. These resources

include OPAC, CD-ROMs, Online-Databases, E-journals, E-books, Internet resources (Oak, 2016).

E-books are the electronic versions of a traditional printed books that can be downloaded over the internet and it can be read using a personal computer or by using e-book reader with a portable electronic device (Rouse, 2005). The application of this e-resources in the libraries especially among students in tertiary institutions of learning provide opportunity to users to access and utilize e-books and other online resources effectively (Saikia & Gohain, 2013; Atram, 2017 & Prakesh, 2017). Several benefits of e-books have been acknowledged by scholars which include portability, convenience, accessibility, affordability functionality, and cost-effectiveness for educational purposes and even for leisure (Hunt, 2012; Rodenhiser & Glackin, 2011 & Kobi, 2008).

Despite the benefits of e-books for teaching and learning particularly among pre-service teachers in tertiary institutions in Nigeria it has been observed that it is constrained by some factors such as low level of awareness and usage that ranges from ease of use (usability issues such as comfort and ease for reading for long periods); display, functionality, battery longevity; to the availability of broadband connection (Hunt, 2012; Dearnly, McKnight & Morris; 2008).

Studies conducted on the level of awareness on e-books among undergraduate students have shown varying results. Findings from most of the studies have shown that undergraduate students are aware of the availability of e-books (El-Berry 2015; Akpojotor 2016; Azubuike 2016 Chirra and Madhusudhan 2009 & Kobi 2008). Similarly, in an independent study Akpojotor, (2016) and Azubuike's (2016) found high rate of awareness of information literacy skills and awareness of electronic information resources among post graduate students in Nigeria This is however in agreement with the findings of Colaklar and Aras (2015) that also observed that social media tools are very effective means of creating user awareness of e-books. From the foregoing discussion it is observed that there is awareness of e-books among undergraduate students in tertiary institutions but with some limitations such as

low usage, availability and access.

Although studies have shown high level of awareness of e-books among students in tertiary institution however, adoption and usage of this resource have not been encouraging. In a study conducted by Wilson,'Ambra, and Drunnond, (2014) which explored university of new south Wales in the performance of their academic tasks using e-books found that e-book usage among the medical students was relatively low. Similarly, a Joint Information Systems Committee (JISC, 2012) study in the UK, found that 60 percent of users surveyed had used e-books. The JISC study also found that while 46 percent of users obtained the last e-book they used through their libraries, nearly the same number (43 percent) obtained their last e-book via the Internet. However, recent studies by scholars have revealed high usage of e-books among students in tertiary institutions due to the frequent use of Facebook, Twitter, YouTube among others Prabhakar & Rani (2017); (El-Berry, 2015; Amusa & Atinmo, 2016; Saikia and Gohain, 2013; Tripathi *et al.*, 2016). While Adeniran (2013) in another study found out that most of users of the library are aware of the electronic information resources such as e-books available in the University library but the usage rate is low. It is found in the literature that there is sometimes a gap between awareness and usage of e-books. This brings to the fore the controversy on the direct link between awareness and utilization and this makes it necessary to determine the awareness level and usage of e-books among pre-service science and technology education teachers in College of Education, Minna Niger State.

Statement of the Problem

The developments in the Information and Communication Technology systems and wide area networks, particularly, the emergence of the Internet has made online information retrieval more popular among undergraduate students in tertiary institutions in Nigeria. However as good as this technology is it is constrained with some factors such as poor access, availability, low level of awareness and usage among others which may affect teaching and learning among pre-service teachers. Some researchers have observed high level of awareness of e-books but have observed low

usage particularly among undergraduates. Therefore, this study determined the awareness and usage of e- books among pre-service science and technology education teachers in College of Education, Minna.

Objectives of the Study

The main objective was to determine the awareness and usage of e-books among pre-service science and technology education teachers in College of Education, Niger State

The study also achieved the following objectives:

1. determined the awareness on e-book among pre-service science and technology education teachers in teaching and learning process.
2. determined the use of e- books among pre-service science and technology education teachers in teaching and learning process

Research Questions

The following research questions were answered in the study:

1. Are pre-service science and technology education teachers aware of e-books in teaching and learning process?
2. How do pre-service science and technology education teachers use e-books in teaching and learning process?

Results

Research Question 1: Are pre-service science and technology education teacher aware of e-book in teaching and learning process

Table 1: Awareness of e-books among pre-service science and technology education teachers in teaching and learning

S/N	Items	Mean	SD	Decision
1	I am aware that there is an application known as the e-books	3.57	0.73	Agreed
2	I am aware that e-books as an electronic version of printed books are available in a digital formant	3.45	0.76	Agreed
3	I am aware that I can download the e-books for independent learning	2.95	0.84	Agreed
4	I am aware that e-books can help me in my assignment and project work	2.00	0.67	Disagreed

Methodology

The study adopted a descriptive survey research design. The population of the study comprised of 600 pre-service science and technology education teachers in Usman Danfodio university of Sokoto undergraduate affiliated program in College of Education Minna, Niger State. A simple random sampling technique was used to select 300 pre-service teachers using hat draw method. The instrument used for data collection was Awareness and Usage of e-book Questionnaire (AUeQ) developed by the researchers. The instrument AUeQ scored on was a 4 – point scale of Strongly Agree, Agree, Disagree and Strongly Disagree consisting of 17 items. A mean score within and above the decision mean of 2.50 was regarded as a positive response while anything below 2.50 was regarded as a negative response. The face and content validity of the instrument was determined by two experts in the department of Educational Technology, Federal University of Technology Minna. The reliability of the instrument was determined using Cronbach alpha and a reliability coefficient of 0.71 was established which shows that the instrument was reliable as ascertained by Sambo (2008). Data collected was analyzed using Mean and Standard Deviation to answer the research the questions

5	I am also aware that I can use computer to access the e-books.	3.65	0.69	Agreed
6	I am aware that android devices can be used to access the e-books	3.43	0.76	Agreed
7	I am equally aware that using e-books makes teaching and learning convenient.	3.27	0.92	Agreed
Grand mean		3.18		

Table 1 shows that pre-service science and technology education teachers are aware of e-books but they are not fully aware that the e-book is an electronic version of printed book and most of them have not downloaded the e-books application for use. The grand mean of 3.18 shows that pre-service teachers are aware of e-books that can be used to enhance teaching and

learning. Hence the result positively answered the research question 1 that pre-service science and technology education teachers are aware of e-books for teaching and learning. All items were agreed by the respondents except item 4 which state that, I'm aware that e-books can help me in my assignment and project work with mean 2.00 and SD 0.67

Research Question 2: How do pre-service science and technology education teachers use e-books in teaching and learning process?

Table 2: Use of e-books among pre-service science and technology education teachers in teaching and learning

S/N	Items	Mean	SD	Decision
1	I use e-books for my assignment	1.61	0.85	Disagreed
2	I use e-books to access information through Quick search from the internet.	2.20	0.74	Disagreed
3	I use e-books for independent learning self/individual learning	1.91	0.38	Disagreed
4	I use a personal computer, android phone, iPad which makes e-books easier to access	2.23	0.53	Disagreed
5	I use e-books frequently and I discover that it saves time compared to visiting the library	1.53	0.87	Disagreed
6	I use e-book because it does not require much space since it does not require the use of printed books	2.76	0.83	Agreed
7	I use e-books because it is easier to access through a laptop, personal computer or smart mobile compared to printed books.	2.36	0.96	Disagreed
8	I use e-books (Single copy) because it can be accessed by many at the same time.	2.33	0.54	Disagreed
9	I use e-books for my academic work such as project and research work	2.12	0.69	Disagreed
10	I am ready to use e-books if all my lecture materials could be transferred to e-books	2.93	0.88	Agreed
Grand Mean		2.19		

Table 2 shows a grand mean of 2.19 which indicates that pre-service teachers are not using e-books in teaching and learning process. Hence, the results have negatively answered the research question. All the items in the questionnaire scored less than 2.50 mean and were all disagreed by the respondents that, e-books are used in teaching and learning process.

Discussion of Results

Research question 1 shows that pre-service science and technology education teachers are aware of e-books applications and that e-books as an electronic version of printed books are available in a digital format which can be used in teaching and learning. This, however, may be attributed to the fact that most of the pre-service teachers have access to e-books through their smart phone devices where they can access and download information for teaching and learning process and necessarily from the electronic resources in the library. Findings of this study are in agreement with Akpojotor 2016; Azubuike 2016 Colaklar and Aras 2015 and El-Berry (2015) that observed that social media tools are very effective means of creating user awareness of e-books among undergraduate students.

Research question 2 also revealed that pre-service science and technology education teachers are not using e-books applications in teaching and learning. This may be attributed to the fact that most of the pre-service teachers don't have the basic knowledge on how to access e-books even though they are aware that it can be accessed online and with other methods. This is however in agreement with the findings of Wilson, Ambra, and Drunnon, (2014) and Adeniran (2013) that observed low usage of e-books among undergraduate students. The findings of this study also contradict that of Prabhakar and Rani (2017); Amusa and Atinmo, (2016), Tripathi *et al.*, (2016) El-Berry (2015) and Saikia and Gohain, (2013) that reported high usage of e-books among students in tertiary institutions due to the frequent use of Facebook, Twitter, YouTube among others.

Findings of this study have shown that, although pre-service teachers are aware of e-books as an electronic version of printed books which they can access and download from their smart phones via Facebook, Twitter and

YouTube. Most of them do not download for educational purpose rather they prefer to download games and videos. The implication of this is that despite the fact that pre-service teachers are aware of e-books they still prefer to use the hard copies of the books.

