ACCESSIBILITY AND UTILIZATION OF EMERGING TECHNOLOGIES IN COMPUTER SCIENCE TEACHING IN POLYTECHNICS AND COLLEGES OF EDUCATION IN DELTA STATE, NIGERIA

BY

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Abstract

This study is designed to investigate the accessibility and the degree of utilization of emerging technologies in computer science departments in two state Polytechnics and two state Colleges of Education in Delta State. The population of the study consisted of 36 lecturers of which 20 of the lecturers are from the two selected Polytechnics situated in Otefe-Oghara and Ogwashi-Uku towns, while 16 of the 36 lecturers were from two (2) Colleges of Education situated in Mosogar and Warri towns respectively. Two hypotheses guided the researcher in the study and the descriptive survey research design was adopted. The instrument for data collection was a structured questionnaire termed: accessibility and degree of utilization of emerging technologies by lecturers (ADUETL) in the study of Computer Science, with a reliability coefficient of 0.83, using the Cronbach alpha statistics. The data collected were analyzed with the statistical values of 0.25, 0.100 and 0.00, 0.125 mean scores, with t-values of 2.52 and -0.23 and p-values of 0.017 and 0.320 respectively. The findings showed that the differences between the degree of accessing and utilizing emerging technologies for teaching Computer Science by lecturers in the Computer Science departments in the sampled state-owned Polytechnics and Colleges of Education in Delta state is insignificant.

Keywords: Accessibility, Degree of utilization, Emerging technologies, Computer science teaching, Institutions of higher learning.

Introduction

Emerging technologies are a set of evolving technologies that are aimed at enhancing communication and research for economic growth of societies and nations at large. In essence, an emerging technology is defined as the technology that is radically innovative and rapidly evolving, and displays some degree of coherence over time with the potential to exert a substantial impact on a nation's socio-economic life. In the opinion of Oliveira et al (2019), emerging technologies are relatively new technologies that have evolved from past human technological accomplishments. Emelogu et al, (2022), defined emerging technologies as novel digital technologies that aid the utilization of multimedia tools.

Emerging technologies are characterized by radical application, rapid growth, coherence, significant impact, and uncertainty and ambiguity. However, the most significant impact of an emerging technology rests on the future, and its emergence phase, which remains uncertain and ambiguous, claimed Rotolo and Martin (2015). Emerging technologies can further be classified into software and hardware technologies, encompassing various categories that include educational technology, artificial intelligence, software engineering, information technology, data analytics, nanotechnology, robotics, biotechnology, and others Rotolo and Martins (2015).

Some examples of interactive emerging technologies are; YouTube, Zoom, Face-book, Email, X (Twitter), Skype, Wiki, WebEx, Blogs, Instagram, Google docs., WhatSapp, etc., stated Emelogu et al (2022). And others within this structure include; 3-D printing, crypto currencies, Internet of Things (IoTs), voice recognition devices, machine learning, wearable computing devices, cloud computing, and several others. In the opinion of Gikandi and Morrow (2015), the incorporation of emerging technologies in teaching can aid lecturers to engage learners in creative and innovative ways, fostering creativity and critical thinking skills. Davis and Warsaw (1989), posited that the utilization of technology acceptance model (TAM) as a concept of an emerging technology has been broadened to include the utilization of telemedicine services, digital technologies for educational and ICT applications, electronic learning platforms for learners, and so on. In the submission of Moore (2019), emerging technologies can provide the means for personalized learning experiences for teachers and learners alike, allowing them to access educational resources, collaborate with peers, and engage in professional development at their own pace and convenience**.** The application of emerging technologies in the education system aids employees to individually and collectively enhance their skills in their work schedules (Parry & Batista, 2019).

In the opinion of Sultan and Kanwal (2017), the projection is aimed at assisting higher education institutions to contribute to national development by advancing teaching and learning for learners' in the 21st century

work place. According to Thompson (2018), emerging technologies can provide teachers and learners alike with access to a wide range of educational resources that include; online courses, research articles, and instructional videos, so as to enhance their developmental opportunities. In similar vein, Ifeakor (2018), Okoli and Osuafor (2018) and Nwana and Egbe (2017), disclosed that limited accessibility of lecturers to technological tools to carrying out their duties effectively is a general issue in our school system at all levels. They further claimed that even when these tools are made available by proprietors in rare cases, lecturers/teachers and students spend minimal time in accessing and utilizing them as educational resources in the teaching and learning process.

