1-2015

Demographic Variables and ICT Access As Predictors Of Information Communication Technologies' Usage Among Science Teachers In Federal Unity Schools In Nigeria

Kolawole Akinjide Aramide Dr
Abadina Media Resource Centre, University of Ibadan, kolaakinjide@gmail.com

Sunday O. Ladipo Rev.
LASUCOM, Ikeja, Lagos, sundayladipo@gmail.com

Ibitayo Adebayo Mr
Abadina Media Resource Centre, University of Ibadan

Demographic Variables And Ict Access As Predictors Of Information Communication Technologies' Usage Among Science Teachers In Federal Unity Schools In Nigeria

Kolawole Akinjide ARAMIDE
Abadina Media Resource Centre
University of Ibadan
kolaakinjide@gmail.com

Sunday O. LADIPO
Lagos State University College of Medicine
Ikeja, Lagos
so.ladipo@yahoo.com

and

Ibitayo, ADEBAYO
Abadina Media Resource Centre
University of Ibadan

Abstract

This study investigated the extent to which demographic variables and ICT access predict ICT use among science teachers in FUS in Nigeria. Out of the Four hundred and sixty four (464) copies of questionnaire administered on science teachers in 25 FGUSs only 353 copies were returned with useful responses. The findings of the study revealed ICT accessibility (B = .431), educational qualification (B = -.187), teaching experience (B = -.154), ICT use experience (B = .152), and location of ICT access (B = .144) as best predictors of ICT use among science teachers in FUSs in Nigeria. Also, the study revealed a low level of access to laboratory-based ICT facilities ($\bar{x}$ = 2.18) and a low level of ICT use ($\bar{x}$ = 1.93) among the science teachers. Moreover, the findings of the study revealed specialized classroom/laboratory ($\bar{x}$ = 0.52), and library ($\bar{x}$ = 0.52) as the most preferred location of ICT access by science teachers in FUSs in Nigeria. Also, positive relationships were established between ICT use experience and ICT use (r = .188), location of ICT access and ICT use (r = 0.278) and degree of ICT accessibility and ICT use (r = 0.471). A positive relationship was also established between location of access and degree of ICT accessibility (r = 0.179). Also, a joint significant relationship was established among demographic variables, location of ICT access, degree of ICT accessibility, and ICT use (F = 20.03 p<0.05) though degree of accessibility was found to contribute more to ICT use among the science teachers than location of ICT access. Demographic variables, location of ICT access and degree of ICT accessibility were found to be responsible for 30.2% of the total variance in ICT use among science teachers in FUSs in Nigeria.

***Keywords**: ICT use, Location of ICT access, ICT accessibility, Demographic variables*

Introduction

Science is a universal subject with no boundaries and the claim for its inclusion in the school curriculum was established based on its ability to revolutionize human life as well as the society. Evidence on relevance of science in schools suggests that science has been

found to have influence on every field of human endeavor. Prakash (2005) while arguing for the inclusion of science in school curriculum described science as a subject that provides unique training in observation and reasoning for students and enables them to form an objective judgment. This is corroborated by Armstrong (2001) who emphasized that science is taught to provide training in and knowledge of scientific method that is useful in life pursuits.

Science as a subject and discipline has contributed immensely to the development in our society and has helped the modern society to be able to respond effectively to changing social, economic, and environmental trends to meet sustainability goals. Olatoye (2007) emphasized that science will continue to be a tool for explaining interactions between human activities and our environment while also proffering solutions to many problems that may arise as a result of human activities.

Turner (2003) presented four arguments to support the teaching and learning of science in schools viz: economic argument, democratic/humanistic argument, skills argument, and cultural argument. The economic argument of teaching science in schools is based on the need to produce more scientists to meet the supply demands in science-related fields. The economic argument is considered as the dominant reason why science is taught especially in advanced and prosperous countries (Hassard, 2010).

The relevance and importance of ICT in the teaching of science has been discussed and advanced at relevant fora. The National Educational Technology Standards (NETS) (International Technology Education Association, 2000), the International Society of Technology in Education, ISTE (2000) and British Educational Communications and Technology Agency, BECTA (2010) recommended the use of ICT in the teaching of science subjects, as a result of observation that reveals that science teachers are not using ICT for teaching and learning of science.

Ramayah (2006) emphasised that ICT provides access to a huge range of resources that are of high quality and relevant to scientific learning. In some instances, the multimedia resources available enable visualization and manipulation of complex models, three dimensional images and movement to enhance understanding of scientific ideas. Lua and Sim (2008) reiterated the capability of ICT in widening the range of materials that can be used in teaching and learning to include text, still and moving images and sound, and increase the variety of ways that the material can be used for whole class and individual learning. Therefore, science teachers have the opportunity of meeting the needs of students with different learning styles as well as being creative in their teaching through the use of ICT.

Of what use is Demographic variables a determinant to effective teaching?

Demographic variables have been described as major factors that may influence or predict the use of ICT resources by individuals. Among the demographic factors that are often cited as having an influence on ICT use include: gender; income; level of education, skills and age (UNDP, 2011; Inan and Lowther, 2009). For the purpose of this study, demographic variables such as age, gender, teaching experience, subject(s) taught, computer use experience, and educational qualification were considered. Therefore, for teachers to effectively make use of ICT resources in the classroom, they must have easy access to various types of ICT resources (Alston, Miller, Chanda, and Elbert, 2003). Access describes the extent to which a particular user is able to easily locate particular resources for use as well as the degree of accessibility of accessibility of such resources. Access is a factor that can influence the use of ICT resources by the science teachers. The ease of location would determine whether a teacher would use ICT resources for teaching or not. It is expected that if teachers finds it easy locating ICT resources the tendency to use such resources is high and vice versa.

