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Information and Communications Technology Infusion Model for Educational Sector in Southwestern Nigeria

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Abstract

In this paper, an ICT infusion model was developed for the educational sector in Nigeria with a focus on Nigerian universities. Five randomly selected universities were used in Nigeria. The researchers constructed questionnaire that measured the ICT tools adopted in the schools on quality of service, and improvement of students on learning performance, and the tasks and activities carried out with ICT. The results showed that 52.7% of respondents suggested that the impact of ICT on the easy collaboration with other students was at least very good out of which 37.3% suggested that it was excellent; 44% of respondents suggested that the impact of ICT on the accessibility to lecturers was at least very good out of which 37.3% suggested that it was excellent, 68.3% of the respondents suggested that the impact of ICT on cheaper activities was very often out of which 52% suggested it was excellent, 81% of the respondents suggested that the impact of ICT on more organized activities was very good out of which 62.3% suggested that it was excellent, 75.7% of respondents suggested that the impact of ICT on the timely feedback mechanism was at least very good out of which 56.3% suggested it was excellent, 55% of the respondents suggested that the impact of ICT on better grades was at least very good out of which 43% suggested it was excellent. The study concluded that the most frequently used ICT devices were mobile devices, school electronic portal, social networks, PCs/laptops, and e-mail services comprising of at least 70% of students. The results further showed that 70% of the students used ICT tools for academic purposes while 50% used ICT tools for performing all the identified activities. The study concluded that the major limitation to the adoption of ICT was electricity followed by Internet Providers and location.

Keywords: Infusion Model, ICT, University, ICT Tools

INTRODUCTION

Information and communications technology (ICT) has in the 21st century constituted a major medium for the processing and dissemination of information. Its influence is so pervasive that virtually all aspects of business (formal and informal, profit and non- profit) which impact on the well-being of the society have been engulfed. According to Uzoegwu and Iloanusi (2010), ICT is an increasingly powerful tool for participating in global markets, promoting political accountability, improving the delivery of basic services and enhancing local development opportunities (Iloanusi and Osuagwu, 2009). This notwithstanding, the rapid development of ICT affects the development of technology implementation in every aspect of life from business, entertainment, socials and education; in effect, ICT determines the economic growth of nations. The success of any nation is often decided by the degree and extent of socio-cultural, socio-economic and political improvement brought to bear through the application of science, technology and mathematics (Hammo, 2007).

There is a rapid development in the use of ICT in organizations since ICT plays a crucial role in the present knowledge-based economy hence, organizations tend to rely heavily on ICT solutions in order to develop and grow their businesses (Ipaye, 2010). The revolution in the use of ICT has profound implications for economic and social development and has pervaded every aspect of human life (Sadiq and Onianwa, 2011). The use of ICT is widespread and regarded as an essential tool for the efficient administration of any organization and in the delivery of services to clients. Brown *et al.* (2007) states that ICTs are being integrated into procedures, structures, and products throughout businesses, governments, and communities. The use of ICT increases the supply of information as ICT plays a key role in information sharing and dissemination. ICT removes distance and time constraint in accessing required information flows. ICT also reduces the cost of production as knowledge is produced, transmitted, accessed and shared at the minimum cost. There is a reduction in the degree of inefficiencies and uncertainty with the use of ICT because it enables businesses to interact more efficiently (Oguntade, 2012).

Educational systems around the world are under increasing pressure to use Information and Communication Technology (ICT) to teach students the knowledge and skills needed in the 21st century (Omwenga, 2007). Development and application of ICT in African institutions of higher learning is critically important if the continent is to reduce the knowledge, technological and economic gaps between itself and the rest of the world (Ogunsola and Aboyade, 2005). Global investment in ICT to improve teaching and learning in schools have been initiated by many governments. ICT Infusion is the process through which ICT devices are adopted deeply and extensively within the work system of an individual or of an organization. Infusion has been defined in the literature as the process through which IT applications are embedded deeply and extensively within the work system of an individual or of an organization (Graham, 2004). It is the extent to which the full potential of an innovation is integrated within an organization's operational or managerial work systems and the depth of that integration (Hammo, 2007).

In Nigeria, there is an increasing adoption of ICT into various sectors of the Nigerian economy but there is no understanding of the degree to which different ICT tools are adopted among students in Nigerian tertiary institutions. Hence, it is not easy to measure the impact ICT has on education in Nigerian tertiary institutions however, it is clear that a number of factors limit the infusion of ICT in educational institutions in Nigeria. In Nigeria, there is no model that can be used to estimate the number of adopters of ICT in Nigerian schools. There is a need for the development of an ICT infusion model which can help in the identification of the number of adopters of ICT among Nigerian students at tertiary institutions thereby examining the extent to which ICT is used and the respective impacts, hence this study.

This study is intended to focus on the identification of the different ICT devices that are used by students studying in Nigerian tertiary institutions in addition to the availability of the devices and their impact following which an infusion model will be develop for estimating the number of adopters of the identified ICT devices used among students selected from Nigerian tertiary institutions.

Related Works

There have been a number of studies aimed at proposing ICT Infusion model for various sectors including the educational sectors. Discussions of such researches are presented in the following paragraphs.

Iloanusi and Osuagwu (2013), in their study investigated ICT diffusion and uptake in Nigerian tertiary educational institutions. The study emphasized the heavy investments made in ICT in administrative and financial transactions, wireless and mobile communications with promising results. The study discussed ICT in its dimensions; how it transforms education; its status in Nigerian educational institutions and the limitations to its infusion in the Nigerian educational system and suggests ways of improvement.

Wilson *et al.* (2014), in their study investigated the use of ICT in higher education from the perspective of students. The study describes the ability of students' in using a wide range of ICT devices to support their personal learning. The study used a self-answering questionnaire and focus-group-discussions (FGD) to collect data from 1500 students. The data from the questionnaires were analyzed using SPSS software to identify and compare students' ICT use and ability. The results revealed that a good number of the students had access to ICT tools and devices, and were competent in using a wide range of ICT tools and devices both for the context of academic and non-academic use. The study concluded that academic programmes need to provide students with activities that require creative use of ICT devices and tools to enhance their skills.

Oyeleye *et al*. (2014), in their study evaluated the impact and challenges of the adoption of Cloud Computing in public universities in Southwestern Nigeria. A sample size of 100 IT staff, 50 para-IT staff and 50 students were selected in each university using stratified sampling techniques with the aid of structured questionnaires. Microsoft excel was used to capture the data while frequency and percentage distributions were used to analyze it. In all, 2,000 copies of questionnaire were administered to ten (10) public universities in the Southwestern part of Nigeria while 1,742 copies were returned which represents a respondent rate of 87.1%. The result of the findings revealed that the adoption of cloud computing has a significant impact on cost effectiveness, enhanced availability, low environmental impact, reduced IT complexities, mobility, scalability, increased operability and reduced investment in physical asset. However, the major challenges confronting the adoption of cloud are data insecurity, regulatory compliance concerns, lock-in and privacy concerns.

Omotosho *et al.* (2015), in their study investigated ICT adoption and use among students of a Nigerian university for distance learning. A descriptive survey design was adopted for this study and the main instrument for data collection was questionnaire. Results from the study showed that the level of ICT use among the respondents was high and easy accessibility to ICT facilities needed for distance learning was the major factor responsible for the high level of usage of ICT by the respondents. The study concluded that the level of ICT use for distance learning and the benefits derivable from it are high although there are few constraints to their effective and maximum use among distance learning students.

Langat (2015), in his study made a re-assessment of the adoption and integration of ICT for enhancing teaching and learning within academic programmes in MOI in a Kenyan university. The research started by assessing the basics of ICTs adoption in 2009 which included ICT infrastructure, ICT hardware, software & information system, human resource and ICT Security which is always the initiation stage. ICT strategies and ICT plans should be continuously evaluated to align with institutional visions and missions in order to achieve effective use of ICT in their academic programmes in preparation for the future human resource in various fields where they will be required to work. The study adopted descriptive research design as a framework that guided the entire research process and used questionnaires and interview for data collection which were analyzed qualitatively and quantitatively. The results of the study acted as an ICT needs analysis which enables universities in East Africa to enhance the acquisition, adoption and integration of ICT into their academic programmes.