Conclusion

The study determined the awareness and usage of e-books among pre-service teachers in College of Education Minna. Finding from the study showed that although pre-service teachers are aware that there are e-books most of them do not make use of these e-books rather prefer to use the hard copies due to some challenges.

Recommendations

Based on the findings of this study, the following recommendations were made;

1. Institutions of higher learning should equip their schools with modern technological tools and devices necessary such as the computers, internet and software applications like the e-book to support teaching and learning. This is important because it will encourage pre-service teacher to study independently.
2. Pre-service science and technology education teachers should be trained on the use of e-books applications and software as supplementary approach to educational resources.
3. Government should improve on funds provided to tertiary institutions for the purchase of electronic resources.
4. Head of tertiary institutions should as matter of urgency improve and update electronic resources (ICT facilities) so that pre-service can have free and easy access to e-books.
5. Tertiary institutions should provide internet connectivity for the use of pre-service teachers

References

- Adeniran, P. (2013). Usage of electronic resources by undergraduates at the Redeemers University, Nigeria. *Academic Journals*. 5(10), 319-324

- Akpojotor, L. O., (2016). Awareness and Usage of Electronic Information Resources among Postgraduate Students of Library and Information Science in Southern Nigeria. *Library Philosophy and Practice (e-journal)*. Paper 1408.
- Amusa O. I. and Atinmo M (2016). Availability, Level of use and Constraints to use of Electronic Resources by Law Lecturers in Public Universities in Nigeria. *Italian journal of Library and information science*. ISSN (online) 2038-1026.
- Aras, B. B. and Çolaklar H., (2015). The Role of Social Media in the Promotion of University Libraries. *Journal of Library and Information Sciences*. Vol. 3(2), pp. 79-105. ISSN 2374-2372. Published by American Research Institute for Policy Development. URL:
- Atram K. P.N. (2017). Digital Library Services in the Digital Age. *International Journal of Library & Information Science (IJLIS)*. 6(1), 79–82
- Azubuike, C. O. (2016). Information Literacy Skills and Awareness of Electronic Information Resources as Influencing Factors of their Use by Postgraduate Students in Two Universities in South-West Nigeria. *Library Philosophy and Practice journal (ejournal)* 14(7)1-19
- Chirra, R. and Madhusudhan, M. (2009). Use of electronic journals by doctoral research scholars of Goa University, India. *Library Hi Tech News*, 26(10): 12-15
- El-Berry D.K., (2015). Awareness and Use of Academic Social Networking Sites by the Academic Staff at the South Valley University in Egypt. *Journal of Library and Information Sciences*. Published by American Research Institute for Policy Development. 3(2), 115-132
- Hunt J. H., (2012); *Global E-books Africa*, Duke University Libraries, December 2012
- Israel, O. and Edesiriu, O. (2017). Undergraduates' Computer Skills and the Use of Online Information Resources: A Case Study of Library and Information Science Students of Delta State University, Nigeria. *International Journal of Academic Library and Information Science*. 4(3), 87-93. ISSN: 2360-7858.
- Joint Information Systems Committee (2012) *Preparing for Effective Adoption and Use of E-books in Education* (JISC Observatory TechWatch Series, Report No. 4, Final Version, December 2012).
- Kobi, Didier (2008)) *E-books Usage Trends and Statistics* - The Springer Report 2008
- McKnight, C., Dearnley, J and A. Morris, (2008). Making e-books available through public libraries: Some user reactions. *Journal of Librarianship and Information Science*, 40 (1), 31-43.
- Nnadozie, C.O. and Nwosu C. C. (2016). Analysis of Final Year Students' Satisfaction with Information Resources and Services in Four Nigerian Federal University Libraries. *International Journal of Advanced Library and Information Science*. Cloud Publications. 4(1), 333-345
- Oak, M., (2016). Assessing the Library Users Expectations: A Select Study of Management Institutions in Savitribai Phule Pune University (Sppu), Pune, India. *International Journal of Library & Information Science (IJLIS)*. 5(3), 149–158
- Okezie, C. A., (2016). Types of Library and Information Science Publications Available in Selected Academic Libraries in Nigeria. *Journal of Library and Information Sciences* 4(1), 63-72.
- Prabhakar, S.V.R. and. Rani, S.V. M. (2017). Influence of Social Networking Sites on Library and Information Centers. *International Journal of Library &*

- Information Science (IJLIS)*. 6(1), 83–87
- Prakash, I. N., (2017). Resource Sharing: A Library Perceptive. *International Journal of Library & Information Science (IJLIS)*. 6(1), 19–22
- Rodenhiser, R., & Glackin, B. (2011): *Required Reading: Using e-books and Mobile Devices to support the Educational Experience*, Paper presented at the Boise State University Mobil Symposium
- Sambo, A.A (2008). *Research Method in Education* Stirling –Horders Publishers(Nig) Ltd Ibadan
- Saikia, M. and Gohain, A. (2013). "Use and User's Satisfaction on Library Resources and Services in Tezpur University (India): a study" *Library Philosophy and Practice (ejournal)* Paper 972
- Tripathi, B. Sonkar, S. K., and Rajbanshi V. J. (2016). Use and Impact of E-Resources Among Research Scholars: A Comparative Study of Agriculture and Technology Universities In Uttar Pradesh. *International Journal of Library & Information Science (IJLIS)*. 5(3), 108–118
- Wilson, C.S., D'Ambra, J., & Drunnon, R. (2014). Exploring the fit of e-books to the needs of medical academics in Australia". *Electronic library*, 32 (3), 403-422.



Computer Education Research Journal (CERJ)

Volume 5: Issue No. 1 pp 127-135, 2018

CHALLENGES TO UTILIZATION OF INFORMATION AND COMMUNICATION TECHNOLOGY IN TEACHING COMPUTER EDUCATION COURSES IN TERTIARY INSTITUTIONS IN ENUGU STATE, NIGERIA

BY

Ifeanyi John ENEOVO

Department of Computer and Robotics Education, University of Nigeria, Nsukka.
ifeanyi.eneovo@unn.edu.ng , +2348035688700, ORCID: 0000-0002-3928-3250

ABSTRACT

The study investigated challenges to utilization of Information and Communication Technology in teaching Computer Education courses in tertiary institutions in Enugu State, Nigeria. The study adopted descriptive survey research design. The instrument for data collection was a structured questionnaire. The data collected for the study was analysed using mean and standard deviation, while null hypotheses were tested using analysis of variance (ANOVA) at 0.05 level of significance. The population consists of 78 respondents (Computer Educators) from seven tertiary institutions in Enugu State. Based on data analyzed, the results revealed that inadequate instructional software; inadequate ICT infrastructure; and incompetent ICT skills; were major challenges to utilization of Information and Communication Technology in teaching Computer Education courses in tertiary institutions in Enugu State, Nigeria. Thus, recommendations were made among others that government should intensify efforts in increasing the funding of tertiary institutions in line with the UNESCO standard of 26% allocation of national budget to education; and establishing Information and Communication Technology Trust Fund (ICTTF) will help to raise and allocate money for provision of ICT infrastructures and training funds in tertiary institutions.

Keywords: Information and Communication Technology; utilization; teaching; computer education

Introduction

In education, Information and Communication Technology (ICT) is an indispensable tool in the modern teaching-learning process (Adebayo, 2008). ICT according to Adomi and Kpangban (2010) is an electronic technology used for gathering, storing, retrieving, processing, analyzing and transmitting information. Similarly, Ayodele in Afolabi and Abidoye (2011) stated that ICT is an electronic based technology generally used to store, process, retrieve and package information as well as provide access to knowledge. Equally, Ogunsola (2005), stated that ICT is an electronic based system of information transmission, reception, processing and retrieval, which has

drastically changed the way people think, the way people live and the environment in which people live. ICT according to Okwor in Ncharam and Okoyediji (2010), is the use of computer and telecommunication system in the collection, collation, analysis, processing, retrieval, transmission and communicating different forms of data which may include audio, visual and audio-visual formats. Anowor and Anigbo (2013) stated that ICT is basically concerned with the use of technological tools for managing the communication process. In this context, ICT is an electronic device which is utilized for information and communication needs of individuals and tertiary institutions for teaching purposes.

Utilization in this study simply means making practical and effective use of ICT while teaching computer education courses to impart knowledge. ICT is being utilized in different ways by different groups of people for the purpose of meeting challenges facing humanity. According to Anowor and Anigbo (2013), ICT is being used for efficient processing of information, dissemination of information, and facilitate presentation of information in the fields of education. ICT is used to prepared lesson, write students report, storage of data, collect and analyses student's achievements. It gives room for modern method of assessment and evaluation of students' performance. ICT is used as a complement to conventional classroom teaching process. In other words, incorporating ICT add value to the conventional classroom activities. The use of ICT in education increases access to learning opportunities; enhances the quality of education with advanced teaching methods; improves learning outcomes; and enables reform or better management of education systems (UNESCO, 2009). Through the simultaneous use of audio, text, multicolor images, graphics, motion, ICT gives ample and exceptional opportunities to the students to develop capacities for high quality learning and to increase students' innovation (Ajmal, Rahman, Ullah, Hina & Ghayyur, 2011). Ajmal et al further stated that ICT is capable of activating the senses of sight, hearing and touch of the learner thereby, improving memory retention, increasing motivation and generally deepening understanding. Although the use of technology in schools varies, it can be grouped primarily into; technology for Instructional preparation, technology for instructional delivery, and technology as learning tool (Inan & Lowther, 2010).