There had been several studies on the use of ICT by teachers such as Aladejana (2007), Jarosievitz (2009), Hernesey, Harrison, and Wimkote (2010), Oye, Iada, and Rabin

(2011), and Jarosievitz (2012). The researcher is unaware of any study that has investigated the combination of demographic variables and ICT access as factors that predict ICT use among science teachers in FUSs in Nigeria. Therefore, the focus of this study is to investigate the extent to which demographic variables such as age, gender, subjects taught, educational qualification, ICT use experience, and teaching experience as well as degree of ICT accessibility and location of ICT access predict ICT use among science teachers in Federal Unity Schools in Nigeria. The following research questions were addressed in this study:

Objectives of the Study

The broad objective of this study is to investigate the extent to which demographic variables, ICT accessibility, and location of ICT access predict their use of ICT in teaching at the Federal Unity Schools (FUSs) in Nigeria. The specific objectives of the study are to:

i. investigate the pattern of ICT access (i.e location of access and degree of accessibility) among science teachers in FUSs in Nigeria
ii. determine the relationship among demographic variables, ICT access, and ICT use by science teachers in FUSs in Nigeria.
iii. find out the best predictors of ICT use among the demographic variables (age, gender, subjects taught, educational qualification, ICT use experience, and teaching experience), degree of ICT accessibility and location of access among science teachers in FUSs

Research Questions

The following research questions were answered in the study

1. What is the degree of ICT accessibility among science teachers in FUSs in Nigeria?

2. Where is the preferred location of ICT access among science teachers in FUSs in Nigeria?
3. What relationships exist among demographic variables, ICT access, and ICT use by science teachers in FUSs?
4. Which of the demographic variables (such as age, gender, subjects taught, educational qualification, ICT use experience, and teaching experience), degree of ICT accessibility and location of ICT access predict ICT use?

Research Hypotheses

The following hypotheses were tested at 0.05 level of significance

H_{01}. There is no significant joint relationship among demographic variables, ICT accessibility location of access and ICT use among science teachers in FUSs

H_{02}: There is no significant relative contribution of demographic variables, ICT Accessibility and location of ICT access to ICT use by science teachers in FUSs in Nigeria

Literature Review

Interest in the use of ICT resources especially in secondary education is increasing significantly (Alampay, 2006). Therefore, as the teaching importance of ICT resources continue to rise among teachers involved in secondary education, understanding of the factors that encourage ICT use among the teachers become critical (Jiang, Hsu, Klein and Lin, 2000). Alampay (2006) while commenting on differences in capabilities and opportunities to access and use of ICT resources by people affirmed that while access to ICT is a prerequisite to use, the capability approach says that individual differences, capabilities and choice play a role on whether an individual will make use of these ICT resources.

Scholars have theorized demographic factors as having the ability to determine the extent of use or non-use of ICT. Among the demographic factors that are often cited as having

an influence on ICT use: gender; income; level of education, and age (UNDP, 2011). Olatokun (2009) highlighted demographic factors such as income level, level of education, age, and gender as the key individual differences that determine the freedoms, capabilities and functioning's that relate to ICT use.

Mayanja (2002) affirmed the influence of age on the use of ICT by reporting that young teachers make use of ICT resources more than the old people. According to the study, young teachers within the age range of 21-40 years were found to be more capable of using the ICT resources than every other age group. One explanation for this is the fact that the ICT is a more recent development and that the young population would have had the benefit of being exposed to it in their schools. This was corroborated by Alampay's (2006) study in the Philippines that emphasised that the use of ICT is more pronounced among the younger generation. Sanni, Awoleye, Egbetokun and Siyanbola (2010) corroborated Mayanja (2002) views on age differences in ICT use. According to them ICT usage is more pronounce among the younger teachers than among their older counterparts.

On the issue of gender and ICT use, Kirk and Zander (2004) reported gender as a very influencing factor on ICT use.. They (Kirk and Zander) reported that there is a gender digital divide, as result of high versus low literacy, high versus low income and rural-urban divide. According to Alampay (2006) men were more receptive to ICT use than women which may mean that male teachers would be more receptive to ICT use than female teachers. This according to Alampay (2006) may be due to the fact that women are more preoccupied with other issues that they do not have time to use the ICT facility. Research findings on gender gap have shown that females teachers differ in terms of ICT use (Mitra, 2001; Liu, 2000; Butler, 2000).

Furthermore, scholars such as Abu-Obadieh et.al. (2012), Teczi (2009), Jawarneh, El-Hersh and Khazaleh (2007), Sabariah Sharif, Khaziati and Osman (2005) have

established, in their studies, a non-significant influence of teachers' demographic characteristics in terms of gender on teachers' ICT use in contrast to studies by Samak (2006), Sadik, (2005), and Lu and Mille (2002) that found a significant influence of gender on ICT use by teachers.

As far as education qualification is concerned, it was important, not only with respect to gaining the needed skills to use ICT, but also with respect to people's motivation to even use ICT. Olatokun (2009) emphasised that level of education had the strongest influence on the use of ICT as most of the people that use ICT are mainly educated people. Yi (2008) also asserts that those with higher education levels are more likely to use ICT because they may have more skills and chances to go online. At the same time, the role of formal education in building teachers equipped with ICT skills is currently the subject of debate. Taylor (2003) reported that teachers with higher education levels are more likely to use ICT because they may have more skills and chance to go online. Meso, Musa and Mbarika (2005) reported academic discipline as another demographic factor that determines the adoption and use of ICT by teachers. They reported a significant difference between academic discipline of teachers, (that is, science, social sciences and humanities, and arts) and their use of ICT. Teachers in the social sciences and humanities were found to use ICT the most.