Adavbiele (2016), in his study presented the use of ICT for enhancing university education in Nigeria. The study examined the gap and challenges facing the use of ICT in university education in Nigeria. The study is a descriptive survey that assessed five universities for the most urgent solution. The population of the study was 120 respondents and was made up of university lecturers and students. The results revealed that there is a gap between the university teachers and students and ICT usage in classrooms and many university lecturers and students have to go to commercial cyber cafés in town before they could have access to a computer that is internet connected. Teachers were faced with some challenges and barriers of availability of facilities which prevent the employment of ICT in the classroom; the solutions proffered include funding, provision of facilities and technical expertise in Nigerian universities.

RESEARCH METHODOLOGY

Research Design

For this study, the research design is a series of process required for meeting up to the stated objectives of the study. The study location for the research was identified as tertiary institutions located in Southwestern Nigeria following the identification of the sample size of the respondents from which data was collected for the purpose of data analysis needed for developing the ICT infusion model. The instrument of data collection was used to collect information from the respondents of the study and such data included demographic information, Information and Communications Technology (ICT) facility availability and functionality, tasks and activities carried out with ICT, access to ICTs and the impact of ICTs on the respondents.

Following the collection of data from the respondents, the data were analyzed using standard descriptive statistics tools: tables for data presentation and graphs for data presentation. The ICT infusion model was formulated using mathematical equations needed to represent sequences and series of data – representing the total number of people who use each ICT for each period of time between the periods of infusion till 2017. The infusion model for ICT was presented for each ICT component identified given a base year.

Data Collection

For the purpose of the collection of data needed for this study from the identified respondents (students of tertiary academic institutions), the questionnaire was considered as the instrument of data collection. A questionnaire was administered to each respondent. The questionnaire comprised five (5) sections, each focusing on a specific type of information required. The different sections of the questionnaire were addressed such as demographic information, ICT facility used and extent of use, tasks and activities carried out with ICT, access to ICTs and jmpact of ICTs.

Data Analysis

This study incorporated the use of descriptive statistical techniques for the purpose of analyzing the data collected for this study from the respondents. The descriptive statistics methods used helped in the simplification of large amount of data in a much sensible way by the provision of summary using both numerical and graphical tools. The numerical tools involved the estimation of means, median, mode and standard deviation while the graphical methods were used to identify the patterns evident in the data collected using tables, graphs and charts. The data analysis was performed using the data analysis tool-pack available in the Microsoft® Office 2010 Excel software add-ins. Data collected were initially presented in table for numerical presentation following which they were presented using graphs and charts for graphical presentation.

ICT Infusion Model Formulation

For the purpose of this study, the ICT infusion model was formulated as a function of the number of years, y from a base year, Y_1 using a polynomial equation of one variable for each identified IT component. The number of IT components acquired by the respondents in the five (5) tertiary academic institutions was considered for each year as a sequence of terms following which the cumulative total for each successive year was determined till 2017. The cumulative total number of ICT devices used by respondents of each financial institution (banks and insurance companies) for each year from the base year till 2017 was considered as a series of terms.

Assuming an ICT device which was used starting from a base year, Y_1 = 2001 with x_1; it will be discovered that the total number of terms in the sequence of users from 2001 till 2017 is t = 17 years (see equation 1). In equation 1, it will be observed that each n_m for $1 \leq t \leq 17$ represents the number of users of the ICT device for each successive year from 2001 till 2017. Equation 1 was then converted to a sequence of the cumulative sum (otherwise called the cumulative frequency distribution) of users for each successive year from the base year, Y_1 (equation 2) which was represented as equation 3.

$$x_t = x_1, x_2, x_3, x_4, \ldots \ldots \ldots, x_{17} \tag{1}$$

$$S_t = x_1, (x_1 + x_2), (x_1 + x_2 + x_3), \ldots \ldots (x_1 + x_2 \ldots + x_{17}) \tag{2}$$

$$S_t = S_1, S_2, S_3, S_4, \ldots\ldots\ldots\ldots, S_{17} \tag{3}$$

Where: $S_1 = x_1$, $S_2 = (x_1 + x_2)$,, $\ldots\ldots\ldots S_{17} = (x_1 + x_2 \ldots. + x_{17})$

Hence, the infusion model is a polynomial equation of degree n that is a true representation of the number of users of a specified IT device by year, Y_x- x years after the base year, Y_1. Thus, the IT infusion model is a polynomial of degree z which is the best fit of equation 3 expressed in terms of x (the number of years after the base year). Hence, the ICT infusion model is expressed as shown in equation 4 while the value of x is derived from the year of infusion Y_1 to the year of interest Y_x according to equation 5.

$$S(x) = a + bx + cx^2 + \ldots\ldots + dx^z \tag{4}$$
$$x = Y_x - Y_1 + 1 \tag{5}$$

In addition to the polynomial plot of best fit to the cumulative frequency distribution of the number of users of each ICT technology, the value of the coefficient of determination, R^2 was also estimated which explains the proportion of the total variations in the dependent variable that is attributable to the variations in the independent variable.

RESULTS AND DISCUSSION

Demographic Distribution of Respondents

The questionnaire used for this study was distributed among the five (5) tertiary academic institutions selected for this study, for which a total of 300 questionnaires were distributed. The selected respondents provided the necessary information required for this study as presented in the questionnaires with the data extracted and stored in a spreadsheet file. Table 1 shows a description of the number of respondents selected from each tertiary institution respectively – an equal number of 50 students were selected from Oduduwa University (OUI), University of Ibadan (UI), Joseph Ayo Babalola University (JABU) and Osun State University (UNIOSUN) while 100 students were selected from Obafemi Awolowo University (OAU). The questionnaires were distributed across 2 federal, 2 private and 1 state-owned tertiary institutions.

Table 1: Number of Respondents Selected

Universities	Type	Frequency	Percentage
Obafemi Awolowo University	Federal	100.00	33.33
Oduduwa University	Private	50.00	16.67
Osun State University	State	50.00	16.67
University of Ibadan	Federal	50.00	16.67
Joseph Ayo Babalola University	Private	50.00	16.67
Total		**300.00**	**100.00**

Table 2 shows the distribution of the gender of the respondents selected for this study and shows that an equal proportion of male and female students were selected from all the locations. The results of the ethnicity of the students selected indicated that majority of them were Yoruba owing for about 52.3% of respondents followed by the Ibo and other ethnic groups (e.g. Tiv, Fulani, Benin, etc.) with proportions of 20% and 15% respectively (see Table 3). The results of the distribution of the discipline to which the students selected belonged to showed that an unequal number of students were identified from which majority were selected from faculty of sciences (18%) followed by administration (15%), arts and education (14.3% each) as shown in Table 4.

Table 2: Distribution of Gender of Respondents

Gender	Total	Percentage
Male	150	50.00
Female	150	50.00
Total	**300**	**100**

Table 3: Distribution of Ethnicity of Respondents

Ethnicity	Total	Percentage
Yoruba	157	52.33
Hausa	38	12.67
Ibo	60	20.00
Others	45	15.00
Total	**300**	**100**

Table 4: Distribution of the Discipline of Respondents

Discipline	Total	Percentage
Science	54	18.00
Administration	45	15.00
Arts	43	14.33
Social Sciences	38	12.67
Engineering	40	13.33
Law	37	12.33
Education	43	14.33
Total	**300**	**100.00**

The results of the level of IT compliance of each student selected was also evaluated and showed that majority were on a scale of 4 and 5 with a proportion of 28.3% and 28% of selected students respectively (Table 5) while the results of the distribution of the religion of the students selected showed that majority were Christians with a proportion of 68.3% of respondents (Table 6). The results of the distribution of smartphone users revealed that about 95.7% of respondents had smartphones (Table 7) among which majority used Android OS (51.2%) followed by those who used iOS and Windows OS with a proportion of 23.7% and 12.9% respectively (Table 8).

Table 5: Distribution of the IT Compliance of Respondents

IT Compliance	Total	Percentage
Scale 1	38	12.67
Scale 2	48	16.00
Scale 3	84	28.00
Scale 4	45	15.00
Scale 5	85	28.33
Total	**300**	**100.00**

Table 6: Distribution of the Religion of Respondents

Religion	Total	Percentage
Christian	205	68.33
Islam	56	18.67
Traditional	25	8.33
Others	14	4.67
Total	**300**	**100.00**

Table 7: Distribution of the Smartphone Owner among Respondents

Have Smartphone	Total	Percentage
Yes	287	95.67
No	13	4.33
Total	**300**	**100.00**

The results of the demography of the tertiary institution students selected for this study showed that science, administration, arts and education students are most likely to use ICT tools than most other students but for varying reasons while an average number of students are likely to come from other faculties; the results also showed that majority of the students were very compliant regarding the use of ICT devices identified and majority of the sampled students had smartphones which were majorly running on Android Operating System (OS) devices.