Jack and Songo (2020), identified the challenges for the effective utilization of emerging technologies as issues related to the adequate provision of technological resources due to the absence of indigenous computing technologies. In the opinion of Janika et al (2021), emerging technologies have the potential future impact on the development and teaching process in tertiary institutions. And according to Gamage et al (2020), the wide spread impact of the COVID-19 (Corona Virus Disease of 2019) pandemic led to the recognition of the significant gains of emerging technologies application in the education sector world-wide. The advent of the pandemic led to the closure of educational institutions worldwide, that compelled educators globally to engage in the transmission of skills and knowledge to learners using distance instruction media instead of the traditional face-to-face approach, said Gamage et al (2021). In the opinion of Alzahrani and Beck (2018), an emerging technology can enhance the quality of teachers' and learners' productivity by providing opportunities for collaborative learning, personalized instruction, and access to a whole lot of educational resources.

According to Ghanbaripour et al (2024), emerging technologies like augmented reality (AR), virtual reality (VR) and artificial intelligence (AI),etc., are increasingly being introduced into the education sector to provide new approaches to enhancing students learning by creating immersive and interactive environments that engages practical experiences. Emerging technologies presently can play critical roles in aiding lecturers and students in the institutions of higher learning like the selected Polytechnics and Colleges of Education. The study is focused on investigating the accessibility and the degree of utilization of emerging technologies in Computer Science departments in the selected State Polytechnics and Colleges of Education in Delta State, Nigeria.

Statement of the Problem

The need to involve emerging technologies in the educational system process is no more a matter of choice, but a necessity for teachers, students and other stakeholders in the education space, especially in the study of Computer Science. The introduction of these technologies in the study

of Computer Science is born out of the demand for flexibility in impacting Computer Science concepts to learners and the need to foster creativity and innovation in the teaching and learning process.

In this era of global connectivity, it is important to reason their impact on teaching and learning of Computer Science in our institutions of higher learning like the Polytechnics and Colleges of Education that are the nation's middle man-power providers, as a result of the continuous changes and on-going reforms in the education sector in the country. The accessibility and effective utilization of emerging technologies in the teaching and learning of Computer Science in the selected Polytechnics and Colleges of Education calls for the need to investigate the impact of the accessibility and degree of utilization of these emerging technologies in the teaching and learning of Computer Science in the departments of Computer Science in the aforementioned selected higher institutions of learning.

Purpose of the Study

The intention of this paper is to analysis the accessibility and degree of utilization of emerging technologies in the teaching and learning of Computer Science in the departments of Computer Science of the state-owned selected Polytechnics and Colleges of Education. Intentionally, the study is aimed at:

i. determining the mean difference in the accessibility of emerging technologies for teaching Computer Science in the departments of Computer Science in the selected Polytechnics and Colleges of Education in Delta state; and

ii. determining the mean difference in the degree of utilization of emerging technologies for teaching Computer Science in the departments of Computer Science in the selected Polytechnics and Colleges of Education in Delta state.

Hypotheses

The following null hypotheses were formulated

H_{01} : There is no significant mean difference in the accessibility of emerging technologies for teaching of Computer Science among lecturers in Computer Science departments of the selected state-owned Polytechnics and Colleges of Education.

H_{02}: There is no significant mean difference in the degree of utilization of emerging technologies for teaching among lecturers in the Computer Science departments of the selected state-owned Polytechnics and Colleges of Education.

Literature Review

Conceptual Framework

Concept of emerging technologies

Emerging technologies are innovative and rapidly evolving technologies with the capacity to creatively transform education systems, nations' economies, industries, and societies. Their features are novelty, growth, uncertainty and capacity to generate massive social and economic impacts (Rotolo, Hicks and Martin, 2015). Examples of these technologies are; artificial intelligence (AI), quantum computing, crypto-currencies, internet of things (IoT), augmented reality (AR), virtual reality (VR), robotics, machine learning, 5G communication networks, blockchain, etc.

Emerging technologies application in education promotes learner-centred learning, digital content creation, remote networking, and access to global knowledge resources (UNESCO, 2023). Emerging technologies involvement in Nigerian tertiary institutions can support innovative pedagogical approaches, encourage online and blended learning, and improve research productivity (Aina, 2022). In the opinion of Veletsianos (2016), emerging technologies are tools, concepts, innovations and advancements with the potential to reshape educational practices.

Accessibility of emerging technologies

Accessibility of emerging technologies refers to the degree to which individuals obtain, reach, use, and benefit from technological resources, infrastructures, digital devices, software applications, and internet services. These technologies afford lecturers and students enough access to computers, network facilities, digital platforms, smart devices, software tools, and technological infrastructures essential for teaching and learning activities (UNESCO, 2023). The technologies can provide equitable opportunities for lecturers and learners without regard for geographical locations, socio-economic status, gender, or physical abilities, as accessibility is a prerequisite for emerging technologies utilization.