Instructional delivery is a process in which educators apply a repertoire of instructional strategies to communicate and interact with students on academic contents, and to support student engagement. Instructional delivery is also about using technologies to complement teaching. When ICT is used as a delivery mechanism, the focus is on packaging course content for digital delivery (Chinien, 2003). Either the educator or students can use technology for instructional delivery. That is, educators can present instruction by means of a

projector or students may use computer-assisted learning applications such as drill and practice, tutorials, and simulations (Barron, Ivers, Lilavois & Wells, 2006). Technology for Instructional preparation, educator's professional use of technology involves preparation for various classroom activities; such as, preparing instructional material, communicating or collaborating with peers, students and their parents, locating digital resources, and creating lesson plans (Bebell, Russell & O'Dwyer, 2004). The third category, technology as a tool, involves student use of basic software applications to extend their abilities to solve problems, create products, or communicate and share their perspectives with each other (Morrison & Lowther, 2010). The importance of ICT in teaching can be categorized into two namely: instructional strategy and knowledge resource (Ivowi in Ncharam and Okoyediji, 2010). As an instructional strategy, ICT can be used to reach out to learners at every corner of the globe. As a knowledge resource, ICT extends beyond the walls of the school. ICT has broken monotony and provided variety in teaching situations in computer education.

Computer Education according to Smith (2013) is the act of acquiring the basic computer knowledge, ideas, skills and other competencies so as to understand the basic terminologies, weaknesses of computers, potentialities of computers and how computers can be used to solve every day problems. According to Aminu in Yusuf (2005), Computer Education was introduced to bring Nigerians into contact with computer so that Nigerians could use, appreciate, understand, and apply the knowledge and skills to solve emerging problems. However, utilization of ICT in computer education has certain challenges. Challenges are barriers, hindrances, setback, obstacles, as well as difficulties encountered while using ICT to teach Computer Education courses in tertiary institutions. Despite the prevalent nature of ICT in virtually every aspect of human endeavour, ICT has not been adequately utilized in tertiary institutions due to many challenging factors such as: inadequate instructional software, inadequate ICT infrastructure, lack of ICT skills by computer educators, inadequate funding, and erratic

electricity supply (Gambari & Chike-Okoli, 2007). Therefore, this study is poised to find out the challenges to utilization of ICT in teaching Computer Education courses in tertiary institutions.

Statement of the Problem

Information and Communication Technology (ICT) has brought changes from chalk to multimedia presentation, online learning, and gradually moving towards mobile learning. By implication, there was supposed to be a paradigm shift from the box of coloured chalk to e-learning, blended learning and probably to m-learning to make teaching less strenuous for educators and the students. But, it is very disturbing that teaching computer education courses in the Nigerian tertiary institutions is very much retarded in terms of technological and modern facilities. This is why the conventional methods of teaching remained predominant in the Nigerian educational system. In spite of the benefits of ICT in teaching, it has been established that there are many challenges that hinder utilization of ICT in teaching of computer education courses. Such challenges include: inadequate instructional software; inadequate ICT infrastructure; incompetent ICT skills; erratic electricity supply; inadequate funding for ICT projects; and lack of training. The unfortunate state of the arts is that most educators in tertiary institutions are not competent in the use of ICT for instructional delivery. The consequence of these challenges is that computer educators will not be able to take full advantage of the opportunities provided by ICT. If the above mentioned challenges are not properly redressed, the intention of utilization of ICT in teaching Computer Education courses will not be achieved.

Purpose of the Study

The main purpose of this study is to determine the challenges to utilization of Information and Communication Technology in teaching Computer Education courses in tertiary institutions in Enugu State, Nigeria. Specifically, the study determined the challenges on:

1. Utilization of instructional software in the preparation of lessons in Computer

Education courses in tertiary institutions in Enugu State.

2. Utilization of ICT hardware for instructional delivery in Computer Education courses in tertiary institutions in Enugu State.
3. Strategies for ameliorating the challenges to utilization of ICT in teaching Computer Education courses in tertiary institutions in Enugu State.

Research Questions

Three research questions were formulated in line with the specific purposes of the study to guide the research study:

1. What are the challenges to utilization of instructional software in the preparation of lessons in Computer Education courses in tertiary institutions in Enugu State?
2. What are the challenges to utilization of ICT hardware for instructional delivery in Computer Education courses in tertiary institutions in Enugu State?
3. What Strategies are required to ameliorate the challenges to utilization of ICT in teaching Computer Education courses in tertiary institutions in Enugu State?

Hypotheses

The following null hypotheses were formulated to guide the study and was tested at 0.05 level of significance.

- H₀₁: There is no significant difference in the mean responses of computer educators from federal, state and private institutions on the challenges to utilization of instructional software in the preparation of lessons in Computer Education courses in tertiary institutions in Enugu State.
- H₀₂: There is no significant difference in the mean responses of computer educators from federal, state and private institutions on the challenges to utilization of ICT hardware for instructional delivery in Computer Education courses in tertiary institutions in Enugu State.

Methodology

This study adopted a descriptive survey research design. The study was carried out in seven

tertiary institutions that offer Computer Education courses in Enugu State, with a population of 78 respondents (Computer Educators). The instrument for data collection was a structured questionnaire and the instrument was face-validated by three experts from the Department of Computer and Robotics Education, University of Nigeria, Nsukka. Reliability of the instrument was established using Cronbach Alpha reliability method and an Alpha

value of 0.90 was obtained. The data collected for the study were analysed using mean and standard deviation, while null hypotheses were tested using Analysis of Variance (ANOVA) at 0.05 level of significance. Any item with a mean value of 3.00 and above was accepted, while any item with a mean value less than 3.00 was rejected. The instrument was administered by the researcher with the help of three research assistants through personal contact.

Results

The results of the study were presented in two stages namely: the descriptive analysis and the testing of hypotheses in the order of research questions.

Research Question 1

Mean and Standard deviation on the challenges to utilization of instructional software in the preparation of lessons in Computer Education courses in tertiary institutions in Enugu State.

Table 1: Mean and Standard deviation on the challenges to utilization of instructional software in the preparation of lessons in Computer Education courses in tertiary institutions in Enugu State.

N = 78				
S/N	Item	\bar{X}	SD	Decision
1.	Inadequate instructional software to support instructional delivery	4.51	0.59	Accepted
2.	Limited awareness of available instructional software	3.95	0.97	Accepted
3.	High cost of instructional software	3.86	1.03	Accepted
4.	Incompatibility of available instructional software within the nation's curriculum	3.41	1.29	Accepted
5.	Inability to design instructional software packages using local languages	3.76	1.50	Accepted
6.	Inaccessibility of instructional software to computer educators for lesson preparation	4.16	1.04	Accepted
7.	Non-availability of institutionally-produced instructional software for lesson preparation	4.43	0.80	Accepted
8.	Educators' incompetency in the utilization of instructional software for instructional delivery	3.78	1.22	Accepted

Key: \bar{X} = Mean, SD = Standard Deviation, N = Number of Respondents

Table 1 shows that all the variables have mean scores above 3.00. The respondents accepted all the items as challenges to utilization of instructional software in the preparation of lessons in

Computer Education courses. The standard deviation of all the items ranged from 0.59-1.50 revealed that the respondents were close to one another in their opinions from the mean.

Research Question 2

Mean and Standard deviation on the challenges to utilization of ICT hardware for instructional delivery in Computer Education courses in tertiary institutions in Enugu State.

Table 2: Mean and Standard deviation on the challenges to utilization of ICT hardware for instructional delivery in Computer Education courses in tertiary institutions in Enugu State.

N = 78				
S/N	Item	\bar{X}	SD	Decision
1.	Inadequate computer laboratories	4.21	0.97	Accepted
2.	Non-availability of digital classrooms	4.29	0.96	Accepted
3.	Inadequate Institutional Virtual classrooms	4.49	0.72	Accepted
4.	Non-availability of virtual libraries	3.98	1.13	Accepted
5.	Poor equipped digital classrooms	4.33	1.08	Accepted
6.	Inadequate technical infrastructure like fibre optic, poor bandwidth, and poor gateways	4.24	0.86	Accepted
7.	Inadequate system infrastructure like workstations, servers, and routers	4.43	0.80	Accepted
8.	Unavailability of LAN, WAN, and WLAN in the rural areas	4.18	1.07	Accepted
9.	Poor Internet access to support on-line teaching	4.14	0.67	Accepted
10.	Inadequate interactive white board/clever board in the classroom	3.98	1.04	Accepted

Key: \bar{X} = Mean, SD = Standard Deviation, N = Number of Respondents

Table 2 shows that all the variables have mean scores above 3.00. The respondents accepted all the items as challenges to utilization of ICT hardware for instructional delivery in

Computer Education courses. The standard deviation of all the items ranged from 0.72-1.13 showed that the respondents were closed to one another in their opinions from the mean.

Research Question 3

Mean and Standard deviation on the strategies required to ameliorate the challenges to utilization of ICT in teaching Computer Education courses in tertiary institutions in Enugu State.

Table 3: Mean and Standard deviation on the strategies required to ameliorate the challenges to utilization of ICT in teaching Computer Education courses in tertiary institutions in Enugu State.