Table 8: Distribution of the Operating System (OS) used by Smartphone Users

Operating System Used	Total	Percentage
Blackberry OS	35	12.20
Android OS	147	51.22
iOS	68	23.69
Windows OS	37	12.89
Total	**287**	**100.00**

The Use of ICT Tools among the Respondents

Following the distribution of the respondents selected for this study, there was the need of identifying the different ICT devices that were commonly used by the students selected which included mobile computing (e.g. tablets and smartphones), personal computers (PCs and Laptops), E-mail services, Social networks, video conferencing, school electronic portal, bulk sms, instant messaging and electronic library system. Following the identification of the different ICT devices used by the respondents selected for this study, there was a need to understand the availability and functionality of devices, frequency of device use, activities performed using the ICT device identified from the respondents selected for this study and the impact of the ICT devices used among the respondents selected for the study.

Availability and functionality of ICT tools among respondents

The ICT tools availability and functionality among the different tertiary institutions selected were elicited from each respondent using four levels of agreement, namely: available and functioning (AF), available but not function (ANF), not available (NA) and don't know (DK) while information not provided was tagged as missing. Table 9 shows the distribution of the responses of the respondents regarding the availability and functionality of ICT tools among the students selected from the tertiary institutions for this study.

Following the responses from 300 respondents selected for this study concerning the availability and functionality of ICT tools among the students selected from the identified tertiary institutions, a number of observations were made as shown in Table 9. The results of the availability and functionality of ICT devices among the selected students showed that 77% of the students suggested that mobile devices were available and functional while 18.7% suggested that they were available but not functional; 66% of the students suggested that personal computers/laptops were available and functional while 18% suggested that they were not functioning though available while 10.7% suggested that they were not available; 47.7% of students suggested that e-mail services were available and functional while 24.3% suggested that they were not functional.

The results regarding the availability and functionality of ICT tools further showed that 67.7% of students suggested that social networks were in use while 7.7% suggested that they were not in use; 19.7% of students suggested that video conferencing services were functional while 24.3% suggested that they were not functional but 46.3% of students suggested that they had no idea of its availability; 69.7% of students suggested that school electronic portals were functional while 26.3% suggested that they were not functional; 43% of students also suggested that bulk sms were functional while 16% of students suggested that they were not in use; 71.3% of students suggested that instant messaging were in use while 12.7% suggested that they were not in use; and 42.3% of students suggested that electronic library services were functional while 19.7% of students suggested that they were not functional.

Table 9: Availability and Functionality of ICT Devices among Students

ICT Products	Opinion	Total	Percentage
Mobile Devices (smartphones, tablets etc.)	Available and functioning	231	77.00
	Available and not functioning	56	18.67
	Not available	13	4.33
	Don't Know	0	0.00
	Total	**300**	
Personal Computers (PC)/Laptops	Available and functioning	198	66.00
	Available and not functioning	54	18.00
	Not available	32	10.67
	Don't Know	16	5.33
	Total	**300**	
E-mail Services	Available and functioning	143	47.67
	Available and not functioning	73	24.33
	Not available	48	16.00
	Don't Know	36	12.00
	Total	**300**	
Social Networks	Available and functioning	203	67.67
	Available and not functioning	59	19.67
	Not available	23	7.67
	Don't Know	15	5.00
	Total	**300**	
Video Conferencing	Available and functioning	59	19.67
	Available and not functioning	73	24.33
	Not available	29	9.67
	Don't Know	139	46.33
	Total	**300**	
School Electronic Portal	Available and functioning	209	69.67
	Available and not functioning	79	26.33
	Not available	12	4.00
	Don't Know	0	0.00
	Total	**300**	
Bulk SMS	Available and functioning	129	43.00
	Available and not functioning	48	16.00
	Not available	40	13.33
	Don't Know	83	27.67
	Total	**300**	
Instant Messaging	Available and functioning	214	71.33
	Available and not functioning	38	12.67
	Not available	26	8.67
	Don't Know	22	7.33
	Total	**300**	
Electronic Library System	Available and functioning	127	42.33
	Available and not functioning	59	19.67
	Not available	40	13.33
	Don't Know	74	24.67
	Total	**300**	

The results of the availability and functionality of ICT devices among tertiary institution students showed that majority suggested that mobile devices, personal computer/laptops, social networks, instant messaging and school electronic portal were available and functional owing for a proportion of about 66% of the respondents selected while about 40% of the respondents suggested that they were not aware of the existence of video conferencing services at their institutions. It was also observed that about 50% of the students selected suggested that e-mail services, bulk sms and electronic library services were available and functional.

Frequency of Use of ICT Tools among Respondents

The frequency of use of ICT devices identified among the respondents selected from the tertiary institutions was elicited from each respondent using four levels of agreement, namely: rarely, never, often, very often while information not provided were tagged as missing. Table 10 shows respective responses of the frequency of respondents' use of the ICT devices at the tertiary institutions selected for this study. Following the responses from 300 respondents selected for this study concerning the frequency of use of ICT tools within the tertiary institutions identified, a number of observations were made. Based on the availability and functionality of ICT tools among the respondents selected from the tertiary institutions, the following were deduced from the results of the responses of the respondents as shown in figure 1.

The results of the distribution of the frequency of use of the identified ICT devices among the selected students showed that 95.7% suggested that mobile devices were used at least often (out of which 67% used it very often) while 1% have never used it; 84% suggested that PCs/laptops were used at least often (out of which 63% used it very often) while 4.3% have never used it; 72.3% suggested that e-mail services were used at least often (out of which 61.7% used it very often) while 10% have never used it; 87.3% suggested that social networks were used at least often (out of which 79.3% used it very often) while 2% have never used it while 44% suggested that video conferencing were used at least often (out of which 29% used it very often) while 46% have never used it.

The results further showed that 94% suggested that school electronic portals were used at least often (out of which 84% used it very often) while 2% have never used it; 59% suggested that bulk sms were used at least often (out of which 41.7% used it very often) while 21.7% have never used it; 84% suggested that instant messaging were used at least often (out of which 71% used it very often) while 8.3% have never used it; while 62% suggested that electronic library system were used at least often (out of which 41% used it very often) while 27.3% have never used it.

The results of the study further pointed out that regarding the frequency of use of ICT devices, majority of the students selected suggested that the mobile devices, school electronic portal, social networks, PCs/laptops, PCs/laptops and e-mail services comprising of at least 70% of students. The results also showed that minority suggested using video conferencing services and bulk sms services often comprising of at least 40% of students.

Tasks and Activities by Respondents

Information regarding the tasks and activities performed using ICT tools among the respondents selected for this study was elicited using section C of the questionnaire administered. The respondents were required to select as many activities as possible that were applicable to them in each section. The task and activities carried out by respondents using ICT tools at the tertiary institutions selected were elicited from each respondent using two levels of agreements, namely: yes and no. Table 11 shows the distribution of the responses of the respondents regarding the different tasks and activities carried out by the students from the tertiary institutions selected. Following the responses from 300 respondents selected for this study concerning the tasks and activities carried out at the tertiary institutions selected for this study, the results are presented in the following paragraphs.