The relationship between years of experience of teachers and ICT use was also investigated by various scholars with the results showing variations in findings. For example, Mueller, Wood, Willoughby, Ross, and Specht (2008) investigated the discriminating variables between teachers who fully integrate computers and teachers with limited integration and found no significant relationship between teaching experience of teachers and their use of ICT in teaching. This is also corroborated by Abu-Obaideh et.al. (2012) study that revealed a no significant relationship between teachers' years of experience and ICT use in teaching process. This result is however inconsistent with the results of the study conducted by Inan and Lowther (2009) which revealed that

years of teaching experiences affect teachers' use of computer in a negative manner. Also, Kalogiannakis (2008), Ertmer (2005), and Bebell, Russel, and O'Dwyer (2004) revealed through their studies that teachers' years of work experiences influence the teachers' ICT use in teaching. These are pointers to the fact that demographic variables do have implications on ICT use by teachers.

The researchers at the Center for Applied Special Technology (2006) pointed out that acquisition of computers and other related resources is not enough to guarantee the use of ICT resources by teachers but adequate access should be guaranteed. This can be in form of making the ICT resources available in allocation where the teachers can easily have make use of it without any difficulties. This ease of access may end up increasing the frequency of use of the resources. Ertner (2005) describes schools acquisition of computers as just the beginning of ensuring use.

Obviously, for teachers to use computers in classroom instruction, they must have access to computers. While great strides are being made to place computers in classrooms in schools, there are still some great inequalities of access (Russek, 2001). The type of access is an issue because teachers find signing up for the use of a laboratory cumbersome and inconvenient. Teachable moments do not often allow the luxury of signing up for the computer laboratory.

For teachers to effectively use ICT for teaching in classrooms, they must have easy access to the various types of ICT resources. Alston, Miller, and Williams (2003) found that in North Carolina schools, certain types of technology were widely available and accessible for teachers use, meaning the various types of ICT resources were located in the classroom or were easily accessible within the building. Therefore location of access can be considered as a major factor that may influence the use of ICT resources by teachers. Access to ICT within the school is an important component when implementing its use into the classroom (Alston, Miller, and Williams, 2003).

Research Methodology

This study adopted the multi-factor co relational research design. The population of the study comprises all the science teachers in all the Federal government unity schools (FUSs) spread across the six geopolitical zones and thirty six including Federal capital territory, Abuja, in Nigeria. There is a total of one hundred and four (104) unity schools distributed across Nigeria. The multi-stage sampling technique was adopted in selecting the sample population for the study. At the first stage of selecting the sample, the systematic sampling technique was used in selecting every fourth school on the list of the FGUSs arranged in a serial order. Thus, twenty-five FUSs were selected for the study as follows: North West (4), North Central (3), North East (5), South West (5), South East (2), South South (5), and FCT (1). At the second stage of the sampling procedure, the total enumeration method was adopted in view of the fact that the total population of the science teachers in the selected FUSs is not much. Therefore, a total of 464 science teachers, comprising 103 biology teachers, 101 chemistry teachers, 154 mathematics teachers, and 106 physics teachers were selected for the study (Appendix 1). Also, the school library media specialists (25) in the selected FUSs formed part of the respondents.

Two sets of questionnaire namely DIACSAUTQ for science teachers and QSLMCPIU for school library media specialists were adopted for this study. The two sets of the questionnaires were trial-tested on some science teachers and school library media specialists in two selected FUSs in Oyo and Osun states that were not part of the main study. The data collected were subjected to Cronbach Alpha reliability coefficient with the results from DIACSAUTQ and QSLMCPIRU revealing 0.92 and 0.93 respectively. These were considered suitable and appropriate for the study.

Data analysis and Interpretation

The background information of the teachers revealed that there are more science teachers within the age range of 20-40 years (263, 74.5%) than within the age range of 41-60 years (90, 25.5%). The distribution of the science teachers based on gender revealed that

there are more male science teachers (199, 56.4%) than female science teachers among the respondents. The result on the highest qualification possessed by the science teachers revealed that majority of the science teachers holds a Bachelor degree (232, 65.7%) just as there are more science teachers with qualification in education (288, 81.5%) which is a prerequisite for teaching in schools. Further results on the background information revealed that majority of the respondents (232, 65.7%) have taught for 5 years and above which implies that the science teachers have considerable experience in teaching. Furthermore, the background information of the teachers based on subject taught revealed the distribution of the science teachers as constituting, 130 physics teachers (36.8%), 108 biology teachers (30.6%), 45 chemistry teachers (12.7%), and 70 mathematics teachers (19.8%).

Analysis of the background information of school librarians revealed that there are more school librarians (22 or 91.7%) within the age range of 41-60 years. The distribution of the school librarians based on gender revealed that there are more male (18 or 75.0%) than female among the school librarians. Further analysis of the demographic information of respondents revealed that majority of the school librarians are graduates (17 or 70.8%). This implies that majority of the school librarians possessed the minimum qualification to teach in secondary schools in Nigeria. However, results of the analysis revealed that only few of the school librarians (6 or 25.0%) possess qualification in librarianship. This implies that only few of the school librarians in FUSs in Nigeria are professional qualified.

Research question 1: What is the degree of ICT accessibility among science teachers in FUSs in Nigeria?

