

Factors Affecting the Adoption of cloud-based pedagogy and student's utilization; A case study of Post-Graduate students of University of Nigeria, Nsukka

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Abstract

The study assessed factors affecting the adoption of cloud-based pedagogies available in teaching and learning as well as students' utilization of cloud-based services in the University of Nigeria Nsukka. Using descriptive survey design, the study made use of a sample of 100 students from 10 faculties in the institution. Instrument for data collection was questionnaire developed by the researchers. The reliability of the instrument was established using Cronbach Alpha. Percentage, mean and standard were used to analyze the data collected. The result showed that inadequate power supply, high cost of installation, maintenance technological devices, data security and scarcity of ICT infrastructure affects the adoption of cloud-based pedagogy. The study also found that cloud-based pedagogy increases flexibility for teachers in selecting from a wide range of cloud based applications, with a wide range of learning experiences while reducing the cost involved in hardware and software procurement.

Introduction

In the past few years, we have seen both the staff and the students (Ovum survey, 2013). tremendous developments in information and communication technologies, (ICT) and the Internet usually an icon of a cloud has been symbolising the in Nigeria. The use of the Internet and ICTs to entire Internet networks until today. Pedagogical deliver solutions (be it business or educational) is technologies are those learning technologies that are now considered a prevailing practice. There are many used to complement the traditional face-to-face Internet service providers (ISP) rolling out base knowledge delivery system through interactive stations across the continent in a move to try to learning using ICT tools such as computers, smart improve the availability and accessibility of Internet phones or the Internet.

resources to all areas of the African continent. The Education Endowment Foundation, Higher Learning Institutions (HLIs) have not been (EEF, 2015) stated that there is positive evidence that left out on this move; they have been challenged to shows that technology has an integral role to play in also utilize their potential so as to improve the deepening and accelerating learning. The integration quality of, and widen access to education using of cloud computing into the teaching and learning online resources.

Nigerian higher educational institutions are an embedded learning environment known as cloud now searching for innovative ways to improve the pedagogy. Barack (2014) defined cloud pedagogy as delivery of knowledge to learners for them to attract the art of teaching while encouraging omnipresence more students and survive this challenging learning via cloud based applications. In simple distributed knowledge production system (Mlitwa, terms, cloud pedagogy refers to any form of teaching 2005). Higher learning institutions have developed and learning that is done using cloud-based learning and adopted various forms of cloud pedagogical technologies; that is any form of learning using technologies with the aim of improving knowledge cloud-based applications or over a cloud-based

platform. Cloud resources are stored in a virtual education landscape both as a ubiquitous computing environment at a separate location and accessed from tool and a powerful platform that can enhance various forms of web-enabled devices like laptops, engagement among learners in conversing with tablets, and smart phones (Pam, 2014). The study of peers, presenting and defending ideas, exchanging cloud pedagogy is still in its early stages, with not diverse beliefs, questioning others' conceptual much research having been done on cloud pedagogy, frameworks, and make them actively engaged. The and new learning and teaching models are still being author further revealed that it would help instructors developed to replace chalk and textbook convention to understand and improve practice, and thus, approach (Barack, 2014).

increase productivity. The author also found that Cloud based pedagogy can also replace cloud-base service like G suite for education could textbooks with browser-based content delivery, and also facilitate collaboration between students and this would be offering the institution much more than instructors as well as among instructors in sharing just content as a service. The resources could be tested and tried teaching strategies and materials, and delivered as word processors, spreadsheets or to promote maximum retention of knowledge and databases. A good example can be found in deep understanding of subject matter thereby California where in 2009, the State Governor Arnold promoting professional development while allowing Schwarzenegger introduced a program to have the the student to be more successful in their profession. State stop buying textbooks and instead give Azubuike, Nicholas, Charles and Misra students free digital devices (Howlett, 2012). (2013) found that embarking on a national cloud Similarly, this idea was internalised in university of project holds huge economic advantages for and Nigeria Nsukka when the vice Chancellor, Ozumba increases the participation of developing countries in in 2016 made it compulsory for all first years' the on-going ICT revolution to enhance the teaching students to buy laptop at reduced rate through and learning experiences. Adopting a national cloud University management information system (MIS) strategy would require active partnership between unit, to enable student's access online databases and governments, education sectors and the private virtual libraries of universities. However, University sector. The authors also observed that government of Nigeria Nsukka faces many challenges that make would have to establish definite legal frameworks it difficult for her to achieve the targeted objectives. and standards for cloud security, privacy and service These challenges include the high costs ICT reliability are the major challenges.

infrastructure, high cost of bandwidth, inadequate **Cloud based pedagogical Services Available to power supply and inadequate availability of Educational Institutions** competent technical staff (Abdusalam & Fatima, Leading cloud providers have recognized the importance of adjusting their computing services 2011).