A basic issue of concern is digital divide in various developing countries, where the disparity of access to these technologies affects their effective utilization. Digital divide results from poor government funding, poor internet connectivity, unstable electricity supply, and the lack of technological infrastructure and trained staff which can hinder lecturers and students access to emerging technologies in Nigerian tertiary institutions of learning. The unavailability of computers, cloud services, virtual laboratories, active internet

services, digital learning platforms and AI-powered applications in the institutions can limit access to emerging technologies (Aina, 2021).

Utilization of emerging technologies

This is the real application and frequency of using technological tools to achieving objectives in teaching, learning, research, communication, and administration (Venkatesh et al, 2003). The utilization of emerging technologies in the education system involve AI devices, cloud platforms, learning management systems, virtual classrooms, outline databases, simulations, educational applications, and digital collaboration tools (Almaiah et al, 2020). The effective use of emerging technologies leads to instructional delivery, students' engagement, research output and positive perceptions of emerging technologies are better positioned to integrating them in classroom instructions and researches, and administrative efficiency.

Technology acceptance model (TAM)

TAM was developed by Davis (1989) to explain and predict users' acceptance and use of information tools. It posits two major factors that influence technology adoption. They are perceived usefulness (PU) and perceived ease of use (PEOU). PU is the degree to which someone believes that using a technology will improve job performance. While PEOU is the degree to which someone believes that using a technology will be free from effort.

According to Davis (1989), the PU and PEOU influence users' attitudes toward technology, behavioral intentions, and real use of technology. In the context of accessibility and utilization of emerging technologies by lecturers, TAM suggests that lecturers are more likely to use emerging technologies when they perceive that they are beneficial and easy to operate.

Methodology

This study adopted a descriptive survey research design to investigate the accessibility and degree of utilization of emerging technologies in the teaching of Computer Science among lecturers in selected state-owned Polytechnics and Colleges of Education in Delta State, Nigeria. The study was conducted in two state-owned Polytechnics located at Otefe-Oghara and Ogwashi-Uku, and two state-owned Colleges of Education located at Mosogar and Warri. The population of the study comprised all thirty-six (36) Computer Science lecturers in the selected institutions. This included twenty (20) lecturers from the two Polytechnics and sixteen (16) lecturers from the two Colleges of Education. Owing to the relatively small population size, a census sampling technique was adopted, whereby all the lecturers were included in the study. Data were collected using a self-structured questionnaire titled Accessibility and Degree of Utilization of Emerging Technologies by Lecturers (ADUETE). The instrument consisted of two sections: Section A assessed the accessibility of emerging technologies for teaching Computer Science, while Section B measured the degree of utilization of these technologies. Responses were obtained using a four-point Likert scale ranging from 1 to 4.

The questionnaire was validated by experienced lecturers in the Departments of Computer Science at Delta State Polytechnic, Burutu, and the Federal College of Education, Asaba, who were not part of the study population. Their observations were incorporated into the final version of the instrument. To establish reliability, the instrument was pilot-tested on twenty (20) Computer Science lecturers drawn from institutions outside the study area. Cronbach's alpha was used to determine the internal consistency of the instrument, yielding a reliability coefficient of 0.83, which was considered adequate for the study.

The validated questionnaire was subsequently administered to all thirty-six respondents and retrieved immediately after completion to ensure a high response rate and data accuracy. The data collected were analyzed using descriptive statistics and the independent samples t-test to test the two hypotheses at the 0.05 level of significance.

Results and Discussion

For **Polytechnics' lecturers** (20 respondents): On accessibility; 15 of them said they do not have access to emerging technologies (ETs) in lecturing, but 5 of them said they have access.

On utilization; 18 lecturers said they do not utilize ETs in lecturing, but 2 of them said they utilize ETs in lecturing.

For **Colleges of Education lecturers** (16 respondents): On accessibility; 16 of them said they do not have access to emerging technologies (ETs) in lecturing, but none of them said they have access.

On utilization; 14 of them said they do not utilize ETs in lecturing, while 2 of them said they utilize ETs in lecturing computer science.

Testing the null hypotheses

Hypothesis (H_{01}): There is a statistically significant mean difference in the accessibility of emerging technologies for the teaching of Computer Science among lecturers in the Computer Science departments of the selected state-owned Polytechnics and Colleges of Education.

Significant α level = 0.05

Table 1: Accessibility of emerging technologies table. An analysis of the accessibility of emerging technologies for the teaching of Computer Science by the lecturers in the departments of Computer Science in the selected Polytechnics and Colleges of Education.