Table 1: Response on Degree of ICT accessibility

Statement	**Response**				**Mean**	**S.D**
	VEA	**EA**	**OA**	**NA**		
Computer Aided Instructional Software	76 21.5%	64 18.1%	45 12.7%	168 47.6%	2.14	1.23
Individualized instruction tutorials (e.g) Science for Student	63 17.8%	81 22.9%	20 5.7%	189 53.5%	2.05	1.22
Instructional video/audio tapes	100	39	70	144	2.27	1.26

	28.3%	11.0%	19.8%	40.8%		
Multimedia projectors	119 33.7%	77 21.8%	12 3.4%	145 41.1%	2.48	1.32
Presentation software(Power Point, KidPix)	105 29.8%	41 11.6%	17 4.8%	190 53.8%	2.40	1.38
Computers	158 44.8%	85 24.1%	10 2.8%	100 28.3%	2.85	1.26
Word Processor	154 43.6%	41 11.6%	9 2.5%	149 42.2%	2.57	1.40
E-mail (for Online communication with students)	114 32.3%	54 15.3%	43 12.2%	142 40.2%	2.40	1.30
Interactive whiteboard/Smart board	72 20.4%	39 11.0%	45 12.7%	197 55.8%	2.64	1.33
Spreadsheet program (Excel etc)	151 42.8%	44 12.5%	37 10.5%	121 34.3%	2.64	1.33
Online databases	132 37.4%	85 24.1%	14 4.0%	122 34.6%	2.64	1.29
Models/Modeling software	82 23.2%	31 8.8%	11 3.1%	229 64.9%	2.37	1.34
Simulation programme and Games	61 17.3%	22 6.2%	10 2.8%	220 62.3%	2.44	1.44
Graphical visualizing tools	115 32.6%	25 7.1%	11 3.1%	202 57.2%	2.49	1.43
Concept mapping software	111 31.4%	21 5.9%	37 10.5	184 52.1%	2.49	1.36
Multimedia resources	141 39.9%	75 21.2%	6 1.7%	131 37.1%	2.64	1.33
Discussion list/Newsgroup	92 26.1%	39 11.0%	7 2.0%	215 60.%	2.45	1.41
Web-based Internet laboratories	86 24.4%	46 13.0%	17 4.8%	204 57.8%	2.48	1.38
Weighted Mean Average					**2.18**	

Key: (VEA) Very Easily Accessible (EA) Easily Accessible (OA) Occasionally Accessible, (NA) Not Accessible

Table 2 presents information on ICT accessibility by science teachers in FGUSs in Nigerian and it revealed that ICT facilities are accessible by science teachers in FGUSs. However, not all the ICT facilities were found to be accessible. Computers (253or 71.7%) spreadsheet program (232 or 65.8%), online database (231 or 65.5%), multi-media resources (222 or 62.8%), instructional video or audio tapes (209 or 59.1%), multimedia projectors (208 or 58.9%), and computer aided instructional software (185 or 52.4%) were found to be ICT facilities that are commonly accessible to the science teachers. However, the level of accessibility of science-based ICT such as web-based laboratories,

simulation programs and games, model/modeling software, graphical visualizing tools, (and science presentation software was found to be very low. The implication to be drawn from this is that science based ICT facilities are not readily accessible to the science teachers in FUSs

Research question 2: Where is the preferred location of ICT access among science teachers in FGUSs in Nigeria?

Table 2: Preferred location of ICT access by science teachers

Location of access	Frequency	Percentage	Mean	Std Dev
Classroom	55	15.6	0.16	0.363
Library	91	25.8	0.26	0.438
Specialized classroom/laboratory	185	52.4	0.52	0.880
Science laboratory	89	25.2	0.25	0.435
Teachers' office	88	15.3	0.15	0.360
Staff room	54	12.5	0.12	0.331
Meeting room	44	12.2	0.12	0.328
Multimedia classroom	43	19.5	0.20	0.397
Cybercafé	69	19.3	0.19	0.395
At home	68	12.2	0.12	0.328
ICT laboratory	43	9.3	0.09	0.292
Other locations	33	27.2	0.27	0.446

Table 2 presents information on the preferred location of ICT access by the science teachers. It revealed the most preferred location of ICT access by science teachers as specialized classroom/laboratory (185 or 52.4%, $\bar{x}$ = 0.52). Other location preferred by the science teachers include, library (91 or 25.8%, $\bar{x}$ = 0.52), science laboratory (89 or 25.2%, $\bar{x}$ = 0.25), teachers' office (88 or 15.3%, $\bar{x}$ = 0.15), cybercafé (69 or 19.3%, $\bar{x}$ = 0.19), and at home (68 or 12.2%, $\bar{x}$ = 0.12). This implies that the most used location of access to ICT facilities by the science teachers is the specialized classroom/laboratory within the school.

Research question 3: What are the relationships among demographic variables (age, gender, subject taught, teaching experience, educational qualification, and years of

using ICT), ICT accessibility, location of ICT access and ICT use by Science teachers in FUSs?

Table 3: Summary of Test of Significant Relationships among Variables of Interest

S/N	Variable	$\bar{x}$	SD	1	2	3	4	5	6	7	8	9
1	ICT Use	1.32	1.59	1.000								
2	Age range	1.99	1.02	-.301	1.000							
3	Gender	1.44	0..50	-.033	.041	1.000						
4	Subject (s) taught	2.14	1.11	-164	.485	.075	1.000					
5	Highest educational qualification	2.88	1.44	-110	.015	.154	-.077	1.000				
6	Teaching experience	2.48	1.50	-.277	.649	-.039	.462	.164	1.000			
7	ICT use experience	1.69	0.92	.188	-.099	-.062	-.017	.432	.108	1.000		
8	ICT accessibility	2.45	1.36	.471	-.483	.032	-.445	.170	-.298	.305	1.000	
9	Location of ICT access	0.79	2.93	.278	-.193	-.013	-.098	-.187	-.210	-.003	.179	1.000

N.B: **Sig p<0.05

In Table 3 presents information on the relationships between the independent variables (demographic variables such as age, gender, subjects taught, teaching experience, ICT use experience, educational qualification, ICT accessibility, and location of ICT access) and ICT use. It revealed that age range of respondents (r = -0.301), subject(s) taught (r = -0.164), educational qualification (r = -.110), and teaching experience (r = -0.277) as negatively correlated with ICT use. It can be inferred from the information that younger science teachers and science teachers teaching less difficult subjects tend to use ICT more than older teachers. Also, it may be inferred that science teachers with lower educational qualification and less teaching experience use ICT more than science teachers with higher educational qualification and higher teaching experience. On the other hand ICT use was positively related to ICT use experience (r = .188), ICT accessibility (r = .278), and location of access (r = .278). This implies that science teachers with higher ICT use experience make use of ICT more than science teachers with lower ICT use experience.