N = 78					
S/N	Item	\bar{X}	SD	Decision	
1.	Government statutory increase in funding of ICT infrastructures at tertiary level of education	4.57	0.50	Accepted	
2.	Sustainable partnerships between the government, private sector and NGO's in procurement of ICT resources for institutions	4.43	0.53	Accepted	
3.	Ability to provide ICT resources and training funds by Tertiary Education Trust Fund (TETFund)	4.38	0.55	Accepted	
4.	Ability to establish Information and Communication Technology Trust Fund (ICTTF) by the federal government	4.35	0.60	Accepted	
5.	Use of internally generated revenues by administrators of tertiary institutions in providing ICT facilities	4.08	0.83	Accepted	
6.	Ability to retrain educators once a year	4.03	1.06	Accepted	
7.	Partnership with software developers in developing and use of software for instructional delivery	4.19	0.67	Accepted	
8.	Ability to provide alternative source of power by administrators of tertiary institutions for ICT usage	4.46	0.56	Accepted	

Key: \bar{X} = Mean, SD = Standard Deviation, N = Number of Respondents

Table 3 shows that all the variables have mean scores above 3.00. The respondents accepted all the items as strategies required to ameliorate the challenges to utilization of ICT in teaching

Computer Education courses. The standard deviation of all the items ranged from 0.50-1.06 indicated the respondents' closeness to one another in their opinions from the mean.

Null Hypothesis 1

Analysis of Variance (ANOVA) of computer educators in federal, state and private institutions on the challenges to utilization of instructional software in the preparation of lessons in Computer Education courses in tertiary institutions in Enugu State.

Table 4: Analysis of Variance (ANOVA) of computer educators in federal, state and private institutions on the challenges to utilization of instructional software in the preparation of lessons in Computer Education courses in tertiary institutions in Enugu State.

Source of variable	Sum of Squares	df	Mean Square	F	Sig.	Remark
Between	5.15	2	2.58	2.52	0.33	NS
Within	68.32	75	1.14			
Total	73.47	77	3.72			

Key: * = Significant at 0.05 (Reject Null Hypothesis), S = Significant, NS = NOT Significant

The result of the analysis in Table 4 indicates that an $F(2, 75) = 2.52$, $p = 0.33$ was not significant at 0.05 alpha level. This indicates that there was no significant difference in the mean responses of computer educators from

federal, state and private institutions on the challenges to utilization of instructional software in the preparation of lessons in Computer Education courses in tertiary institutions in Enugu State.

Null Hypothesis 2

Analysis of Variance (ANOVA) of computer educators in federal, state and private institutions on the challenges to utilization of ICT hardware for instructional delivery in Computer Education courses in tertiary institutions in Enugu State.

Source of variable	Sum of Squares	df	Mean Square	F	Sig.	Remark
Between	4.21	2	2.11	2.70	0.23	NS
Within	50.65	75	0.85			
Total	54.86	77	2.96			

Key: * = Significant at 0.05 (Reject Null Hypothesis), S = Significant, NS = NOT Significant

The result of the analysis in Table 5 indicates that an $F(2, 75) = 2.70$, $p = 0.23$ was not significant at 0.05 alpha level. This indicates that there was no significant difference in the mean responses of computer educators from federal, state and private institutions on the challenges to utilization of ICT hardware for instructional delivery in Computer Education courses in tertiary institutions in Enugu State.

Discussion of the Findings

The data presented on utilization of instructional software in the preparation of lessons in Computer Education courses revealed that software that is appropriate and culturally suitable to the Nigerian education system is in short supply (Aduwa-Ogiegbaen & Iyamu, 2005). Thus, there is a great discrepancy between relevant software supply and demand in developing countries like Nigeria. Even if Nigeria tries to approach this software famine by producing software that would suit its educational philosophies, there is a major challenge to be encountered. The cost of producing relevant software for the country's educational system is enormous. Obtaining and maintaining instructional software has been an expensive and challenging part of ICT to institutions that have limited financial resources. Most instructional software that tertiary institutions use is produced by proprietary software companies that normally charge considerable sums of money for their products (Hepburn, 2005). The cost and usage restrictions that characterize proprietary

software place an enormous stress on the institutions.

The data presented on utilization of ICT hardware for instructional delivery in Computer Education courses revealed that a formidable obstacle to the use of ICT in teaching in the tertiary institutions is infrastructure deficits (Okolo, 2012). This simply means that, ICT infrastructure in tertiary institutions is grossly inadequate. To support this claim, Adedoyin, Akinnuwesi and Adegoke (2008), and Achimugu, Oluwagbemi and Oluwaranti (2010), asserted that tertiary institutions in Nigeria lack adequate ICT infrastructure to effectively tap into the opportunities offered by the cyberspace. This is in line with Aduwa-Ogiegbaen and Iyamu (2005) assertion that many of the tertiary institutions lack adequate infrastructure.

The findings revealed that funding is one of the strategies to improve on the challenges to utilization of ICT in teaching Computer Education courses in tertiary institutions in Enugu State. Adejoke (2009) revealed that Government should increase funding of the entire educational sector with particular emphasis on ICT. This will help improve the level of ICT infrastructure in tertiary institutions. The findings further revealed that there should be continuous and periodic training of educators on ICT skills acquisition (Kwache, 2007). This continuous retraining of educators on ICT should be provided since development in technology is dynamic and the educators need to keep abreast with current trends.

Conclusion

In conclusion, Information and Communication Technology (ICT) is a willing instructional tool which the computer educator can use to present information and manage class activities in order to help students achieve their educational goals. ICT is used for the presentation and distribution of instructional content through web environment to support learning and communication. ICT enhances teaching through its dynamic, interactive, flexible, and engaging content. In spite of the prevalent nature of ICT in virtually every aspect of human endeavour, ICT has not been adequately utilized in tertiary institutions due to many challenging factors such as: lack of ICT skills by computer educators; inadequate ICT infrastructure, inadequate instructional software, erratic electricity supply, and inadequate funding. This invariably affects the effective use of the few ICT facilities available. For Nigeria to catch up with the developed world, ICT should be of great priority in tertiary institutions.

Recommendations

The following recommendations were made based on the findings of the study:

1. Government should intensify effort in increasing the funding of tertiary institutions in line with the UNESCO standard of 26% allocation of national budget to education.
2. Establishing Information and Communication Technology Trust Fund (ICTTF) will help to raise and allocate money for provision of ICT infrastructures and training funds in tertiary institutions.
3. Compulsory ICT training should be enforced for all computer educators to enable educators be proficient in utilization of ICT for instructional delivery in tertiary institutions.
4. Software developers should be encouraged to develop instructional software in local languages.
5. National Electricity Regulatory Commission should license more private companies to build more independent power stations as more private sector intervention will

be a crucial success factor.

6. Administrators of tertiary institutions should explore solar energy as alternative source of electricity since Nigeria has abundance of sun light all year round.

7. Grant from international agencies such as World Bank, International Monetary Fund (IMF), United Nations (UN) and African Union (AU) will help to raise money for the purchase of ICT infrastructures.

REFERENCES

- Achimugu, P., Oluwagbemi, O. & Oluwaranti, A. (2010). An evaluation of the impact of ICT diffusion in Nigeria's higher educational institutions. *Journal of Information Technology Impact*, 10(1), 25-34. Retrieved on 14th June, 2017, from <http://www.jiti.com/v10/jiti.v10n1.025-034.pdf>
- Adebayo, F. A. (2008). Usage and challenges of Information and Communication Technology (ICT) in teaching and learning in Nigeria universities. *Asian Journal of Information Technology*, 7(7): 290-295. Retrieved on 22nd July, 2017, from <http://docsdrive.com/pdfs/medwelljournals/ajit/2008/290-295.pdf>
- Adedoyin, A. A., Akinnuwesi, B. A. & Adegoke, M. A. (2008). The prospects and challenges of ICT in Nigeria tertiary education. Retrieved on 28th May, 2017, from http://www.herp-net.org/revitalization_of_african_higher_education/chapter%2022.pdf
- Adejoke, O. S. (2009). E-education in Nigeria: A proposal for college level technology capacity building. *European Journal of Scientific Research*, 36(2), 269-279. Retrieved on 17th June, 2017, from http://www.eurojournals.com/ejsr_36_2_10.pdf
- Adomi, E. E. & Kpangban, E. (2010). Application of ICTs in Nigerian secondary schools. Retrieved on 22nd