Despite the fundamental roles cloud based specifically to the needs of educational institutions. pedagogies plays in higher education, only few These include customized software packages at low researchers work have tried to determine the factor prices that more institutions can afford. Some of the that affects the adoption of cloud computing, hence, most widely used educational platforms are listed no much empirical work has been done on factors below.

that affect cloud-based pedagogy and students' **Microsoft for Education**; The Microsoft's cloud is utilization in higher institution (Norwell, 2015). The currently available to the educational institutions in study of cloud pedagogy is still in its early stages, the form of Office 365 for Education (formerly with not much research having been done on cloud Microsoft live@edu) and Office Web Apps, pedagogy and this necessitated this study. Microsoft (2014). Microsoft also offers a set of Web

Cloud-based pedagogy apps that are close version of word, Excel, Sunusi (2015) revealed that the cloud PowerPoint, and OneNote which can be used via the computing has a significant place in the higher

internet without installing any software (Adeoye, which aims at establishing a framework that delivers 2015).

a personalized, adaptable and adaptive learning **G suite for Education;** Google has initiated two experience in a collaborative environment for important campaigns in form of virtual classroom learners (Adeoye, 2015). iClass includes a number and seminar for introducing improvements in the of services and an adaptive intelligent system education sector (Google, 2016). According exploiting the potential of ICT to support a Mohammed (2009), the Google for Education (now personalized, flexible, learner-centered approach, G suite for Education) provides Virtual Learning for facilitating personalised e-Learning experiences Environments (VLEs), which are electronic (Mohammed, 2009).

platforms that can be used to provide and track e- With these cloud-based pedagogy services, learning courses and enhance face-to-face learners can access their learning tools from any instruction with online components and also share computing device, regardless of platform, as long as educational videos through YouTube. Online videos the device is able to connect to the cloud. As a result give students control over lecture because it is of these important roles these applications play in the portable and enable them to replay the segment as mist of numerous challenges necessitated the need to they study the contents. In effect, they can adjust the for this study.

instructors' delivery speed and topic selection to **Cloud computing infrastructure and skills** match their individual learning pace and interest Cloud computing has gained much (David, 2012). It provides self-regulated pedagogy popularity in the world of information and approach which are very much learner controlled and communication technology (ICT). When it was first suited to self-directed learning through Google Docs introduced, it promised to have a significant impact as web-based office where individual can share on many sectors of the economy particularly in documents with peer learners and for collaborative education included (Ercan, 2010). Cloud computing report writing.

technology is useful in society especially in **Chrome books for Education** is another important education where lectures and labs are based on cloud Google's projects aimed at education innovation platform through virtualization. A variety of which provide a secured platform for administering knowledge and skills can be made available to students' assessments. Jeanne, Karen and Martha teachers and students through cloud-based services (2010) noted that when instructor embed formative and these services can be accessed anytime, assessment technique into online lessons, they can anywhere and on any device. The US National obtain information to evaluate how well students are Institute of Standards and Technology (NIST) as learning concepts and make adjustment to teaching cited by Nowell (2015) defined cloud computing as plans as needed and students can receive immediate a model for enabling convenient, on-demand feedback on activities when automated scoring with network access to a shared pool of configurable rationale are used by the instructor.

computing resources (for example, networks, **Amazing web service (AWS)** cloud is an education-servers, storage, applications, and services) that can friendly set of services that provides cost-efficient be rapidly provisioned and released with minimal solutions to universities, community colleges and management effort or service provider interaction.

vocational schools. AWS delivers a set of computer, Several authors identified five essential storage, database, analytics, and application and characteristics of cloud computing: 1.) Storage space deploy services that lower costs, scale application and services that are consumed directly from the and respond quickly in emergencies and meet the cloud can be automatically provisioned and released ever changing needs of the modern students as per user request. 2.) Cloud computing services (Amazon, 2017).