Ease of ICT accessibility by science teachers and ease of accessing location of ICT access would also contribute more to ICT use among science teachers in FUSs in Nigeria.

Research question 4: Which of the demographic variables (such as age, gender, subjects taught, educational qualification, ICT use experience, and teaching experience), degree of ICT accessibility and location of ICT access predict ICT use?

Table 4: Summary of Level of Prediction of Independent Variables on Dependent Variables

Model	Variable	R	R square	Adjusted R Square	Std Error of the Estimate
1	Accessibility to ICT	.471	.222	.219	1.405
2	Location of ICT access	.510	.260	.256	1.372
3	Educational qualification	.533	.284	.278	1.352
4	ICT use experience	.549	.301	.293	1.338
5	Teaching experience	.558	.312	.302	1.329

Table 4 above revealed ICT accessibility and location of ICT access as best predictors of ICT use among the science teachers. ICT accessibility topped the list of best predictor of ICT use contributing 21.9% to the total variance in ICT use (Step 1). This is followed by location of access that contributed 4.7% to the total variance in ICT use as a variable and together with ICT accessibility contributed 25.6% to the total variance in ICT use (Step 2). The third predictor of ICT use is educational qualification that added 5.2% to the total variance in ICT use and together with ICT accessibility and educational qualification accounted for 27.8% of the total variance in ICT use (Step 3). Moreover, teaching experience alone, as a predictor of ICT use added 1.5% to the total variance in ICT use while together with ICT accessibility, location of ICT access, and educational qualification contributed 29.3% to total variance in ICT use. Also, teaching experience was found to have independently contributed 0.9% to the total variance in ICT use and together with ICT accessibility, location of ICT access, educational qualification, and

ICT use experience accounted for 30.2% of the total variance in ICT use among science teachers in FUSs.

H_{01}: There is no significant joint relationship among demographic variables, ICT access and ICT use by science teachers

Table 5: Summary of regression analysis showing significant status of joint relationship of demographic variables, computer self-efficacy, attitude toward ICT, ICT access, role of SLMC, and ICT use

Model	Sum of Squares	df	Mean Square	F	Sig
Due to Regression	283.05	8	35.38	20.03	.000
Due to Residual	607.77	344	1.77		
Total	890.82	352			

$R = 0.564$, $R^2 = 0.318$, Adjusted $R^2 = 0.302$, SEE = 1.329

a. Predictors: (Constant), Subject(s) taught, Gender, Years of using, ICT, Teaching experience, Highest educational qualification, Age range, ICTaccessibility, Location of ICT access.
b. Dependent variable: Use

From Table 5 it can be inferred that there is a joint significant relationship among independent variables (demographic variables, ICT accessibility, location of ICT access) and dependent variables (ICT use) among science teachers in FUSs in Nigeria (F – 20.03, $p = .000<0.05$). Therefore, the null hypothesis is rejected. It was further observed that demographic variables, ICT accessibility, and location of ICT access jointly accounted for 30.2% of the total variance in ICT use ($r^2 = 0.302$).

H_{02}: There is no significant relative contribution of demographic variables, Degree of ICT Accessibility, Location of ICT Access to ICT Use by science teachers in FUSs in Nigeria

Table 6: Multiple regression analysis showing relative contributions of independent variables to dependent variable

Model	Unstandardised	Standard	t	Sig

	Coefficients'		Coefficients		
	B	Std Error	Beta		
ICT Use	.359	.368		.977	.329
Age	.013	.102	.008	.123	.902
Gender	-.066	.149	-.021	.443	.658
Subject(s) taught	.134	.081	.094	1.668	.096
Educational qualification	-.206	.058	-.187	3.527	.000
Teaching experience	-.163	.067	-.154	2.441	.015
ICT use experience	.283	.092	.152	2.853	.005
ICT accessibility	.505	.067	.431	7.580	.000
Location of ICT access	.078	.025	.144	3.081	.002

Table 6 presents information on the relative contribution of independent variables (demographic variables, ICT accessibility, and location of ICT access) to the dependent variable (ICT use by science teachers) and it revealed educational qualification, ($B = -.187$, $t = 3.527$, $p<0.05$), teaching experience ($B = -.154$, $t = 2.441$, $p<0.05$), ICT use experience ($B = .152$, $t = 2.853$, $p<0.05$), ICT accessibility ($B = .431$, $t = 7.580$, $p<0.05$), and location of ICT access ($B = .144$, $t = 3.081$, $p<0.05$) as factors that significantly contribute to the use of ICT by among science teachers. This implies that educational qualification, teaching experience, ICT use experience, ICT accessibility, and location of ICT access are the only factors that significantly contributed to and predict ICT use among the science teachers

Discussion of findings

ICT Access by Science teachers in FUSs

Effective use of ICT resources by teachers is dependent on the ease of access to various types of ICT resources (Alson, Miller, and Williams, 2003). This study investigated the degree of accessibility of ICT facilities and location of ICT access among science

teachers in FUSs and the findings from the study revealed only few ICT facilities such as computers, spreadsheet program; online database, multimedia resources and projectors, instructional video or audio tapes, and computer aided instructional software are easily accessible to the science teachers while other ICT facilities such as simulations, models, web-based laboratories, and graphical visualizing tools were found not to be frequently accessed by the science teachers. This implies that there is high level of accessibility to general ICT facilities among science teachers in FUSs but a low level of accessibility to science-based ICT facilities such as web-based laboratories, simulation programs and games, model/modeling software, graphical visualizing tools, and science presentation software. This implies that science-based ICT applications are not easily accessible to science teachers in FUSs in Nigeria.