The results of the distribution of the tasks and activities carried out by students from the tertiary institutions selected showed that 81% suggested using ICT tools for leisure, 72.7% suggested using ICT tools for accessing course materials, 47.7% suggested using ICT tools for submitting assignments, 71% suggested using ICT tools for making presentations, 52,3% suggested using ICT tools for playing games, 88.3% suggested using ICT tools for registering courses, 71.3% suggested using ICT tools for accessing

Table 10: Use of ICT Tools among Respondents Selected

ICT Products	Opinion	Total	Percentage
Mobile Devices (smartphones, tablets etc.)	Very often	201	67.00
	Often	86	28.67
	Rarely	10	3.33
	Never	3	1.00
	Total	**300**	
Personal Computers (PC)/Laptops	Very often	189	63.00
	Often	63	21.00
	Rarely	35	11.67
	Never	13	4.33
	Total	**300**	
E-mail Services	Very often	185	61.67
	Often	32	10.67
	Rarely	53	17.67
	Never	30	10.00
	Total	**300**	
Social Networks	Very often	238	79.33
	Often	24	8.00
	Rarely	32	10.67
	Never	6	2.00
	Total	**300**	
Video Conferencing	Very often	87	29.00
	Often	45	15.00
	Rarely	30	10.00
	Never	138	46.00
	Total	**300**	
School Electronic Portal	Very often	252	84.00
	Often	30	10.00
	Rarely	12	4.00
	Never	6	2.00
	Total	**300**	
Bulk SMS	Very often	125	41.67
	Often	52	17.33
	Rarely	58	19.33
	Never	65	21.67
	Total	**300**	
Instant Messaging	Very often	213	71.00
	Often	39	13.00
	Rarely	23	7.67
	Never	25	8.33
	Total	**300**	
Electronic Library System	Very often	123	41.00
	Often	63	21.00
	Rarely	32	10.67
	Never	82	27.33
	Total	**300**	

Table 11: Distribution of tasks and activities carried out at auditing firms

Purposes	Opinion	Total	Percentage
Leisure	Yes	243	81.00
	No	57	19.00
	Total	**300**	
Access Course Materials	Yes	218	72.67
	No	82	27.33
	Total	**300**	
Submitting Assignments	Yes	143	47.67
	No	157	52.33
	Total	**300**	
Making Presentations	Yes	213	71.00
	No	87	29.00
	Total	**300**	
Playing Games	Yes	157	52.33
	No	143	47.67
	Total	**300**	
Registering Courses	Yes	265	88.33
	No	35	11.67
	Total	**300**	
Accessing Information	Yes	214	71.33
	No	86	28.67
	Total	**300**	
Viewing Grades	Yes	250	83.33
	No	50	16.67
	Total	**300**	
Collaborating With Other Students	Yes	158	52.67
	No	142	47.33
	Total	**300**	
Meeting Lecturers	Yes	132	44.00
	No	168	56.00

personal information, 83.3% suggested using ICT tools for viewing grades, 52.7% suggested using ICT for collaborating with other students and 44% suggested using ICT tools for meeting lecturers.

The results of the study regarding the extent of use of ICT devices showed that they were used majorly for registering courses, viewing grades, leisure, accessing course materials, accessing personal information and making presentations by at least 70% of the students selected while at most about 52% used ICT tools for submitting assignments, meeting lecturers, playing games and collaborating with other students. The results further showed that most of the students used ICT tools for academic purposes while an average number of students used ICT tools for performing all the activities.

The Impact and Limitations of ICT Tools

The impact of ICT tool on the job functionality and productivity was accessed from respondents selected for this study on five (5) levels of agreements, namely: excellent, good, very good, fair and poor as provided by the respondents. Table 12 shows the distribution of the responses for the impact of ICT tools on the job functionality and productivity of each respondent selected from the tertiary institutions selected for this study. The different limitations facing the adoption of ICT tools by students was also required hence, the students were required to select as many limitations as was identified among religion, data costs, electricity and Internet providers. Table 13 shows the distribution of the limitations to the adoption of ICT tools as identified by the students.

Table 12: Impact of ICT on the Productivity and Functionality of Students

Impact on Job functions and Productivity	Opinion	Total	Percentage
Easy Collaboration with other Students	Excellent	112	37.33
	Very good	46	15.33
	Good	87	29.00
	Fair	45	15.00
	Poor	10	3.33
	Total	**300**	
Accessibility to Lecturers	Excellent	112	37.33
	Very good	20	6.67
	Good	89	29.67
	Fair	35	11.67
	Poor	44	14.67
	Total	**300**	
Cheaper Activities	Excellent	156	52.00
	Very good	49	16.33
	Good	43	14.33
	Fair	36	12.00
	Poor	16	5.33
	Total	**300**	
More Organized Activities	Excellent	187	62.33
	Very good	56	18.67
	Good	39	13.00
	Fair	18	6.00
	Poor	0	0.00
	Total	**300**	
Timely Feedback Mechanism	Excellent	169	56.33
	Very good	58	19.33
	Good	43	14.33
	Fair	28	9.33
	Poor	2	0.67
	Total	**300**	
Better Grades	Excellent	129	43.00
	Very good	36	12.00
	Good	58	19.33
	Fair	32	10.67
	Poor	45	15.00
	Total	**300**	

The results of the impact of the use of ICT tools showed that 52.7% of the respondents suggested that the impact of ICT on easy collaboration with other students was at least very good out of which 37.3% suggested that it was excellent; 44% of the respondents suggested that the impact of ICT on accessibility to lecturers was at least very good out of which 37.3% suggested that it was excellent, 68.3% of the respondents suggested that the impact of ICT on cheaper activities was very often out of which 52% suggested it was excellent, 81% of the respondents suggested that the impact of ICT on more organized activities was very good out of which 62.3% suggested that it was excellent, 75.7% of the respondents suggested that the impact of ICT on the timely feedback mechanism was at least very good out of which 56.3% suggested it was excellent, 55% of the respondents suggested that the impact of ICT on better grades

Table 13: Limitations of the Adoption ICT by Students

Limitations	Options	Frequency	Percentage
Religion	Yes	15	5.00
	No	285	95.00
	Total	**300**	
Data Costs	Yes	49	16.33
	No	251	83.67
	Total	**300**	
Electricity	Yes	157	52.33
	No	143	47.67
	Total	**300**	
Internet Providers	Yes	98	32.67
	No	202	67.33
	Total	**300**	
Location	Yes	84	28.00
	No	216	72.00
	Total	**300**	

was at least very good out of which 43% suggested it was excellent. The results revealed that majority of the students disagreed that ICT tools improve their accessibility to their lecturers and fellow students and provide the means of getting better grades.

The results of the limitations that were facing the adoption of ICT tools by the students revealed that out of 300 students selected, 5% suggested that religion was a limitation, 16.3% suggested that data costs constituted a limitation, 52.3% suggested that electricity was a limitation, 32.7% suggested that Internet Providers were a limitation while 28% suggested that location of the user was a limitation. Therefore, over 50% of the students suggested that the major limitation to the adoption of ICT tools was electricity.

Duration of use of ICT tools by respondents
Following the results collected from 300 respondents belonging to the 5 academic tertiary institutions selected regarding the duration of use of identified ICT tools; information relevant to the year of infusion of ICT tool for each ICT tool at each tertiary institution considered for this study was analyzed using tables and charts for presentation. Table 14 shows the distribution of the number of respondents who started using each ICT tool between the years 2004 till 2017 (a period of 14 years). The number of users for each ICT tools used was recorded over the period of 14 years including years 2004 and 2017. The initial number and total number of users of each ICT tool used in all locations were also considered from the period of infusion till 2017.

From the results, 244 (81.3%) students have been using mobile devices since the year 2006 with 18 initial users, 284 (94.7%) students have been using PCs/laptops since the year 2004 with 21 initial users, 274 (91.3%) students have been using e-mail services since the year 2005 with 15 initial users, 211 (70.3%) students have been using social networks since the year 2008 with 25 initial users, 70 (23.3%) students have been using video conferencing since the year 2009 with 10 initial users, 257 (85.7%) students have been using school electronic portals since the year 2006 with 24 initial users, 168 (56%) students have been using bulk SMS services since the year 2007 with 17 initial users, 144 (48%) students have been using

Table 14: Distribution of the Number of Users of ICT Tools for the Period of 2004 till 2017

ICT Components	y04	y05	y06	y07	y08	y09	y10	y11	y12	y13	y14	y15	y16	y17	Users	%	Non-Users	%
Mobile Devices	0	0	**18**	27	26	15	23	15	15	26	24	16	21	18	**244**	81.33	56	18.67
PCs/Laptops	**21**	15	22	15	25	21	17	25	24	18	24	15	25	17	**284**	94.67	16	5.33
E-mail Services	0	**15**	25	25	21	24	20	18	20	25	21	19	22	19	**274**	91.33	26	8.67
Social Networks	0	0	0	0	**25**	24	16	15	20	22	23	25	17	24	**211**	70.33	89	29.67
Video Conferencing	0	0	0	0	0	**10**	10	6	7	9	8	8	5	7	**70**	23.33	230	76.67
School Electronic Portals	0	0	**24**	20	25	21	24	24	18	17	18	24	23	19	**257**	85.67	43	14.33
Bulk SMS Services	0	0	0	**17**	18	17	11	15	16	16	14	15	12	17	**168**	56.00	132	44.00
Instant Messaging	0	0	0	0	0	**16**	20	15	19	10	12	20	12	20	**144**	48.00	156	52.00
Electronic Library System	0	0	0	0	**11**	8	11	14	10	10	9	13	10	14	**110**	36.67	190	63.33

instant messaging since the year 2009 with 16 initial users while 110 (36.7%) students have been using electronic library system since 2008 with 11 initial users.