have huge network accessibility. 3.) Resources **Apple iCloud:** The iClass project is an Apple iCloud available on the cloud can be accessed by many services that are primary for open learning system, consumers simultaneously. 4.) Allows for rapid

provisioning of capabilities, in some cases organizations favoured. Developing a mobile app automatically. 5.) Cloud computing uses the pay as that runs on many devices provides the cross-you use model (Plummer et al., 2009; Mell & Grance, 2009, NIST as cited by Nowell, 2015). Similarly, available to users, but it creates a lot of work for Mohammed (2009) found that cloud computing developers. (2) Slow download speed and limited aimed at running applications as services over the internet access; the service speed of some of the Internet on a scalable infrastructure. Many Internet service providers is very poor which makes applications such as word processing, spreadsheets, it difficult for users to download, view and presentations, databases and more can all be participate on the online class.

accessed from a web browser, while the software and files are housed in the cloud. The author noted that hindrances to the adoption of cloud-based pedagogy educational institutions could take advantage of in the education system include:

cloud applications to provide students and teachers **Lack of adequate network responsiveness:** in case with free or low-cost alternatives to expensive, where network services is poor it becomes proprietary productivity tools. In support of this, impossible to deliver lecture through it and most Ingo, Niamh and Daniela (2016) opined that cloud learning institutions lack sufficient bandwidth, hence computing infrastructure plays important role in cannot adopt cloud computing affectively.

teaching and learning especially in practical oriented **Integration:** Different applications require complex courses in which physical experiment processes are integration as to connect to the available on premise recorded in form of video tutorial.

Challenges facing cloud based pedagogy adoption for the integration of existing university data in Higher Education structures and systems with cloud applications.

Previous researchers have identified some of Thus, there is need to have a quick, cost effective and the major challenges of cloud-based simple way to connect university systems with cloud adoption. Abdulsalam and Fatima (2011) identified applications.

issues like the scarcity of ICT infrastructure, high **Service Quality:** This is one of the reasons cited by cost of ownership, unreliable and inadequate learning institutions for not shifting to cloud based electrical power supply as factors that are limiting pedagogy. The author found that the service level the integration of ICT in African higher education. agreements stipulated by the providers of cloud The authors revealed that the cloud's on-demand services are insufficient when it comes to access and pay-as-you-use characteristic could help guarantying performance, availability, as well as cut down on the capital expenditure of institutions scalability. Thus, without adequate guarantee, (Akin, 2014). Nceba and Anass (2015) found that institutions of higher learning shy away from cloud computing has a direct effect on performance adopting cloud computing in running their expectancy, effort expectancy, social influence and operations.

facilitating conditions. Computer experience was **Security and Privacy:** This is a major concern found to be a factor of concern, particularly if the among many institutions of higher learning (Alwi & computer use could have started in primary and Fan, 2010). Cloud computing calls for the junior secondary level for the respondents. introduction of a third party who is the platform

Dimiter (2015) outlined two challenges of provider hence the privacy and security of data is cloud-based pedagogies namely: (1) device hard to maintain.

variability: one of the biggest issues in mobile **Purpose of the Study**

application development is how to build mobile apps The purpose of this study was to investigate the that are applicable to many mobile devices. This factors affecting the adoption of cloud-based issue is being escalated with the advent of bring your pedagogy and student's usage in university of own device (BYOD), a policy that many

Nigeria Nsukka. Specifically, the study was designed of the study comprises 505 post-graduate students to determine:

1. the factors affecting adoption of cloud-based Vocational and Technical Education of the pedagogy in University of Nigeria, Nsukka. University of Nigeria, Nsukka in 2016/2017 session.
2. extent of utilization of cloud-computing by Simple random sampling was used to draw the post-graduate students of University of sample of 100 students. The instrument for data collection was an 18-item titled the Factors Affecting the Adoption of cloud base pedagogy and Nigeria, Nsukka

Research Questions

Two research questions were raised to guide this student's utilization in university of Nigeria, Nsukka. study:

1. What are the factors affecting adoption of cloud of response arranged along a continuum of Strongly based computing in University of Agreed (SD), Agree (A), Disagree (D) and Strongly Nigeria, Nsukka? Disagree (SD) and Little Extent (LE), Moderate
2. To what extents is Post-graduate of University Extent (ME) and High Extent (HE). The instrument of Nigeria Nsukka utilizing cloud-based was face validated by two experts from social computing services? science education in Faculty of Education in

Hypothesis

Ho₁: There is no statistical significance difference the instruments to ensure its clarity, construct and between mean ratings of male and female post-appropriateness of the instruments. The instrument graduate student of University of Nigeria was trial tested with ten students and a reliability of Nsukka on the extent of utilizing cloud-based 0.89 was obtained using Cronbach Alpha. The computing services. researcher administered the research instrument.