- June, 2017, from <http://www.webpages.uidaho.edu/~mbolin/adomi-kpangban.htm>
- Aduwa-Ogiegbaen, S. E. & Iyamu, E. O. S. (2005). Using Information and Communication Technology in secondary schools in Nigeria: Problems and prospects. *Educational Technology & Society*, 8 (1), 104-112. Retrieved on 18th July, 2017, from http://www.ifets.info/journals/8_1/13.pdf
- Afolabi, A. F & Abidoye, J. A (2011). Integration of Information and Communication Technology in Library Operations towards Effective Library Services. *Journal of Educational and Social Research*, 1(4), 113-120. Retrieved on 1st July, 2017, from <http://www.mcser.org/images/stories/JESR-Special-Issues/JESR-November2011/afolabi-a-f.pdf>
- Ajmal, M., Rahman, F., Ullah, M. H., Hina, K. B. & Ghayyur, T. (2011). Assessment of usage of Information and Communication Technology among graduates of Allama Iqbal open university. *International Journal of Humanities and Social Science*, 1 (12), 169-173. Retrieved on 22nd June, 2017, from http://www.ijhssnet.com/journals/Vol_1_No_12_September_2011/23.pdf
- Anowor, O. O. & Anigbo, L. C. (2013). Facilitating ICT Skills for Teachers in a Third World Country: Imperatives and Offline Strategies. Retrieved on 28th June, 2017, from http://www.aace.org/conf/site/submission/uploads/SITE2013/paper_3053_38076.docx
- Barron, A. E., Ivers, K. S., Lilavois, N. & Wells, J. A. (2006). *Technologies for education: A practical guide* (5th ed.). Westport, CT: Libraries Unlimited.
- Bebell, D., Russell, M. & O'Dwyer, L. (2004). Measuring teachers' technology uses: Why multiple-measures are more revealing. *Journal of Research on Technology in Education*, 37(1), 45-63. Retrieved on 22nd June, 2013, from <https://files.eric.ed.gov/fulltext/EJ690959.pdf>
- Chinien, C. (2003). The use of ICTs in technical and vocational education and training. UNESCO Institute for Information Technologies in Education. Retrieved on 22nd June, 2013, from <http://iite.unesco.org/pics/publications/en/files/3214613.pdf>
- Gambari, A. I. and Chike-Okoli, A. (2007). Availability and Utilization of Information and Communication Technology (ICT) Facilities in Higher Institutions in Niger State, Nigeria. *International Journal of Information and Communication Technology*, 4(1), 34-46. Retrieved on 19th August, 2017, from <https://staff.futminna.edu.ng/EDT/content/journal/PF0890/70.pdf>
- Hepburn, G. (2005). Open Source Software and Schools: New Opportunities and Directions. *Canadian Journal of Learning and Technology*, 31(1). Retrieved on 25th June, 2017, <http://www.cjlt.ca/index.php/cjlt/article/view/150/143>
- Inan, F. A. & Lowther, D. L. (2010). Factors affecting technology integration in K-12 classrooms: A path model. *Education Tech Research Dev*, 58(2), 137-154. Retrieved on 15th June, 2017, from <http://marianrosenberg.wiki.westga.edu/file/view/InanFFactorsAffecting.pdf>
- Kwache, P. Z. (2007). The imperatives of Information and Communication Technology for teachers in Nigeria higher education. *MERLOT Journal of Online Learning and Teaching*, 3(4), 395-399. Retrieved on 10th July, 2017, from <http://jolt.merlot.org/documents/kwach>

e.pdf

- Morrison, G. M. and Lowther, D. L. (2010). *Integrating computer technology into the classroom* (4th ed.). Upper Saddle River, NJ: Pearson, Merrill Prentice Hall.
- Ncharam, S. E. and Okoyediji, F. (2010). Relevance of information and communication technology (ict) to the teaching and learning process in the 21st century. *Multidisciplinary Journal of Research Development*, 15(1), 1-5. Retrieved on 2nd July, 2017, from <http://www.globalacademicgroup.com/journals/multidisciplinary%20journal%20of%20research%20development/RELEVANCE%20OF%20INFORMATION%20AND%20COMMUNICATION%20TECHNOLOGY.pdf>
- Ogunsola, L. A. (2005). Information and Communication Technologies and the Effects of Globalization: Twenty-First Century "Digital Slavery" for Developing Countries--Myth or Reality? *Electronic Journal of Academic and Special Librarianship*, 6(1-2). Retrieved on 2nd June, 2017, from http://southernlibrarianship.icaap.org/content/v06n01/ogunsola_l01.htm
- Okolo, B. N. (2012). Vice Chancellors address at the valedictory/inaugural dinner for Deans and Directors at the University of Nigeria. Retrieved on 16th of June, 2017, from <http://www.unn.edu.ng/cms/vice-chancellor%E2%80%99s-address>
- Smith, E. (2013). Studying Computer Education Through Online. Retrieved on 19th August, 2017, from <http://www.articlesbase.com/online-education-articles/studying-computer-education-through-online-6493381.html>
- Uche-Ejeke, A. (2012). The power supply challenges- Punch. Retrieved on 17 June, 2017, from <http://www.punchng.com/opinion/the-power-supply-challenges/>
- UNESCO Institute for Statistics (2009). Guide to measuring information and communication technologies (ICT) in education. Retrieved on 3rd August, 2017, from http://www.uis.unesco.org/Library/Documents/ICT_Guide_EN_v19_reprintwc.pdf
- Yusuf, O. M. (2005). An Investigation into Teachers' Self-Efficacy in Implementing Computer Education in Nigerian Secondary Schools. *Meridian Middle School Computer Technologies Journal*, 8(2). Retrieved on 22nd June, 2017, from http://www.ncsu.edu/meridian/sum2005/computer_ed_nigerian_schools/print.html



Computer Education Research Journal (CERJ)

Volume 5: Issue No. 1 pp 136-145, 2018

CELL PHONE MAINTENANCE COMPETENCY REQUIRED FOR EMPOWERING PRISON INMATES IN ENUGU STATE

BY

DR. JIMOH BAKARE

DEPARTMENT OF INDUSTRIAL TECHNICAL EDUCATION
FACULTY OF VOCATIONAL AND TECHNICAL EDUCATION
UNIVERSITY OF NIGERIA, NSUKKA
Tel: 08039306264

ABSTRACT

The paper determined the cell phone maintenance competencies required for empowering prison inmates in Enugu State. Three research questions guided the study while three null hypotheses formulated were tested at 0.05 level of significance. A descriptive survey design was adopted for the study. The population for the study comprised of 143 lecturers, instructors of electrical/electronic technology and roadside cell phone technicians in Enugu State. There was no sampling because of manageable size of the population. A structured questionnaire was used for collecting data from the respondents. The instrument was validated by three experts and Cronbach alpha reliability method was employed to determine the internal consistency of the questionnaire item; a Cronbach alpha reliability coefficient of 0.83 was obtained. One hundred and forty three copies of the instrument were administered, and 132 copies were retrieved back from the respondents. Mean and standard deviation were used to answer research questions while Analysis of Variance (ANOVA) was used to test the null hypotheses at 0.05 level of significance. The study found that the competencies identified in cell phone maintenance were required for inmates' empowerment. Recommendations include that all the competencies identified should be packaged and used to train prison inmates in Enugu State.

Keywords: prison inmates, empowerment, maintenance, repair, troubleshooting, competency

Introduction

A prison is a place where people who violated laws or committed offence or crimes are kept. An inmate is a person living in an institution such as a prison or hospital (State of Victoria, 2018; Colvin, 2010). According to Christopher (2013), a prison houses people who are convicted of crimes such as robbery, rape, among others. In Nigeria for example, federal inmate population consists of people awaiting trial for violating federal laws or those who have already been convicted of committing a federal crime. An inmate (also known as prisoner, convict, or detainee) is a person who is deprived of liberty against his or her will. This can be by confinement, captivity, or by forcible restraint. The term applies particularly to those on trial or serving a [prison sentence](#) in a [prison](#) (Merriam-

Webster, 2012). Inmates in this study are youths or young educated adults in the prisons awaiting trial or already convicted as a result of committing one crime or another. Majority of inmates in prisons in Enugu State, Nigeria are young people between the ages of 19 and 45 years (Nigerian Prisons Service, 2017). These people can still be called youth because they are still young, strong and energetic to perform both physical and mental activities (Ogbuanya, Bakare & Yisa, 2016). Youths in the view of Sowande and Olaitan (2000) are the most vulnerable individuals in the society, especially in terms of means of livelihood. According to United Nation General Assembly Report (1995), youths are young people of 15-24 years bracket; this age range

may go up to 30 years in some developing countries like Nigeria. Sowande and Olaitan listed some characteristics of youths that could be exploited for skill acquisition to include: having less fear of failure, stronger and generally healthier than the aged, less conservative and ready to welcome innovation faster than adults, having sound memory and very conscious of their personal, occupational and community development. They also have flexible minds and most of them act before they think. Youths have a tendency of committing crimes most especially when they are idled. According to Fanimu and Okere (2009), idled youths are therefore readily available for anti-social criminal activities that undermine the stability of society. Jorge (2011) also stated that generally unemployed and underemployed youths are more exposed to conflicts and illegal activities-many of them fall prey to armed and rebel conflicts.

Training of inmates for acquiring life sustaining skills is part of mandates of Nigerian prisons service; the prisons have various training programmes including trainers and well equipped workshops in different trades or occupations. Some of these trades according to report of Nigerian Prisons Service (2017), are furniture making, soap making, toilet roll, manufacturing of aluminum pots, metal works fabrications, animal husbandry, among others. These are all geared towards giving inmates practical skills that can help them live self-sustaining lives on discharge. It is observed in Nigeria that most of inmates convicted for one crime or another when discharged still go back to their usual crimes they committed before they were jailed and they continue disturbing the peace of the societies. Recently, the controller of Nigerian Prisons service also complained that the population of the inmates in Nigerian Prisons is increasing everyday and this is worrisome. Investigation also revealed that majority of detainees and convicted inmates do not have jobs or skills in any trade at the time of arrest. One of the ways to curb crimes in the society and to improve lifestyle of inmates on discharge is to empower them with life sustaining skills in a trade or an occupation such as cell phone maintenance. This is necessary because most of the well educated young persons who had jobs before conviction easily

lost their jobs while the convicted persons or discharged inmates hardly secure paid employments in Nigerian society. Determination of cell phone maintenance competencies or skills is an essential step for equipping prison inmates in lucrative trades or occupations. To expand the scope of the training given to inmates in Nigerian prisons requires well articulated cell phone maintenance skills. This will be an additional area where young inmates can be trained before they gain their freedom.