On the location of ICT access among the science teachers the findings from the study revealed "specialized classroom/laboratories as the most preferred location of ICT access by science teachers in FUSs. This may be due to the fact that the specialised classroom/laboratories are adequately equipped with ICT facilities and easy to access by the science teachers. The fact that most of the teachers in FUSs are resident within the school premises may also be responsible for the preference for the specialised classroom/laboratories by the science teachers. Observations on ICT access by science teachers revealed that ICT facilities are located in specialised buildings, for example CISCO building, ICT building, or Computer building, in the FGUSs selected for the study. This corroborates (Edward (2005) that reiterated the importance of making ICT resources available in locations within the school where teachers can easily have access if the teachers are to make use of ICT without difficulties. This study investigated the relationship between location of access and degree of accessibility and established a positive relationship between location of access and degree of accessibility. This in turn may mean that ease of accessing location would determine ease of accessibility which in turn may lead to use.

Relationship between demographic variables, ICT access, and ICT use by science teachers

Findings from the study revealed educational qualification, ICT use experience, and teaching experience as demographic variables that predict ICT use by the science teachers in FUSs. This is in support of Teczi (2010) and UNDP (2011) findings that emphasised level of education, and computer use experience as major determinants of ICT use. Educational qualification was found to be the strongest predictor of ICT use among the demographic variables ahead of ICT use experience and teaching experience.

Furthermore, findings from the study on the demographic variables that determine ICT use among science teachers in FUSs in Nigeria established a negative but significant relationship between teaching experience and ICT use by science teachers in line with Inan and Lowther (2009) findings which reported that teaching experience affect teachers' use of computer in a negative manner and Tezci (2010) findings that also reported a significant relationship between teaching experience and ICT use by teachers. Also, findings from the study established a significant relationship was established between years of using ICT (ICT use experience) and ICT use by science teachers in FUSs in Nigeria. This is in agreement with Isman, Evigreen, and Cengel (2008) findings that reported significant relationship between ICT use experience and ICT use.

Educational qualification was also found to be negatively but significantly related to ICT use by science teachers which is in contrast with Lua and Sim (2008) educational qualification as having a significant effect on ICT use among secondary school teachers in Malaysia. Analysis of the relationship between gender and ICT use by the same teachers as revealed by this study established a non-significant relationship as oppose to Tezci (2010) findings that reported a significant relationship between gender and ICT use by teachers. The implication to be drawn from this is that educational qualification, ICT use experience and teaching experience were demographic variables that significantly contribute to the use of ICT by science teachers in FUSs in Nigeria.

Age, subject taught, and gender were found to have no significant relationship with ICT use which corroborates the findings of Myanja (2002) that reported age of teachers as having significant influence on their use of ICT. On the other hand, finding on subject taught was at variance with Mbarika (2005) that reported a significant difference between academic discipline of teachers and their use of ICT.

Summary and Conclusion

The study investigated the extent to which demographic variables and ICT access have predicted ICT use among science teachers in FUSs in Nigeria. The study revealed that demographic variables such educational qualification, ICT use experience, and teaching experience do predict the use of ICT by science teachers but are negatively related to ICT use. Educational qualification was found to be the leading demographic variables predicting ICT usage among science teachers in FUSs in Nigeria. Also, accessibility to ICT (ICT) and location of ICT access were found to be the leading predictor of ICT use among science teachers in FUSs in Nigeria. Therefore, ICT access is an indispensable requirement and a predictor of ICT utilization among science teachers in FUSs

Furthermore, the study revealed a low level of access to science-based ICT facilities and application, such as simulations and modeling, and graphical visualizing tools, among the science teachers in FUSs in Nigeria. Different types of location of access of ICT facilities exist in FUSs in Nigeria such as specialized classroom/laboratories, school library media centre, and teachers; office.

Recommendations

The following recommendations were made based on the findings of the study:

1. Provision should be made for access to ICT facilities within the school environment such as in the school library media centre, ICT centre et cetera to guarantee ease of locating and accessing by the teachers.

2. Also, easy accessibility to the ICT resources placed in the different locations within the school should be guaranteed. Every form of bottlenecks, rules, and regulations that may constrain ease of accessibility should be discouraged to ensure that a science teacher finds it easy to have access to the ICT facilities.
3. The school management and government should ensure the provision of latest relevant technologies that would enhance effective teaching and learning in FUSs. This would enable the teachers to use the technologies in meeting the different learning styles of the students.
4. Government should also make provision for science-based ICT applications such as simulations, modeling, and graphic visualizing tools that do make teaching meaningful and real. Science-based ICT applications ensure the replacement of the abstract nature of teaching that characterized traditional teaching with meaningful and real teaching.
5. Science teachers should endeavor to use ICT facilities for laboratory-based and experimentation activities.
6. There is need for training and re-training of science teachers especially the older ones to integrate them into the digital era and equip them adequately for ICT use for teaching.

References

Abu-Obaideh, A., Ab Rahim, B., Ramlah, H., & Asimiran, S. (2012). Effects of demographic characteristics, educational background, and supporting factors on ICT readiness of technical and vocational teachers in Malaysia. *International Education Studies, 5.6*: 229-243

Aladejana, F. (2007). The implications of ICT and New Kind of Science (NKS) for Science teaching: whither Nigeria. *Complex Systems* 17: 113-124. Available at http://www.complexsystem/Nigeria/17. Retrieved 22/10/2009

Albirini, A. (2006). Teachers' attitudes toward information and communication technologies: The case of Syrian EFL teachers. *Computers & Education*, *47*.4, 373-398.

Alborne, E. (2008). The importance of school-scientist partnerships: The challenge facing school science. *Text of a Presentation to the Parliamentary and Scientific Committee, 27 Octob*er

Al-Mekhlafy, M. & Al- Basha, N. (2000). Integration computer in secondary instructional. Sana'a, Research Center.