From the results of this study, it was discovered that the most commonly used ICT tools among Nigerian students in tertiary institutions starting from the earliest were PCs/laptops in 2004, e-mail services in 2005, school electronic portals and mobile devices in 2006, social networks and electronic library systems in 2008 by about 70% of selected students in 2017. The ICT devices later adopted were instant messaging and video conferencing in 2009 among which the least adopted ICT tool was the video conferencing.

The Formulation of ICT infusion model
Following the presentation of the results for the number users of each ICT tool used by selected students, the infusion model for ICT tools adopted among the students of Nigerian tertiary institutions using the data collected for this study was considered. In order to formulate the ICT infusion model, the sum of users at each consecutive year, n from the base year of infusion (the year the ICT tool was first used in location by a user) for all ICT tools used till 2017 was considered. Table 15 shows the base year considered for each ICT tool while Figure 1 shows a graphical plot of the sum of users per consecutive number of years for each ICT tool used in Nigerian tertiary institutions. For the purpose of developing the polynomial function that was used for estimating the trend line for the distribution of each ICT tool, Microsoft $^®$ Excel Data Analysis Toolkit for estimating the distribution of graphical charts was used. Using the base year (y_0) shown in Table 4.15, the total number of users of a particular ICT by any particular year (y_n) tool can be estimated from the model by providing the value of time, n which is determined by equation (4.1).

$$n = y_n - y_0 + 1 \qquad\qquad (6)$$

In addition to the identification of the value of *n* used to estimate the number of users of a particular ICT tool for any given year, y_n given a base year y_0; the infusion model for this study were estimated using the polynomial of degree *m*. Using the *Microsoft Excel$^®$ Data Analysis tool-pack*, the trend line estimated from the cumulative distribution of users was used to estimate the infusion model represented as a polynomial estimation of the set of points from a scatter plot of the distribution. The *y-axis* contains the total (cumulative) number of users of the ICT tool in question while the *x-axis* contains the value of *n* estimated from equation (6).

Table 15: Year of Infusion (Base year, y_0) ICT tools used by Students

| ICT Components	Year of Infusion	Initial Users	Present Users	Percentage
Mobile Devices	2006	18	244	81.3
PCs/Laptops	2004	21	284	94.7
E-mail Services	2005	15	274	91.3
Social Networks	2008	25	211	70.3
Video Conferencing	2009	10	70	23.3
School Electronic Portals	2006	24	257	85.7
Bulk SMS Services	2007	17	168	56.0
Instant Messaging	2009	16	144	48.0
Electronic Library System	2008	11	110	36.7
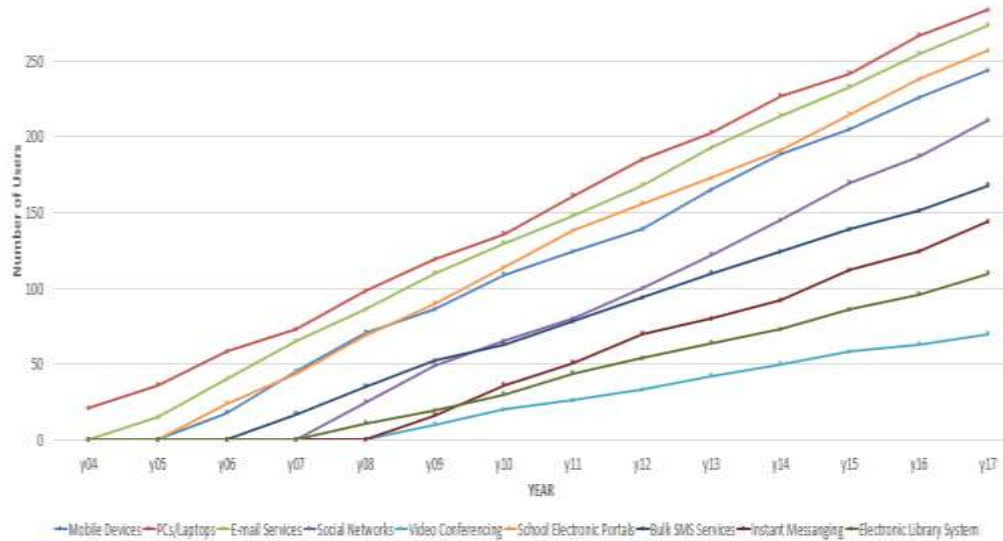
Figure 1: ICT Users of each ICT Tool used for each Year Between 2004 till 2017

Infusion model for the use of mobile computing devices

Following the results of the sum of the number of users of mobile computing devices for each consecutive year, a series of numbers representing the cumulative number of users for each year was presented. In Table 15, the year of infusion of mobile computing devices is 2006 with 18 users. Figure 2 shows the graphical plot of the total number of users of mobile computing devices for each subsequent year considered from the year of infusion; hence, the period between 2006 till 2017 is 12 years.
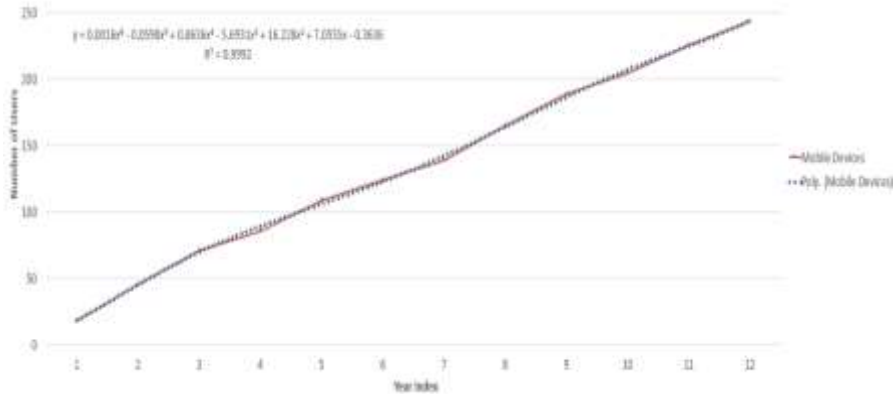
Figure 2: Trend Line of Mobile Computing Users

Each point along the horizontal axis represents the number of years between the base year and the year of interest, e.g. the number of users in 2014 is identified by the point 9 along the horizontal axis which corresponds to 189 users since 2006. Using the auto-generated trend line functionality of the Excel Data Analysis Tool-pack, the infusion model for mobile computing devices use taking the base year as 2006 is estimated using a polynomial of degree, $m = 6$ and $R^2 = 0.9992$ stated as follows:

$$S(n) = 0.002n^6 - 0.06n^5 + 0.86n^4 - 5.69n^3 + 16.2n^2 + 7.06n - 0.36 \quad (7)$$

Therefore, in order to determine the total number of users of mobile computing devices n years from 2006; equation 7 can be used to estimate the number of users since 2006 that have been using mobile computing devices in academic tertiary institutions located in Nigeria.

Infusion model for the use of PCs/laptops
Following the results of the sum of the number of users of PCs/laptops for each consecutive year, a series of numbers representing the cumulative number of users for each year was presented. In Table 15, the year of infusion of PCs/laptops is 2004 with 21 users. Figure 3 shows the graphical plot of the total number of users of PCs/laptops for each subsequent year considered from the year of infusion; hence, the period between 2004 till 2017 is 14 years.