To help these inmates not to go back to their crimes on discharge or fully integrated into the society, they need to be equipped with relevant skills or competencies in lucrative trades such as cell phone maintenance. Both inmates and youths outside the prisons are useful for economic development of a nation. Youths generally are the backbone of the development of the country. Indeed if Nigeria is to be sustained as a viable entity, there must be a very good plan to tap the energy and resourcefulness of the youth population to fast track economic development (Showande & Olaitan, 2000) and one of the ways to achieve this is by empowering them with cell phone maintenance competencies.

Cell phone is an electronic gadget which can be used to make and receive calls. Hahn and Kibora (2008) added that cell phone is an [electronic device](#) used to make [mobile telephone calls](#) across a wide geographic area. Bakare (2014) described a cell phone as portable telephone that uses wireless cellular technology to send and receive phone signals. David (2011) stated that mobile phone is a cordless telecommunication device. The Report of Business Link (2011) mentioned that a cell phone can make and receive telephone calls to and from the [public telephone network](#) which includes other mobiles and [fixed-line](#) phones across the world. It does this by connecting to a [cellular network](#) owned by a [mobile network operator](#). Cell phones have features beyond sending text messages and making the short or long distance voice calls, the other features include: internet browsing, MP3 playback music, email, personal organizer, built in cameras, multimedia messaging (MMS), short messages (SMS), call registries, built in games, voice mails, downloading, video call, blue-tooth

and infrared. David (2011) mentioned basic components of cell phones to include liquid crystal display (LCD), menu button, keypad, antenna, battery, microphone, earpiece, power switch, battery terminal, power integrated circuit, oscillator, frequency divider, central processing unit and flash chips. Cell phones are found useful in businesses, education, health, securities, politics and government. It helps in organizing daily plans and gives some entertainment like phone games, WAP and SMS games (Bakare, 2014). Cell phones and their components are liable to damages or malfunction most especially when used carelessly. Common faults in cell phones include: hardware, software and setting faults. When these faults occur in a cell phone, there is need for urgent maintenance.

Maintenance is a set of activities carried out to extend the lifespan of an equipment or a gadget. Maintenance according to Olaitan in Ihediwah (2007) is a set of measure or steps taken to ensure that a given piece of equipment or infrastructure is kept in good operational order until it attain its maximum possible life span. In the Report of Microsoft Corporation (2009), maintenance is described as the work done regularly to keep a machine, building, or piece of equipment in good condition and working order. According to Bakare (2014), two major types of maintenance can be carried out on cell phones; they are preventive and corrective maintenance. Preventive maintenance can mean servicing while corrective maintenance can be termed as repair. Preventive maintenance or servicing is the activity carried out to prolong life span or active time of equipment while corrective maintenance or repair is the step taken to bring back a faulty equipment to operable state. Servicing of a cell phone may mean simple cleaning of screen, removing dirt and dust, application of methylated spirit to clean cell phone motherboard, among others. Repairing cell phones on other hand may involve troubleshooting and clearing of faults, soldering, de-soldering of components out of motherboard and insertion of good components onto the cell phone motherboard. All these are maintenance activities. Maintenance in this study is the activities carried out to restore back all kinds of faulty cell phones. To maintain a

faulty cell phone effectively, one must be competent.

Competency comprises knowledge, skills and attitudes. Competence in the statement of Olaitan and Ali (1997) is the successful performance of a task through the use of knowledge, skills, attitudes and judgment. Bakare, Okereke and Obe (2018) defined competency as the combination of knowledge, skills and attitudes required for carrying out a task. Bakare (2014) described cell phone maintenance as the activities carried out to repair, service, flash, up-grade and configure a damaged or malfunctioned cell phone. Cell phone maintenance competency therefore is the combination of knowledge, skills and attitudes required by inmates for effective repair and service of different kinds of cell phones in order to earn a living. One must effectively display safety precautionary measures when maintaining cell phones to avoid unnecessary accidents and damages to components

It is also beneficial to maintain a faulty cell phone for the user. The reason is that cell phone help in selling and buying of goods and services with ease but has created some management problems to the users. Most of the users could not easily locate efficient technicians who could repair or service faulty cell phones thereby making users whose cell phones are bad to abandon them for the purchase of new ones. Maintaining faulty phones for the users will therefore reduce continuous spending of money and electronic waste (E-waste) which can cause health problems such as cancer to the people especially where they are exposed carelessly (Ogbuanya, Bakare & Yisa, 2016). It is therefore necessary to tap the huge economic resources available in cell phone maintenance for inmates through the empowerment

With government decision to reduce crime rate and to solve the problem of militancy in Nigeria, the success will require aggressive training of youths most especially inmates in cell phone maintenance in Nigerian prisons for sustainable living on discharge. Most of the discharged inmates have no means of survival except by depending on their relatives and friends. This means that they need to be engaged in cell phone maintenance activities in order to reduce poverty and to prevent them from going back to crimes. Cell phone maintenance could

provide good employment opportunity for these inmates they are adequately empowered with competencies for servicing and repairing of cell phones. In view of these, this study seeks to determine the cell phone maintenance competencies required for empowering prison inmates in Enugu State. Specifically the study sought to:

1. identify maintenance competencies required by prison inmates for repairing cell phones
2. identify maintenance competencies required by prison inmates for servicing cell phones
3. identify safety precautionary measures required by prison inmates for effective maintenance of cell phones

Research Questions

The following research questions guided the study:

1. What are the maintenance competencies required by prison inmates for repairing cell phones?
2. What are the maintenance competencies required by prison inmates for servicing cell phones?
3. What are the safety precautionary measures required by prison inmates for effective maintenance of cell phones?

Hypotheses

The following hypotheses were tested at 0.05 level of significance:

H₀₁: There is no significant difference in the mean responses of the lecturers, instructors of electrical/electronic technology and road side cell phone technicians on the maintenance competencies required by prison inmates for repairing cell phones

H₀₂: There is no significant difference in the mean responses of the lecturers, instructors of electrical/electronic technology and road side cell phone technicians on the maintenance competencies required by prison inmates for servicing cell phones

H₀₃: There is no significant difference in the mean responses of the lecturers, instructors of electrical/electronic technology and road side cell phone technicians on the safety precautionary measures required by prison

inmates for maintenance of cell phones

Methodology

Survey research design was employed for this study. Descriptive design in the opinion of Ali (2006) is a descriptive study which uses sample of an investigation to document, describe and explain what is in existent or non-existent on the present status of phenomena being investigated. The survey research design was therefore suitable for this study since it tends to obtain data from electrical and electronic instructors, lecturers and road side cell phone technicians on cell phone maintenance competencies. The study was conducted in Enugu State of Nigeria. The population for the study was 143; comprised 67 Lecturers of Electrical/Electronic Technology and 28 Instructors in the University of Nigeria, Nsukka, Enugu State University of Technology, Enugu State College of Education (Technical) and Institute of Management and Technology, Enugu and 48 road side cell phone technicians conveniently selected using convenience sampling technique.

A structured questionnaire made up of 80 competency items was developed for collecting data in accordance with the research questions. The instrument was in three sections A-C. Section A was centered on cell phone maintenance competencies required by inmates repairing cell phones. B was for collecting data on cell phone maintenance competencies required by inmates for servicing cell phones. C was for collecting data on safety precautionary measures required by inmates for effective maintenance of cell phones. Each questionnaire item was assigned a 4 point response scale of strongly required, required, slightly required and not required with values of 4, 3, 2 and 1. Three Lecturers in the Department of Industrial Technical Education validated the instrument for the study while Cronbach alpha reliability method was used to determine the internal consistency of the questionnaire items and a reliability coefficient of 0.83 was obtained. The 143 copies of the questionnaire were administered on respondents with the help of three research assistants. Only one hundred and thirty two copies of the questionnaire were retrieved which represented 92.30% return. This is an acceptable response rate according to a study by Baruch (1999) who recommended a

standard of 60 +/-20% for surveys in managerial and behavioural sciences.

The data collected from the study were analyzed using Mean for answering the research questions while Analysis of Variance (ANOVA)

was used for testing the null hypotheses at probability level of 0.05. An item with a mean rating of 2.50 or above was regarded as required while any item with the mean rating below 2.50 was regarded as not required.

Results

The results for the study were obtained from the research questions answered through data collected and analyzed.