Alston, A.J., Miller, W.W., Chanda, D. & Elbert, C.D. (2003). A correlational analysis of instructional technology characteristics in North Carolina and Virginia secondary agricultural education curricula. *Journal of Southern Agricultural Education Research,* 53 (1): 140-153

Al-Zaidiyeen, N., Mei, L., & Fook, F. (2010). Teachers' attitudes and levels of technology use in classrooms: The case of Jordan schools. *International Education Studies*, 3(2), 211-218.

Anderson, J. (2004). IT, e-learning and teacher development. *International Educational Journal* 5 (5): 1-14.

Armstrong, H.E. (2001). Scientific method in board schools. Popular Science Monthly, 46. Retrieved from en.wikisource.org/wiki/popular_science_monthly_volume_46/March_1885/Scientific_Method_in_Board_Schools

Bebell, D., Russell, M., and 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.

Benedetto, A.O (2005). *Does technology influence teaching practice in the classrooms*? Paper presented at the National Educational Computing Conference, Philadelphia.

British Educational Communications and Technology Agency (BECTA). (2010). *Leading next generation learning*. Retrieved from http://www.education.gov.uk

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development, 53*.4: 25–39. Retrieved from http://dx.doi.org/10.1007/BF02504683 om 19th May, 2012

Francis-Pellon, L. and Pellon, T.W. 1996. Building attitudes: How a technology course affects preservice teachers' attitudes about technology. Retrieved from http://www.math.bym.edu/

Garland, K. J. and Noyes, J. M. 2004. Computer experience: a poor predictor of computer attitude. *Computers in Human Behavior*, *20*: 823-840.

Godwin, S. 2004. Whole-class technology for learning mathematics: the case of functions and graphs, *Education, Communication & Information*, 4.1: 131-152.

Haddad, W. D. 2003. *Is instructional technology a must for learning?* Techknowlogi.org, retrieved, September 23, 2004, from http://www.techknowlogia.org/TKL_active_pages2/CurrentArticles/main.asp?IssueNumber=19&FileType=HTML&ArticleID=455.

Hassard, J. (2010). Why do we teach science? The art of teaching science. Retrieved from artofteachingscience.org/2010/11/25/why-do-we-teach-science/on 13/11/2012

Hennesy, S., Harrison, D. & Wimkote, L. (2010). Teacher factors influencing classroom use of ICT in Sub-sSharan Africa. *Itupale Online Journal of African Studies*, 2: 39-54

Hew , K. F. & Btush, T. (2007). Integrating technology into K-12 teaching and learning: current knowledge gaps and recommendations for future research. *Educational Technology Research and Development, 55.3*: 223-252

Inan. I, A., & Lowther. D. L. (2009). Factors affecting technology integration in K-12 classrooms: a path model. *Education Tech Research Dev., 58*.2: 137-154. Retrieved from http://dx.doi.org/10.1007/s11423-009-9132-y on 30th May 2011

Ingersoll, P. & Culsaw, J. (2004). *Managing information technology*. Connecticut, Libraries Unlimited.

International Society for Technology Education. (2000). National education technology standards for teachers. Eugene OR. *International Society for Technology in Education Projects*. Retrieved from http://onets.iste.org/index3.html on 15 June, 2012

International Technology Education Association (ITEA). (2000). Standards for technological literacy. Content for the study of Technology. Reston, Virginia

Isman, A. Evigreen, H. & Cengel, M. 2008. Barriers to Internet use among teachers employed in the provincial directorate of MNE in Sakarya. *Proceedings of the 8th International Educational technology Conference.* Retrieved from http://ietc2008.home.anadolu.edu.tr/ietc2008/29.doc

İşman, A., Evirgen, H. & Çengel, M. (2008). Barriers to Internet use among teachers employed in th provincial directorate of MNE in Sakarya]. *8th International Educational Technology Conference Proceedings.* Retrieved on 20 October, 2010, from: http://ietc2008.home.anadolu.edu.tr/ietc2008/29.doc

ISTE. 2004. *The National Educational Technology Standards*, retrieved November 30, 2010 from http://www.iste.org/standards/.

Ittigson, R.J & Zasse, J. G. (2003).Technology in the mathematics and Science classroom. In Tomei, L.A.(Ed). Challenges of Teaching with Technology Across the Curriculum: Issues and Solutions. Hershey: *Information Science Publishing,* 114-133

Jarosienvitz, B. (2012). ICT in physics teaching for secondary schools and colleges. *New Perspective in Science Education*

Jarosievitz, B. (2007). ICT used in physics education. In: 101 innovative idea (Microsoft). Retrieved from http://download.microsoft.com/download/b/b/584cad on 15/11/2012

Jenkins, D. R. (2008). Computer literacy, access, and use of technology in the family and consumer sciences classroom. A Master's Theses submitted to University of Kentucky. Retrieved from http://uknowledge.uky.edu/grads_school_theses/515

Jewitt, C & Scott, P. (2002). Meaning Making in science classrooms: a joint perspective drawing on multimodal and sociocultural theoretical approaches *Language, action and communication in science education symposium*, ISCRAT, 2002.

Kalogiannakis, M. (2008). Training with ICT for ICT from the trainee's perspective. A local ICT teacher training experience. *Education and Information Technologies Journal, 15*(1), 3-17. Retieved from http://dx.doi.org/10.1007/s10639-008-9079-3 on 22 June, 2012

Lau, B., & Sim, C. (2008). Exploring the Extent of ICT Adoption among Secondary School Teachers in Malaysia. *International Journal of Computing and ICT Research, 2*.2: 19-36.

Mitra, A. Lenzmeier, S., Steffensmeier, T., Avon, R. Qu, N & Hazen, M. (2001). Gender and computer use in academics institution. Report from a longitudinal study. *Journal Education computing Research* 23.1: 67-84.