Each point along the horizontal axis represents the number of years between the base year and the year of interest, e.g. the number of users in 2014 is identified by the point 11 along the horizontal axis which corresponds to 227 users since 2004. Using the auto-generated trend line functionality of the Excel Data Analysis Tool-pack, the infusion model for PCs/Laptops use taking the base year as 2004 is estimated using a polynomial of degree, $m = 6$ and $R^2 = 0.9994$ stated as follows:
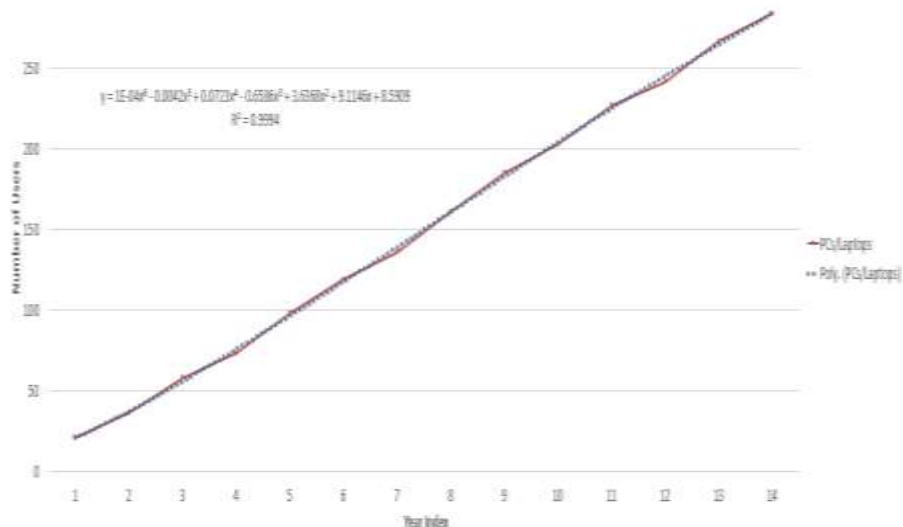
Figure 3: Trend line of PCs/Laptops Users

$$S(n) = 0.0001n^6 - 0.004n^5 + 0.07n^4 - 0.66n^3 + 3.64n^2 + 9.11n + 8.59 \quad (8)$$

Therefore, in order to determine the total number of users of PCs/Laptops n years from 2004; equation 8 can be used to estimate the number of users since 2004 that have been using PCs/Laptops among students of academic tertiary institutions located in Nigeria.

Infusion model for the use of e-mail services
Following the results of the sum of the number of users of e-mail services for each consecutive year, a series of numbers representing the cumulative number of users for each year was presented. In Table 15, the year of infusion of e-mail services is 2005 with 15 users. Figure 4 shows the graphical plot of the total number of users of e-mail services for each subsequent year considered from the year of infusion; hence, the period between 2005 till 2017 is 13 years.

Each point along the horizontal axis represents the number of years between the base year and the year of interest, e.g. the number of users in 2014 is identified by the point 10 along the horizontal axis which corresponds to 214 users since 2005. Using the auto-generated trend line functionality of the Excel Data Analysis Tool-pack, the infusion model for e-mail services use taking the base year as 2005 is estimated using a polynomial of degree, $m = 6$ stated as follows:

$$S(n) = 0.103n^5 - 2.541n^4 + 22.797n^3 - 90.466n^2 + 164.09n - 53.33 \quad (9)$$

Therefore, in order to determine the total number of users of e-mail services n years from 2005; equation 9 can be used to estimate the number of users since 2005 that have been using e-mail services among students of academic tertiary institutions located in Nigeria.
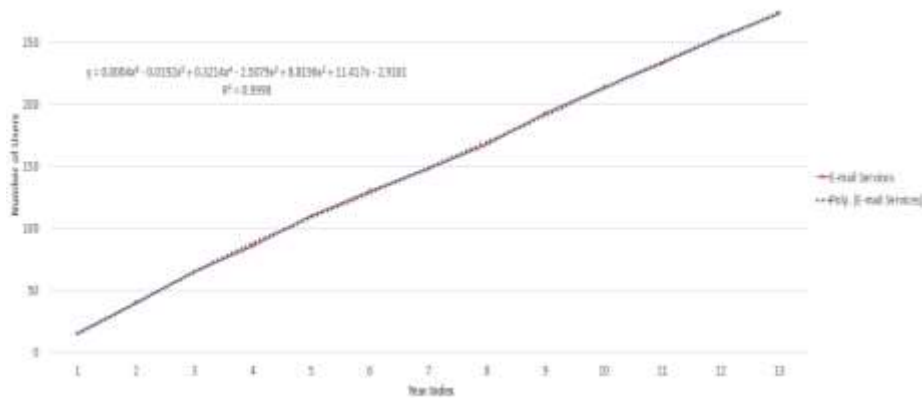

Figure 4: Trend line of E-Mail Services Users

Infusion model for the use of Social networks
Following the results of the sum of the number of users of Social networks for each consecutive year, a series of numbers representing the cumulative number of users for each year was presented. In Table 15, the year of infusion of Social networks is 2008 with 25 users. Figure 5 shows the graphical plot of the total number of users of Social networks for each subsequent year considered from the year of infusion; hence, the period between 2008 till 2017 is 10 years.
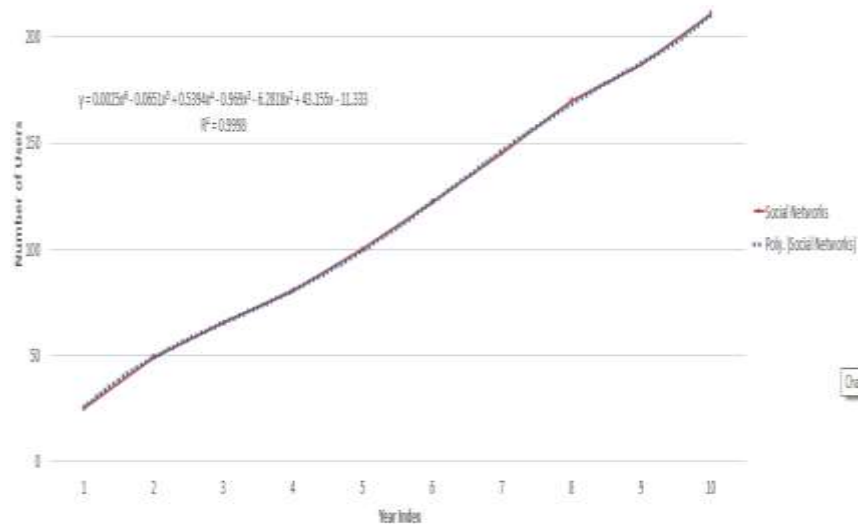
Each point along the horizontal axis represents the number of years between the base year and the year of interest, e.g. the number of users in 2014 is identified by the point 7 along the horizontal axis which corresponds to 145 users since 2008. Using the auto-generated trend line

functionality of the Excel Data Analysis Tool-pack, the infusion model for Social networks use taking the base year as 2008 is estimated using a polynomial of degree, $m = 6$ and $R^2 = 0.9998$ stated as follows:

$$S(n) = 0.003n^6 - 0.07n^5 + 0.54n^4 - 0.97n^3 - 6.28n^2 - 43.2n - 11.3 \quad (10)$$

Therefore, in order to determine the total number of users of Social networks n years from 2008; equation 10 can be used to estimate the number of users since 2008 that have been using Social networks among students of academic tertiary institutions located in Nigeria.

Infusion model for the use of video conferencing
Following the results of the sum of the number of users of Video conferencing for each consecutive year, a series of numbers representing the cumulative number of users for each year was presented. In Table 15, the year of infusion of Video conferencing is 2009 with 10 users. Figure 6 shows the graphical plot of the total number of users of Video conferencing for each subsequent year considered from the year of infusion; hence, the period between 2009 till 2017 is 9 years.

Figure 5: Trend line of Social Networks Users
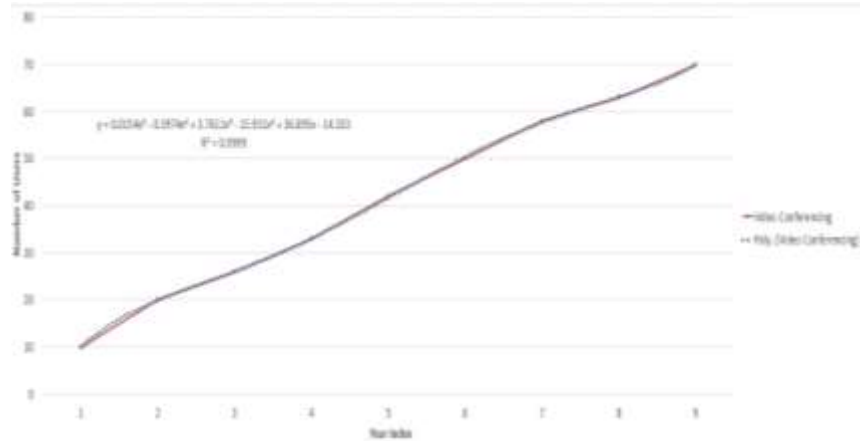
Figure 6: Trend line of Video Conferencing Users

Each point along the horizontal axis represents the number of years between the base year and the year of interest, e.g. the number of users in 2014 is identified by the point 6 along the horizontal axis which corresponds to 50 users since 2009. Using the auto-generated trend line functionality of the Excel Data Analysis Tool-pack, the infusion model for Video conferencing use taking the base year as 2009 is estimated using a polynomial of degree, $m = 5$ and $R^2 = 0.9999$ stated as follows:

$$S(n) = 0.015n^5 - 0.397n^4 + 3.761n^3 - 15.931n^2 + 36.895n - 14.333 \quad (11)$$

Therefore, in order to determine the total number of users of Video conferencing n years from 2009; equation 11 can be used to estimate the number of users since 2009 that have been using Video conferencing among students of academic tertiary institutions located in Nigeria.