Table 1

Mean Responses and Analysis of Variance of Lecturers, Instructors and Road Side Cell Phone Technicians on the Cell phone Maintenance Competencies required by Inmates for Repairing Cell Phones

N = 132

S/N	Competency items	Mean	S.D.	Remarks	P-values	Ho
1	Write down the history of the faults from the cell phone user	3.57	0.81	Required	0.23	NS
2	Identify the facilities for troubleshooting faulty cell phone	3.55	0.87	Required	0.41	NS
3	Test the faulty cell phone in the present of the owner	3.25	0.83	Required	0.23	NS
4	Recognize the symptoms of all the possible faults	3.09	0.80	Required	0.15	NS
5	List all the possible causes of the problems	3.11	0.83	Required	0.71	NS
6	Check the list of possible causes against the list of the symptoms	3.58	0.70	Required	0.09	NS
7	Rank the remaining causes in order of likelihood	2.99	0.82	Required	0.22	NS
8	Reveal the result of the troubleshooting to the owner of the cell phone	3.25	0.76	Required	0.16	NS
11	Record down the outcome of the troubleshooting	3.19	0.72	Required	0.32	NS
12	Tackle the likeliest causes in the order of the complexity, cost and /or time required to check them	3.17	0.78	Required	0.56	NS
13	Remove battery cover of a cell phone	3.67	0.89	Required	0.27	NS
14	Remove the battery from the cell phone	3.50	0.82	Required	0.62	NS
15	Unscrew the faulty cell phone	3.27	0.86	Required	0.22	NS
16	Remove the SIM card (s)	3.91	0.92	Required	0.32	NS
17	Split the casing of the cell phone	3.57	0.78	Required	0.56	NS
18	Separate the keypad from the mechanism	3.56	0.88	Required	0.12	NS
19	Identify faulty area or components in a cell phone	3.79	0.79	Required	0.36	NS
20	Test the unit or component one by one using appropriate tools or equipment	2.88	0.88	Required	0.12	NS
21	Use tested okay unit to replace bad unit of the same capacity if fault is obvious	2.79	0.80	Required	0.15	NS
22	Test the components with appropriate testing instruments such as ohmmeter	3.77	0.83	Required	0.71	NS
23	Remove the component(s) from the motherboard using appropriate tools	3.58	0.90	Required	0.09	NS
24	Select components of correct specification	3.78	0.82	Required	0.12	NS
25	Verify the condition of the components before fixing it back to the mother board	3.67	0.79	Required	0.08	NS
26	Repair or change the faulty components if totally bad	3.76	0.83	Required	0.19	NS
27	Fix back the components into motherboard correctly	3.68	0.94	Required	0.32	NS
28	Apply soldering iron for only 3 seconds if needed	3.62	0.88	Required	0.65	NS
29	Apply sufficiency flux to point(s) being soldered	2.89	0.84	Required	0.11	NS
30	Insert the electronic panel correctly into the main body	3.04	0.78	Required	0.44	NS
31	Screw the panel gently without breaking	2.98	0.87	Required	0.23	NS
32	Insert the SIM card to rest on it sit	3.61	0.76	Required	0.45	NS
33	Fix back the battery correctly	3.23	0.88	Required	0.54	NS
34	Put back the casing correctly	3.58	0.80	Required	0.36	NS
35	Switch on the phone	3.60	0.79	Required	0.28	NS

Keys: SD = Standard Deviation, NS = Not Significant, N = number of respondents

Data in Table 1 revealed that all the 35 items on the maintenance competencies required by inmates for repairing cell phones had their mean values ranged from 2.79 to 3.91 which are above the cutoff point of 2.50. This shows that all the maintenance competencies are required for empowering inmates in Enugu State. The Table also indicates that items had their p-values greater than 0.05 at degree of

freedom 2 and 129. This indicated that there was no significant difference in the mean rating of the lecturers, instructors of electrical/electronic technology and road side cell phone technicians on maintenance competencies required by inmates for repairing cell phones. Therefore, the hypothesis of no significant difference was upheld for the 35 items on cell phone repair.

Table 2
Mean Responses and Analysis of Variance of Lecturers, Instructors and Road Side Cell Phone Technicians Respondents on the Competencies required by Inmates for Servicing Cell Phones
N = 132

S/N	Competency items	Mean	S.D.	Remarks	P-values	Ho
1	Check for proper coupling of the cell phones	3.19	0.76	Required	0.08	NS
2	Check the battery contacts for proper connection	3.39	0.82	Required	0.68	NS
3	Service the battery by removing carbon from the contacts	3.75	0.71	Required	0.51	NS
4	Clean the motherboard of a phone for proper operations	3.60	0.89	Required	0.34	NS
5	Check the settings of the phone for functionality	3.58	0.75	Required	0.09	NS
6	Check each ICs inside the phone for functionality	3.60	0.84	Required	0.62	NS
7	Dry-clean the phone using appropriate methods if drop inside the water	3.72	0.75	Required	0.50	NS
8	Check for proper contact of SIM card	3.45	0.82	Required	0.61	NS
9	Clean the whole of cell phone with appropriate agents	3.54	0.49	Required	0.21	NS
10	Check the speaker or mouth piece for proper operation	3.72	0.61	Required	0.09	NS
11	Check the charging point of a phone for functionality	3.63	0.67	Required	0.41	NS
12	Service the screen of a cell phone	3.73	0.73	Required	0.22	NS
13	Check the flash light of a cell phone for proper operation	3.49	0.89	Required	0.21	NS
14	Check the flip flop IC for proper operation in case of sliding phone	3.68	0.71	Required	0.10	NS
15	Check the power ICs of a cell phone for functionality	3.00	0.67	Required	0.11	NS
16	Check all electrical installation operations as designed in schematic manual	3.19	0.78	Required	0.46	NS
17	Check for contact of keyboard for proper operation	3.56	0.68	Required	0.82	NS
18	Check the keyboard IC for effective operation	3.08	0.88	Required	0.12	NS
19	Check the active components in the charger for functionality	2.99	0.79	Required	0.08	NS
20	Check the passive components in the charger for functionality	2.90	0.75	Required	0.78	NS
21	Adjust the screen when malfunctioned	3.56	0.62	Required	0.21	NS
22	Clean the screen of a cell phone with a very soft dampened cotton cloth	3.59	0.71	Required	0.34	NS

Keys: *SD* = Standard Deviation, *NS* = Not Significant, *N* = Number of respondents

Data in Table 2 revealed that all the 22 items on the maintenance competencies required by inmates for servicing cell phones had their mean values ranged from 2.90 to 3.75 which are above the cutoff point of 2.50. This showed that all the 22 maintenance competencies are required by inmates for servicing cell phones. Table 2 also indicates that all the items had their p-values greater than 0.05

at degree of freedom 2 and 129. This shows that there was no significant difference in the mean rating of the lecturers, instructors and road side technicians on the maintenance competencies required by inmates for servicing cell phones in Enugu State. Therefore, the hypothesis of no significant difference was upheld for the 22 competency items

Table 3

Mean Ratings and Analysis of Variance of Lecturers, Instructors and Road Side Cell Phone Technicians on the Safety Precautionary Measures Required by Inmates for Maintenance of Cell Phones

S/N	Competency items	Mean	S.D.	Remarks	P-values	Ho
1	Switch off the cell phone before repair or maintenance	3.07	0.90	<i>Required</i>	0.08	<i>NS</i>
2	Remove the battery of the phone before servicing	3.56	0.82	<i>Required</i>	0.06	<i>NS</i>
3	Be extremely care when disassembling cell phone for any reason	3.50	0.86	<i>Required</i>	0.22	<i>NS</i>
4	Apply the right pry tools and screwdrivers when changing the faceplates or other components	3.61	0.79	<i>Required</i>	0.35	<i>NS</i>
5	Apply recommended soldering iron when working on cell phones	3.76	0.71	<i>Required</i>	0.12	<i>NS</i>
6	Use appropriate tools to remove bad components from a cell phone	3.57	0.82	<i>Required</i>	0.21	<i>NS</i>
7	Always leave the terminals of a battery open always	3.67	0.83	<i>Required</i>	0.34	<i>NS</i>
8	Use a blur tool or as leverage for removing the battery.	3.58	0.90	<i>Required</i>	0.50	<i>NS</i>
9	Never force any parts of cell phone apart; gently pry until they come loose on their own	3.78	0.86	<i>Required</i>	0.62	<i>NS</i>
10	Do not use tweezers, nail files or any other instruments not intended for mobile phone disassembly	3.72	0.81	<i>Required</i>	0.06	<i>NS</i>
11	When setting phone down, place it directly onto the surface	3.79	0.80	<i>Required</i>	0.57	<i>NS</i>
12	Place a cell phone on a smooth soft object while dismantling in the laboratory	3.60	0.82	<i>Required</i>	0.08	<i>NS</i>
13	Use correct tools to open a cell phone	3.72	0.86	<i>Required</i>	0.15	<i>NS</i>
14	Do not overcharge the battery of a cell phone	3.66	0.75	<i>Required</i>	0.47	<i>NS</i>
15	Avoid applying excessive heat on a cell phone's mother board while soldering	3.72	0.83	<i>Required</i>	0.52	<i>NS</i>
16	Use appropriate cleaning agent as a solvent for cell phones	3.11	0.76	<i>Required</i>	0.21	<i>NS</i>
17	Protect hands with gloves and wear safety shoes when operating portable tool and machine	3.69	0.78	<i>Required</i>	0.09	<i>NS</i>
18	Do not bridge or close terminals of a battery for any reason	3.22	0.67	<i>Required</i>	0.43	<i>NS</i>
19	Do not repair or service a cell phone if not conversant with the mode of operation	3.62	0.92	<i>Required</i>	0.10	<i>NS</i>
20	Install save software onto the cell phone in case of smart phones	2.89	0.76	<i>Required</i>	0.78	<i>NS</i>
21	Wear wrist scrap for preventing static current shock	3.56	0.82	<i>Required</i>	0.30	<i>NS</i>
22	Observes, solely rules relating to soldering while soldering a components in a cell phone	2.67	0.88	<i>Required</i>	0.56	<i>NS</i>
23	Handles mother board with care while working on a cell phone to avoid damage	3.50	0.79	<i>Required</i>	0.28	<i>NS</i>