Method

The design adopted for this study is question. Based on the four-point scale of 2.50 and descriptive survey research design. This is because 1.50 on three-point scale were adopted. Therefore, survey design according to Nworgu (2015) aims at mean ratings of 1.50, 2.50 and above were regarded collecting data and describing in a systematic as accepted while mean rating of 2.50 and 1.50 manner the characteristics, features, or facts about a below regarded as rejected. Out of the 100 copies of given population. Survey design is appropriate for questionnaire distributed, 100 were retrieved which this study because it sought to extract information on is 100 percent return rate. Analysis of data was done factors affecting the adoption of cloud-based based on the number of questionnaires that were pedagogy and student's utilization in university of returned.

Nigeria Nsukka. The study was carried out in **Results**

University of Nigeria Nsukka in Nsukka Local Based on the analysis of data, the following are the Government in Enugu State Nigeria. The University results obtained as contained in Table 1 and 2 was selected because it has Internet services for respectively. students and staff of the university. The population

Table 1

Mean responses of the factors affecting the adoption of cloud-based computing in University of Nigeria, Nsukka among post-graduates students (N = 100)

Challenges of cloud-based pedagogy	No	\bar{x}	S.D	Remark
The data security is the biggest challenges facing the Institution to adopt any cloud base pedagogy	100	3.24	.726	Agreed
Irrelevant junk advert on web page	100	3.10	.611	Agreed
Individual privacy are not guaranteed on cloud	100	2.93	.795	Agreed
There is reliability challenges	100	2.97	.745	Agreed
User control is limited	100	3.06	.814	Agreed
There is a resistant to change in technology (device variability)	100	2.85	.869	Agreed
High cost of installation and maintenance technological Devices	100	3.27	.649	Agreed
Inadequate power supply	100	3.40	.620	Agreed
Lack of adequate skills and professionals in ICT	100	2.88	.686	Agreed
The scarcity of ICT infrastructure	100	3.15	.642	Agreed

Key: 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree.

Table 1 shows the responses of post-graduate respondents' responses, where low standard deviation students on factors affecting the adoption of cloud-based pedagogy in teaching and learning presented in mean and standard deviation. The benchmark for the challenges of adoption of cloud-based pedagogies was mean rating of $\bar{x} = 3.40$, $SD = .620$). Other challenges were high cost of installation, maintenance technological Devices ($\bar{x} = 3.27$, $SD = .649$) and data security ($\bar{x} = 3.24$, $Sd = .726$) and the scarcity of ICT infrastructure ($\bar{x} = 3.15$) challenge to the adoption of cloud based pedagogies. The standard deviation depicts the variability in the

Table 2

Mean ratings of the extent post-graduate students' of University of Nigeria Nsukka level of utilization of cloud-based computing services.

Extent of utilizing cloud-based computing service	No.	\bar{x}	SD	Remark
Virtual Classroom	100	1.18	.435	Little Extent
Apple iCloud's	100	1.40	.586	Little Extent
Google drive	100	1.44	.558	Little Extent
The Virtual Seminar	100	1.39	.530	Little Extent
Peer online learning group	100	2.05	.783	High Extent
Software libraries	100	2.43	.700	High Extent
Online video tutorial	100	2.91	.288	High Extent
Online assessment	100	2.94	.239	High Extent

Legend: 1= to little extent; 2 = to Moderate extent; 3 = to high extent

The benchmark for extent male and female post-graduate students utilizing cloud-based computing service was mean rating of 1.5. A score above this indicated that students uses that item while a mean rating score below 1.5 indicates that students uses the item to a little extent. Online assessment (mean rating = 2.94, SD = .530), online game and simulation (mean rating = 1.39, SD = .239) was identified as the major cloud-based computing service that students frequently use,

Table 3

t-test statistics analysis of difference between mean ratings of male and female post-graduate student of University of Nigeria Nsukka on the extent of utilizing cloud-based computing services

Item Statement	\bar{x}_1	S ₁	\bar{x}_2	S ₂	T	Df	Sig.(2-tailed)	Remark
Virtual Classroom	1.22	.503	1.14	.354	.835	98	.406	NS
Apple iCloud's	1.354	.522	1.45	.647	-.818	98	.415	NS
Google drive	1.47	.578	1.41	.537	.559	98	.577	NS
The Virtual Seminar	1.37	.528	2.18	.808	-.335	98	.739	NS
Peer online learning group	1.92	.744	1.41	.537	-1.688	98	.095	NS
Software libraries	2.35	.744	2.51	.649	-1.125	98	.264	NS
Online video tutorial	2.90	.300	2.92	.277	-.284	98	.777	NS
Online Assessment	2.96	.196	2.92	.277	.887	98	.377	NS
Over all summary Result	15.55	1.369	15.94	1.449	-1.387	98	1.69	NS