Infusion model for the use of school electronic portal
Following the results of the sum of the number of users of School electronic portal for each consecutive year, a series of numbers representing the cumulative number of users for each year was presented. In Table 4.15, the year of infusion of school electronic portal is 2006 with 24 users. Figure 7 shows the graphical plot of the total number of users of school electronic portal for each subsequent year considered from the year of infusion; hence, the period between 2006 till 2017 is 12 years.

Each point along the horizontal axis represents the number of years between the base year and the year of interest, e.g. the number of users in 2014 is identified by the point 9 along the horizontal axis which corresponds to 191 users since 2006. Using the auto-generated trend line functionality of the Excel Data Analysis Tool-pack, the infusion model for School electronic portal use taking the base year as 2006 is estimated using a polynomial of degree, $m = 5$ and $R^2 = 0.9996$ stated as follows:

$$S(n) = -0.005n^5 + 0.18n^4 - 2.25n^3 + 12.09n^2 - 3.99n + 18.36 \quad (12)$$

Therefore, in order to determine the total number of users of School electronic portal n years from 2006; equation 12 can be used to estimate the number of users since 2006 that have been using school electronic portal among students of academic tertiary institutions located in Nigeria.
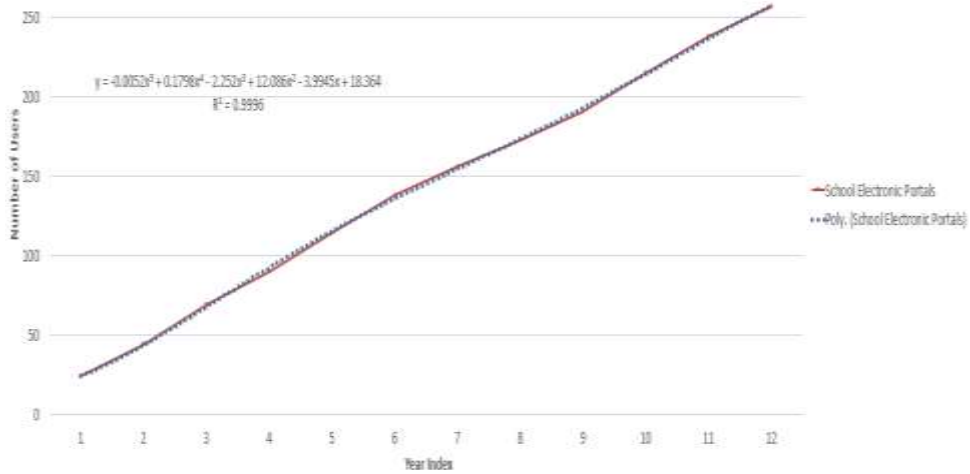
Figure 7: Trend line of School Electronic Portal Users

Infusion model for the use of Bulk SMS services

Following the results of the sum of the number of users of bulk SMS services for each consecutive year, a series of numbers representing the cumulative number of users for each year was presented. In Table 15, the year of infusion of bulk SMS services is 2007 with 17 users. Figure 8 shows the graphical plot of the total number of users of bulk SMS services for each subsequent year considered from the year of infusion; hence, the period between 2007 till 2017 is 11 years.
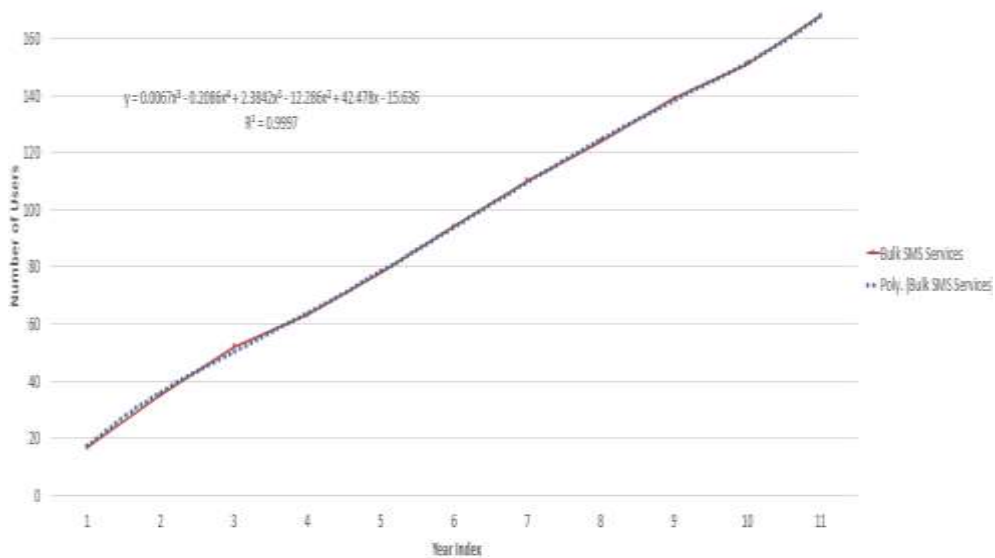
Figure 8: Trend line of Bulk SMS Services Users

Each point along the horizontal axis represents the number of years between the base year and the year of interest, e.g. the number of users in 2014 is identified by the point 8 along the horizontal axis which corresponds to 124 users since 2007. Using the auto-generated trend line functionality of the Excel Data Analysis Tool-pack, the infusion model for Bulk SMS services use taking the base year as 2007 is estimated using a polynomial of degree, $m = 5$ and $R^2 = 0.9997$ and stated as follows:

$$S(n) = 0.007n^5 - 0.209n^4 + 2.384n^3 - 12.286n^2 + 42.478n - 15.636 \quad (13)$$

Therefore, in order to determine the total number of users of Bulk SMS services n years from 2007; equation 13 can be used to estimate the number of users since 2007 that have been using Bulk SMS services among students of academic tertiary institutions located in Nigeria.

Infusion Model for the Use of Instant Messaging
Following the results of the sum of the number of users of instant messaging for each consecutive year, a series of numbers representing the cumulative number of users for each year was presented. In Table 15, the year of infusion of instant messaging is 2009 with 16 users. Figure 9 shows the graphical plot of the total number of users of instant messaging for each subsequent year considered from the year of infusion; hence, the period between 2009 till 2017 is 9 years.
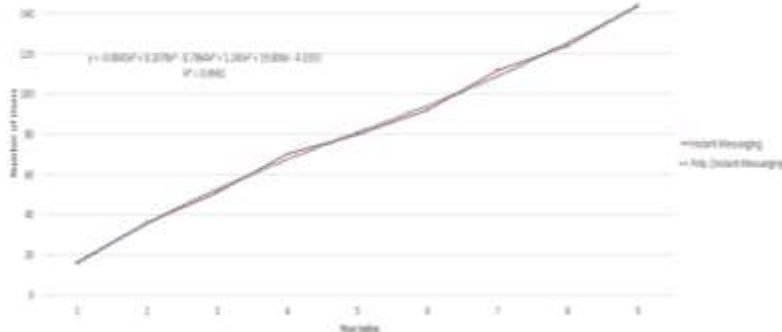

Figure 9: Trend line of Instant messaging Users

Each point along the horizontal axis represents the number of years between the base year and the year of interest, e.g. the number of users in 2014 is identified by the point 6 along the horizontal axis which corresponds to 100 users since 2009. Using the auto-generated trend line functionality of the Excel Data Analysis Tool-pack, the infusion model for instant messaging use taking the base year as 2009 is estimated using a polynomial of degree, $m = 5$ stated as follows:

$$S(n) = -0.0045n^5 + 0.108n^4 - 0.786n^3 + 1.243n^2 + 19.808n - 4.333 \quad (14)$$

Therefore, in order to determine the total number of users of instant messaging n years from 2009; equation 14 can be used to estimate the number of users since 2009 that have been using instant messaging among students of academic tertiary institutions located in Nigeria.