Institutions	Numbers (N)	With Access	With No Access	Mean	SD
Polytechnics	20	5	15	0.250	0.444
Colls. of Education	16	0	16	0.000	0.000

From the table 1: Mean difference = 0.250; Degrees of freedom (df) = 34; Calculated t-value = 2.52 and two-tailed p-value = 0.017. Since the $p < 0.05$, there is a statistically significance difference in accessibility between the Polytechnics and Colleges of Education, H_{o1} is rejected.

Table 2: Utilization of emerging technologies table. The analysis on the utilization of emerging technologies for the teaching of Computer Science by the lecturers in the departments of Computer Science in the selected Polytechnics and Colleges of Education.

Institutions	Number (N)	Use ETs	No Use of ETs	Mean (X)	SD
Polytechnics	20	2	18	0.100	0.308
Colls. of Edu.	16	2	14	0.125	0.342

From the table 2: Mean difference = -0.025, Degree of freedom (df) = 34, t-value = -0.23, p-value = 0.82.

Summary table of emerging technologies' accessibility and degree of utilization between the Polytechnics and Colleges of Education.

Institutions	Variables	Means	SD	Mean differences	df	t-Value	p-value
Polytechnics	Accessibility	0..250	+0.444				
	Utilization	0.100	±0.308	0..250	34	2.52	0.017
Colleges of Education	Accessibility	0.000	+0.000				
	Utilization	0.125	±0.342	-0.025	34	-.0.23	0.820

The level of significance $\alpha = 0.05$,

Discussion of Findings

Accessibility of Emerging Technologies

The finding of the study revealed a significant difference in the accessibility of emerging technologies for teaching Computer Science between lecturers in the selected Polytechnics and Colleges of Education. However, the overall result suggests that lecturers in both categories of institutions experience generally low access to emerging technologies. This finding is consistent with the studies of Ifeakor (2018), Okoli and Osuafor (2018), and Nwana et al. (2017), who reported that inadequate access to ICT facilities and emerging technologies remains a major challenge facing teachers and lecturers in Nigerian educational institutions. Similarly, Aina (2021)

observed that poor technological infrastructure, unstable internet connectivity, and inadequate funding continue to limit access to digital technologies in Nigerian higher education institutions. These findings indicate that accessibility challenges are common across tertiary institutions despite differences in institutional types.

Degree of Utilization of Emerging Technologies

The study also found no significant difference in the degree of utilization of emerging technologies between lecturers in the selected Polytechnics and Colleges of Education, indicating that lecturers in both institutions utilize emerging technologies at similarly low levels. This finding agrees with Jack and Songo (2020), who found that the utilization of technology-based instructional resources among lecturers was constrained by inadequate technological facilities and institutional support. The finding also supports Emelogu et al. (2022), who reported that although lecturers are aware of emerging technologies, their effective utilization is hindered by insufficient training and infrastructural challenges. Furthermore, the result aligns with the Technology Acceptance Model (Davis, 1989), which posits that technology utilization depends largely on users' perceived usefulness and ease of use, both of which are influenced by the availability of adequate technological resources and institutional support.

Conclusion

The findings of the study showed that although, the Polytechnics' lecturers had a relatively higher accessibility and degree of utilization level of 55.6% compared to their counterparts in the Colleges of Education with 44.4%, the difference was not statistically sufficient to establish a real disparity between the two groups. This proved that lecturers across the selected higher institutions access and utilize emerging technologies at slightly different degrees. The result may be caused by similar challenges confronting Nigerian lecturers in tertiary institutions like the lack of adequate technological infrastructure, lack of constant electricity supply, lack of professional training opportunities, insufficient institutional support, and many others that affect technological accessibility and degree of utilization across the nation's academic institutions. This finding supports the fact that availability of technology alone does not guarantee effective utilization unless supported by adequate access, sufficient training, institutions and government policies.

Recommendations

From the findings of the study, the recommendations below are suggested.

1. The state government and non-governmental agencies should as a matter of deliberate policies provide the needed emerging technologies tools for teaching and learning in the state-owned Polytechnics and Colleges of Education.

2. Institutions' heads should make it a duty to use some percentage of their internally generated revenues (IGRs) to provide these technologies in aiding lecturers to achieve resourceful service delivery.
3. Lecturers should be trained and re-trained occasionally to be adequately exposed and equipped on the effective utilization of emerging technologies for the benefit of the students and society at large.
4. The Proprietor through the Governing Council Chairmen or persons of the institutions should ensure the provision of essential technological tools for resourceful teaching and learning so as to achieve global competiveness and best practices.

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