Keys: *SD* = Standard Deviation, *NS* = Not Significant, *N* = Number of respondents

Table 3 revealed that all the 23 items on the safety precautionary measures required by inmates for maintenance of cell phones had their mean values ranged from 2.67 to 3.79 which were above the cutoff point of 2.50. This shows that all the 23 safety precautionary measures were required when maintaining cell phones. Table 3 also indicates that all the items had their p-values greater than 0.05 at degree of freedom 2 and 129. This shows that there was no significant difference in the mean responses of the lecturers, instructors of electrical/electronic technology and road side cell phone technicians on the safety precautionary measures required by inmates for effective maintenance of cell phones. Therefore, the hypothesis of no significant difference was upheld for the 23 safety precautionary measures

Discussion of Result

The findings of the study revealed 35 maintenance competencies in repairing cell phones, 23 maintenance competencies in servicing cell phones and 22 safety precautionary measures required by inmates for effective maintenance of cell phones. The findings of this study therefore show that majority of the lecturers, instructors and technicians agreed with the cell phone maintenance competencies determined for empowering prison inmates. The results of this study were also in agreement with the findings of a study conducted by Ogbuanya and Bakare (2014) on mechatronic skills required for integration into electrical/electronic engineering technology programme in polytechnics for sustainable employment of graduates in contemporary Nigeria. The

findings of the authors revealed that all the areas where graduates require mechatronic skills and the skills identified in the study were needed by graduates of electrical and electronics technology for sustainable employment in contemporary Nigeria. These findings were in agreement with the study of Olaitan, Asogwa and Abu (2011) who conducted a study on technology competencies required by secondary school graduates in maintenance, servicing and repairing of electronic machines for agribusiness occupations to minimize wastage and found that 19 competencies are required by secondary school graduates for maintenance, servicing and repairing of computer, 15 competencies are required by secondary school graduates for maintenance, servicing and repairing of internet and 13 competencies for maintenance, servicing and repairing of phones.

These findings also concurred with the finding of Yakubu (2004) who conducted a study on safety practice skills needed by woodwork students of technical colleges in Kaduna State where he found that students of woodwork in technical colleges needed sixteen safety practice skills in using hand tools; twenty safety practice skills in operating portable power tools; thirty safety practice skills in operating machines; ten safety practice skills in handling wood materials and ten safety practice observances in the use of instructional operating guides. The findings of this were in consonance with the findings of Ifeanyieze and Olaitan (2009) who carried out a study on requisite required for capacity building of teachers of Agriculture for effective teaching of yam production in colleges of Agriculture in south eastern Nigeria. The authors found that teachers of agriculture needs capacity building in 9 skills in each of pre-planting and planting operations; 16 skills in post planting operations, 13 in processing and storage and 18 delivering in instruction.

Furthermore, the results of hypotheses one, two and three show that there were no significant differences in the mean responses of lecturers, instructors of electrical/electronic technology and road side cell phone technicians on the maintenance competencies required by prison inmates for servicing, repairing cell

phones and that there was no significant difference in the mean responses of lecturers, instructors of electrical/electronic technology and road side cell phone technicians on the safety precautionary measures required by inmates for effective maintenance of cell phones. This means that the opinions of lecturers, instructors and road side cell phone technicians were the same on cell phone maintenance competencies required for young prison inmates' empowerment. The findings of the authors in their various studies helped validate the findings of this study on cell phone maintenance competencies required for prison inmates' empowerment in Enugu State.

Conclusion

Cell phone is an electronic device used for communication and it is useful in almost every activity of human endeavour. Maintenance of this gadget is seen as recent and lucrative trade where the potentials of inmates and other youths can be tapped for economic development of Nigeria. Nigerian Prisons Service takes the training of inmates in different occupations or trades as part of its mandates except cell phone maintenance. This study was now conducted because the researcher felt that there is need to expand the scope of training given to the inmates. Competencies for repairing and servicing of all kinds of cell phones were therefore determined to train inmates at various skill acquisition centers.

Recommendations

The following recommendations were made:

1. The cell phone maintenance competencies should be packaged and integrated to the training programme of Nigerian Prisons Service for training of inmates
2. The cell phone maintenance competencies should be integrated to the programme of skills acquisition centre in every State of the federation for training youths and interested adults

References

- Akinduro, I.R. (2006). Electrical installation and maintenance work skills needed by technical college's graduates to enhance their employability in Ondo State. *An Unpublished M.Ed Project* Submitted to the Department of Vocational Teacher Education, University of Nigeria, Nsukka
- Ali, A. (2006). *Conducting research in education and the social sciences*. Enugu: Tashiwa Netwoness Limited.
- Bakare, J. (2014). Development and validation of cell phone maintenance training modules for national diploma students. *An Unpublished Ph.D thesis* Submitted to the Department of Vocational Teacher Education, University of Nigeria, Nsukka
- Bakare, J., Okereke, G.K.O., & Obe, P. J. (2018). E-teaching competencies for capacity building needs of lecturers for effective delivery of technical education programmes in the universities in south eastern Nigeria. *Journal of Technical, Vocational Education Training and Research*, 2(1), 317-328
- Baruch, Y. (1999). Response rate in academic studies- A comparative analysis, *Human relations*, 52, 421-438
- Businesslink (2011). *Cell phones*. Retrieved from <http://www.businesslink.gov.uk/bdottg/action/detail?itemId=107429821&type=resources>
- Christopher, Z. (2013). *Inmates, prisoners, and convicts: what's the difference?* Retrieved from <https://www.prisonerresource.com/life-in-prison/inmates-prisoners-convicts-difference/> on 21/03/2018
- Colvin, M. (2010). Review: David ward. alcatraz: the gangster years. *The American Historical Review*, 115 (1): 247. doi:10.1086/ahr.115.1.246.
- David, U. (2011). *Mobile phone parts*. Retrieved from <http://ezinearticles.com/?Mobile-Phone-Parts&id=1709752> on 15 April, 2011
- Fanimio, D. & Okere, R. (2009). 'Nigerians bemoan rate of unemployment, seek action', *The Guardian*, Tuesday 7, 2012.
- Hahn, H. & Kibora, L. (2008). The domestication of the mobile phone: oral society and new ICT in Burkina Faso. *Journal of Modern African Studies*, (46) 87-109.
- Ifeanyieze, & Olaitan, S.O. (2009). Prerequisite skills required for capacity building of teachers of agriculture of education in South-Eastern Nigeria. *Journal of Faculty of Education*, 10 (1), 29-38
- Ihediwah, O. E. (2007). Measures for effective maintenance of introductory technology equipment in junior secondary schools in Abia State. *An Unpublished M.Ed Project* Submitted to the Department of Vocational Teacher Education, University of Nigeria, Nsukka.
- Jorge, S. A. (2011). *Africa Region of the World Bank says 'unemployed and underemployed youth are more exposed to conflicts and illegal activities-many of them fall prey to armed and rebel conflicts'*. Work bank report 2011
- Merriam-webster (2012). [Prisoner - Definition and more from the free merriam-webster dictionary](https://www.merriam-webster.com/dictionary/prisoner)". Retrieved on 21 / 03 / 2018 from www.merriamwebster.com
- Microsoft (2009). *Encarta dictionary*. USA: Microsoft Corporation
- Nigerian Prisons Service (2017). *Inmates's*

- training and productivity*. Retrieved on 21/03/2018 from http://prisons.gov.ng/inmates_training
- Ogbuanya, T.C., & Bakare, J. (2014). Mechatronics skills required for integration into electrical/electronic engineering technology programme in polytechnics for sustainable employment of graduates in contemporary Nigeria. *Nigerian Vocational Association Journal*, 19 (1), 190-197
- Ogbuanya, T.C., Bakare, J. & Yisa, M.A. (2016). Development of appropriate contents in cell phone maintenance for youth empowerment. *Journal of Association of Vocational and Technical Educators of Nigeria*, 21 (2), 234-246
- Olaitan, S.O. and Ali, A. (1997). *The making of curriculum (Theory, process, product and evaluation)*. Onitsha: Cape Publishers Int. Ltd.
- Olaitan, S.O. and Ekong, A.O. (2000). *Research models*. In S. O. Olaitan (Ed). Researcher skills in education and social sciences. Owerri: Cape Publishers Int. Ltd
- Olaitan, S. O., Asogwa, V. C. & Abu, M. (2011). Technology competencies required by secondary school graduates in maintenance, servicing and repairing of electronic machines for agribusiness occupations to minimize wastage. In N. Onyegegbu, and U. Eze, (eds) *Optimising e-Learning, opportunities for effective educational service delivery*. Enugu: Timex Publisher, (Pg. 60-72)
- State of Victoria (2018). *Work, education and training*. Retrieved from <http://www.corrections.vic.gov.au/home/prison/going+to+prison/work+education+and+training/> on 21/02/2018
- Sowande, K.G. & Olaitan, S.O. (2000). Reducing poverty among youths through skill training in agriculture and technology at secondary school level. *Journal of Nigerian Education Research Association*, 14, 201-203
- United Nation General Assembly (1995). *Youth policy and resources related to rural youth programmes*. Rome: FAO
- Yakubu, A. (2004). Safety practice skills needed by woodwork students of technical colleges in Kaduna State. An unpublished M. Ed project submitted to the Department of Vocational Teacher Education, University of Nigeria, Nsukka
- Zuehike, E. (2009). *Youth Employment and underemployment in Africa brings uncertainty and opportunity*. Population Reference Bureau.