Meso, D., Musa, F., Mbarika, V.M.A., Okoli, C., Byrd, T.A. and Delta, P. (2005). The neglected continent of IS research: A research agenda for Sub-Saharan Africa. *Journal of the Association for Information Systems, 6.5*: 130-170

Mueller, J., Wood, E., Willoughby, T., Ross, C., & Specht, J. (2008). Identifying discriminating variables between teachers who fully integrate computers and teachers with limited integration. *Computer & Education*, 51.4: 1523-1537. Rettrieved from http://dx.doi.org/10.1016/j.compedu.2008.02.003 on 26th Feb, 2012

Olatoye, R.A. (2007). Effect of further mathematics on students' achievement in mathematics, biology, chemistry, and physics. International Journal of Environmental and Science Education, 2.2: 48-53. Retrieved from www.ijese.com on 11/02/2013

Oye, N.D., Iahad, N.A. & Rabin, Z.A. (2011). A model of ICT acceptance and use for teachers in higher education institutions. *International Journal of Computer Science and Communication Networks, 1.1*: 22-40

Papapzoglou, A. (2001). School libraries and resource centers section. Newsletter.

Prakash, J. (2005). What is the importance of science education as a school subject? Preserve Articles. Retrieved from www.preservearticles.com/201105216961/importance-of-science-as-a-school-subject.html

Sabariah S. & Khaziyati O. (2005). Teacher's perception on professional development needs in information and communication technology (ICT). Inovasi Teknologi Instruksional dalam Pengajaran dan Pembelajaran: *Konvensyen Teknologi Pendidikan* ke-18 446-454. Terengganu: Persatuan Teknologi Pendidikan Malaysia.

Sadik, A. (2006). Factors influencing teachers attitude towards personal use and school use of computers in science teaching (ERIC Document Reproduction Service No. ED 418 869)

Sadik, A. (2009). Factors influencing teachers' attitudes toward personal use and school use of computers: New evidence from a developing nation. *Evaluation Review, 2.1*: 1-29

Samak, Z. A. (2006). *An Exploration of Jordanian English Language Teachers'attitudes, Skills, and Access As Indicator of Information and Communication Technology Integration in Jordan*. Unpublished Doctoral Thesis. Florida State University.

Shabaya, P. (2009). *The changing role of Information and Communication Technologies (ICTs) for instruction in Higher Education Institutions in Kenya*. Paper presented at Starthmore ICT Conference in Nairobi, Kenya, 1-11. Retrieved from www.digital.library.strathmore.edu on 23rd April, 2012

Sulton, B. B. (2006). *Pedagogy and curriculum*. Centre for Media in Community, EDC. Retrieved from www.digitaldivide.net/news/view.php? headline ID=701. On 21st August, 2009

Swee, T. & Abdullah, A. (2005). The status of school library automation in Malaysian Chinese secondary schools: a national survey. Malaysian Journal of Library & Information Science, 10 (1), pp.29-48.

Todd, R. J. (2004). 'Learning through Information Technology: Insights from Student Learning through Ohio School Libraries Research Study' in Scan, 23.3: 29-35.

Turner, J. H. (2003). Human institutions: A theory of social evolution. London: Rowman & Littlefield.

U.S. Congress, Office of Technology Assessment, OTA. (1995). Teachers and technology: Making the connection (OTA-EHR-616). Washington, DC: U.S. Government Printing Office.

UNDP. (2011). Promoting ICT for human development programme. A Pionnering Regional Human Development Report in Asia. Retrieve from http://www.apdip.net/projects/rhdr/resources/PDF on 15/08/2011

Appendix I

Table 1: Federal Unity Schools Selected and Population of Science Teachers

S/N	State Code	State	Name of FUS	No of Teachers				
				Bio	Chem	Maths	Phy	Total
1	02	Adamawa	FGC, Ganye	6	4	5	3	18
2	03	Akwa-Ibom	FGGC, Ikot-Obio-Ibong	4	3	5	6	18
3	04	Anambra	FSTC, Awka	7	6	8	5	26

4	06	Benue	FGGC, Gboko	3	4	12	6	25
5	07	Borno	FGGC, Monguno	2	2	5	3	12
6	09	Delta	FGC, Warri	5	6	4	8	23
7	10	Edo	FSTC, Uromi	2	3	6	4	15
8	12	Imo	FGGC, Owerri	6	6	5	5	22
9	14	Kaduna	FGGC, Zaria	5	6	7	4	22
10	16	Katsina	FGC, Daura	7	5	9	6	27
11	17	Kebbi	FGGC, Gwandu	4	4	7	3	18
12	19	Kwara	FGC, Ilorin	4	5	9	5	23
13	20	Lagos	Queens College, Lagos	5	6	8	6	25
14	21	Niger	FGGC, New Bussa	4	2	6	4	16
15	22	Ogun	FSTC, Ijebu Mushin	3	4	5	4	16
16	24	Osun	FGC, Ikirun	5	3	6	3	17
17	25	Oyo	FGGC, Oyo	3	5	7	4	19
18	27	Rivers	FGGC, Abuloma	5	2	5	4	16
19	29	Taraba	FGGC, Wukari	2	2	9	2	15
20	30	Yobe	FGGC, Potiskum	4	5	4	5	18
21	31	Abuja	FGBC, Apo-Garki, Abuja	3	5	6	5	19
22	32	Bayelsa	FGGC, Imiringi	3	3	4	3	13
23	34	Ekiti	FGC, Ido Ani	3	4	4	2	13
24	35	Gombe	FGGC, Bajoga	3	2	3	3	11
25	37	Zamfara	FGGC, Gusau	5	4	5	3	17
			Total	103	101	154	106	464

Source: Preliminary Survey, 2011

Key: FGC, Federal Government College; FGGC, Federal Government Girls College; FSTC, Federal Science Technical College, FGBC, Federal Government Boys College