\bar{x}_1 = male Mean, \bar{x}_2 = Female mean, sd_1 = Male Standard deviation, sd_2 = Female standard deviation

Table 3 showed that an independent-sample t-test was conducted to compare the extent of use of cloud based computing services for male and female post-graduate students. There was no statistically significant difference in score for male ($\bar{x}_1 = 15.55, sd_1 = 1.361$) and female ($\bar{x}_2 = 15.94, sd_2 = 1.449$); (t = 1.398, p = .169, two-tailed). The null hypothesis of no significance difference between male and female mean ratings was upheld.

Discussion

All the factors that affecting the adoption of cloud based computing were all accepted by the respondents. Some of the major challenges identified include data

security ($\bar{x} = 3.24$) which was identified as one of the major challenges facing adoption of cloud based computing. Lending support to this findings of Rania (2016) and Alwi and Fan (2010), who found that data security is one of the major concern of many institution of higher learning in adoption cloud based pedagogies. Respondents attested to the existence of resistant to change in technology ($\bar{x} = 2.85$) as a factor affecting the adoption of cloud computing services. This implies that resistant to change has become a pre-eminent problem in tertiary institutions. This could be attributed to ignorance of the importance of cloud-based services. Others were inadequate power supply, scarcity of

ICT infrastructure, high cost of installation and maintenance of technological device, irrelevant junk advert on web page, individual privacy not guaranteed, lack of inadequate skill and professional in the ICT. The above findings are in line with Abdulsalam and Fatima (2011) who noted that these factors limit the integration of cloud-based computing in African higher education.

On the extent of utilization of cloud computing services by post-graduate students, eight item questions were presented to the respondents and four items were accepted. From the views expressed by respondents, online classroom assessment ($\bar{x} = 2.94$) is frequently utilized by the respondents. This might be as result of online compulsory screening examination by the University of Nigeria, Nsukka for her prospective post-graduates students. This observation was also affirmed by Jeanne, Karen and Martha (2010), who asserted that when instructor embed formative assessment technique into online lessons, they can obtain information to evaluate how well students are learning concepts and make adjustment to teaching plans as needed and students can receive immediate feedback on activities when automated scoring with rationale are used by the instructor. The result equally shows that online video tutorial ($\bar{x} = 2.91$) and software libraries ($\bar{x} = 2.43$) are frequently utilized by the post-graduates students. This findings lends credence to David (2012) who found that online videos and software libraries give students control of the lecture because it is portable and enable students to replay the segment and stop the lecture as they study the contents. In effect, they can adjust the instructors' delivery speed and topic selection to match their individual learning pace and interest.

However, the other four items that were utilized to a little extent include virtual

classroom ($\bar{x} = 1.18$), apple icloud ($\bar{x} = 1.40$), google drive ($\bar{x} = 1.44$) and virtual seminar ($\bar{x} = 1.39$). Despite the fundamental roles these services play in a cloud-computing environment, the post-graduate students of University of Nigeria have not fully utilized these services available in the cloud. The null hypothesis tested at 0.05 levels significant on males and females respondents with respect to the extent of utilization of cloud-based computing services shows that there was no significant difference between male and female respondents on the extent of utilization of cloud based computing services. The post-graduate students uniformly agreed on extent of utilization of cloud computing services.

Conclusion

The result of the study have indicated that major factor affecting the adoption of cloud-based computing service by post-graduate students were inadequate power supply, high cost of installation, maintenance technological devices, data security and scarcity of ICT infrastructure. This study found that post-graduate students of the university Nigeria Nsukka have not fully utilized the services of the cloud-based computing to a very large extent as result of the identified factors. Hence, the male and females post-graduate students' view on the extent of utilization of cloud-based computing service did not differ.

Recommendations

1. Funding of ICT personal should be given priority attention. It should cover the cost in service training for cyber security purchase, installation and maintenance of ICT facilities.
2. Lecturers should be given adequate training on the utilization of cloud-based pedagogies services in form of workshop and seminar.
3. Post-graduates Students should also be encouraged to utilize cloud-based service in their academic endeavour.

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