Infusion Model for the Use of Electronic Library Systems

Following the results of the sum of the number of users of electronic library system for each consecutive year, a series of numbers representing the cumulative number of users for each year was presented. In Table 15, the year of infusion of electronic library system is 2008 with 11 users. Figure 10 shows the graphical plot of the total number of users of electronic library system for each subsequent year considered from the year of infusion; hence, the period between 2008 till 2017 is 10 years.
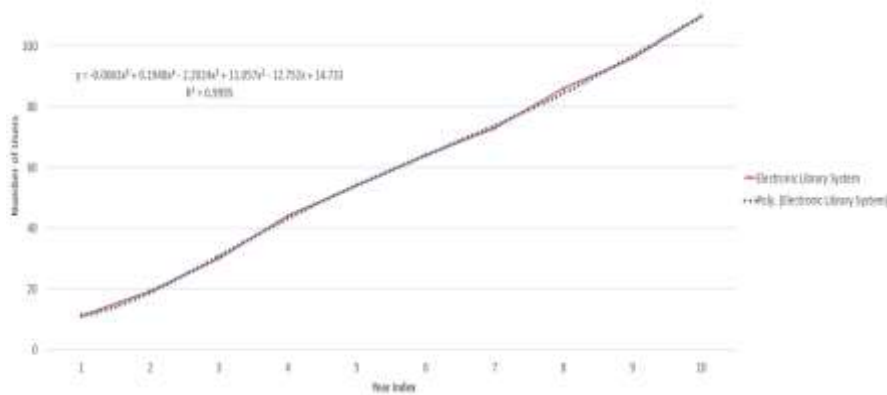

Figure 10: Trend line of Electronic Library System Users

Each point along the horizontal axis represents the number of years between the base year and the year of interest, e.g. the number of users in 2014 is identified by the point 7 along the horizontal axis which corresponds to 73 users since 2008. Using the auto-generated trend line functionality of the Excel Data Analysis Tool-pack, the infusion model for electronic library system use taking the base year as 2008 is estimated using a polynomial of degree, $m = 5$ stated as follows:

$$S(n) = -0.006n^5 + 0.195n^4 - 2.202n^3 + 11.06n^2 - 12.752n + 14.733 \quad (15)$$

Therefore, in order to determine the total number of users of electronic library system n years from 2008; equation 15 can be used to estimate the number of users since 2008 that have been using electronic library system among students of academic tertiary institutions located in Nigeria.

Discussion

The results of the demography of the students selected form the identified academic tertiary institutions in Nigeria showed that majority of the students were from Obafemi Awolowo University in equal distribution of males and females and of Yoruba ethnicity. The results also showed that majority of ICT tool users belonged to the sciences and administration discipline and with IT compliance of 5 and 3 suggesting that majority of the students have a good understanding of the use of IT devices. The results also further showed that majority of the students have their

own personal smartphones with operating systems vendors of Google Android® OS followed by Apple iOS® for iPhone devices.

The results of the study further pointed out that regarding the frequency of use of ICT devices, majority of respondents suggested that mobile computing were used by about 77% followed by instant messaging by 70% of the respondents, the adoption of instant messaging software could have been influenced by the adoption of mobile devices by the users since most instant messaging software can also be installed on mobile devices. The results of the study regarding the extent of use of the identified ICT devices showed that majority of the students used the ICT devices for registering courses, leisure, accessing course materials, accessing personal information and making presentation by at least 70% of the respondents.

The results of the impact of ICT on productivity and functionality of the respondents showed that majority of the respondents constituting about 80% suggested that the impact of ICT on productivity and functionality reduces operation costs was at least very good while at least 60% suggested that the impact of ICT was at least good on improved service performance, information processing speed, reliable back-up of information, flexible problem solving approach and guaranteed data security. The results of the study further showed that the ICT tools used among Nigerian auditing firms were, starting from the earliest: mobile computing, PCs/laptops, wireless communication/hotspots services and computer hardware in the year 2009 followed by spreadsheet application and auditing software packages in the year 2010, database applications in the year 2011 and statistical software packages in the year 2013.

CONCLUSION

Following the analysis of the information collected from 300 students selected from five (5) tertiary institutions consisting of two federal, 1 state and 2 private schools, a number of conclusions were drawn from the results of the analysis performed. The study concluded that science, administration, arts and education students were the majority adopters of ICT who were IT compliant regarding the use of ICT devices identified of which majority of the sampled students had smartphones using Android Operating System (OS).

The study concluded that at most 70% of the students suggested the availability and functionality of mobile devices, personal computer/laptops, social networks, instant messaging and school electronic portal systems while 50% suggested the availability and functionality of e-mail services, bulk sms and electronic library services. The study concluded that the most frequently used ICT devices were mobile devices, school electronic portal, social networks, PCs/laptops, PCs/laptops and e-mail services comprising at least 70% of students. The results further showed that 70% of the students used ICT tools for academic purposes while 50% used ICT tools for performing all the identified activities. The study also concluded that the students suggested that the major limitation to the adoption of ICT was electricity followed by Internet Providers and location.

The study concluded that the earliest commonly used ICT devices were PCs/laptops in 2004, e-mail services in 2005, school electronic portals and mobile devices in 2006, social networks and electronic library systems in 2008 by about 70% of the students. Polynomial functions of degrees 5 and 6 were used to formulate the ICT infusion model for the identified devices based on the information collected from the students regarding the year of adoption of ICT devices. The study showed that using the polynomial ICT infusion model of a certain degree m in terms of n – the number of years after ICT infusion; the number of users adopting an ICT device can be estimated.

REFERENCES

Adavbiele, J.A. (2016).   The Use of ICT to Enhance University Education in Nigeria. *International Journal of Education, Learning and Development 4*(5): 1 – 11.

Brown, M., Anderson, B. and Murray, F. (2007). E-learning policy issues: Global trends, themes and tensions. Available from http://www.ascilite.org.au/conferences/singapore07/procs/brown.pdf [Accessed July 23, 2017].

Graham R. C. (2004). Part One: Introduction to Blended Learning. *Handbook of blended learning: Global Perspectives, Local Designs*. San Francisco, CA: Pfeiffer Publishing.

Hammo, B. (2007). Beyond Traditional Lecturing: Interactive Computer-Based Classroom. In: *Proceedings of the 2007 MIT Learning International Networks Consortium* (LINC) Conference, Amman, Jordan, October 28-30: 23 – 45.

Iloanusi, O.M. and Osuagwu, C.C. (2013).   ICT Diffusion and Uptake in Nigerian Tertiary Educational Institutions. *African Journal of Computers and ICT – Special Issue on the ICT in the African Environment 5*(4): 77 – 84.

Ipaye, B. (2010). E-learning in a Nigerian Open University. 2010. In: *Proceedings of the Fifth Conference of Learning International Networks Consortium* (LINC) May 23 – 26, 2010 MIT, Cambridge, Massachusetts, USA.

Langat, A.C. (2015). Reassessment of the Adoption and Integration of ICTs to Enhance Teaching and Learning in Academic Programmes in MOI University Kenya. *International Journal of Recent Research in Social Sciences and Humanities 2*(4): 179 – 192.

Ogunsola, A. and Aboyade, W.A. (2005). Information and Communication Technology in Nigeria: Revolution or Evolution. *Journal of Social Sciences 11*(1): 7 - 14.

Oguntunde, T (2012). Challenges of Managing a Higher Academic Institution Information and Communication Technology (ICT) Unit from Cradle: University of Ibadan Experience. *African Journal of Computing and ICT 5*(2): 23-28

Omotosho, A.O., Lateef, E.B., Amusa, O.I. and Bello, T.O. (2015).   Information and Communication Technology Adoption and Use among Students of a Nigerian University for Distance learning. *Journal of Library Philosophy and Practice 12:* 1 – 13.

Oyeleye, C.A., Fagbola, T.M. and Daramola, C.Y. (2014). The Impact and Challenges of Cloud Computing Adoption on Public Universities in South-western Nigeria. *International Journal of Advanced Computer Science and Applications 5*(8): 13 – 19.

Sadiq, F.I. and Onianwa, C.U. (2011). Towards a Scalable Web Assessment System for Post University Matriculation Examination in Nigeria. *African Journal of Computing and ICT*. *4*(2): 25-30.

Uzoegwu, P. and Iloanusi, O. (2010). Social and Economic Challenges to Lifelong Learning in Nigeria. In: *Proceedings of the Fifth Conference of Learning International Networks Consortium* (LINC) May 23 – 26, 2010 MIT, Cambridge, Massachusetts, USA.

Wilson, K.B., Tete-Mensah, I. and Boateng, K.A. (2014).   Information and Communication Technology Use in Higher Education: Perspectives from Students. *European Scientific Journal 10*(19): 161 – 171.