Information Communication Technology Skills and Students' Engagement in Online Learning Spaces during the Covid-19 Pandemic

Bukola Amao-Taiwo, Geraldine Njideka Ekpe-Iko
University of Lagos
Idahosa Eki
York University

Abstract

The circumstances surrounding the Coronavirus disease 2019 (COVID-19) pandemic presented a drastic decline in the use of traditional face-to-face methods of teaching and learning in higher education institutions. As the new normal advanced the use of information and communication technology (ICT) devices and skills for online and distance learning and the use of digital libraries, this study investigated the extent to which the access and use of ICT devices and skills have supported students' engagement in online classes during the school closures that characterised the COVID-19 pandemic era. The study adopted a mixed-methods research design involving the use of questionnaires and online focus group discussions to draw responses from participants from public and private higher education institutions in Lagos and Ogun States, Nigeria. Two research questions and one hypothesis were formulated to guide the study. A researcher-designed questionnaire and a focus group discussion guide were administered online to elicit responses from participants. Data were analysed using descriptive and inferential statistics. Results showed a significant positive relationship between the ICT skills of students and the level of engagement during online classes. It was recommended that lecturers and facilitators of knowledge in online learning facilities should make concerted efforts to up-skill such that the facilitation of learning will be engaging for the students in online facilities even beyond the pandemic era.

Keywords: ICT access, ICT devices, ICT skills, students' engagement, digital libraries, online learning facilities.

Introduction

One of the innovations that characterised the twentieth century is the acceleration of information communication technology (ICT) devices as support for businesses, health, and education-related services. Beyond the use of devices, the advent of ICT has ushered in the need for new knowledge and skills that will enhance the productivity of various sectors. Van Slyke (2008) defines ICT as the range of technologies that support the utilisation of information, including computers and computer-related products, email, multimedia messaging services (MMS), and other forms of communication. Even though the use of ICT as support for learning and business is becoming the norm, the ability to think critically to create new knowledge and solutions that enhance productivity through these devices has become more important than being able to access and operate ICT devices.

Saheb (2005) argued that it is becoming practically impossible for many people to spend a day without interacting with sophisticated information and communication technologies (ICTs) ranging from television and radio to the mobile telephone and the Internet. However, for millions of people in the world's poorest countries, there remains a "digital divide", excluding them from the benefits of ICTs. The *Digital 2020 Global Overview Report* outlined that 169.2 million mobile connections constituted 83% of Nigeria's total population. However, about 50% of these mobile phone connections are by urban residents, implying that the proportion would be skewed towards high socio-economic and urban households. The digital divide has been a major factor responsible for the educational inequalities that have become the order of the day and were deepened by the pandemic.

Adopting the use of ICT resources for education has led to what Saheb (2005) termed the "new education system." This system is characterized by learning strategies such as e-learning, distance learning, Internet-based learning, or web-based learning. It presents the opportunity for educators to digitalize texts, images, sounds, and videos, making it easy to access any kind of information anywhere in the world. This is achieved with a few clicks on digital libraries. Today, ICT has minimised the challenge of access to educational resources, and people can access information without barriers. However, one challenge that hinders the full adoption of ICT tools in the university system is the cost of acquiring and accessing infrastructure that makes using ICT resources seamless for lecturers and students.

Beyond access to ICT devices and infrastructure, adopting engaging pathways that embed the use of ICT skills in the content, delivery of lectures, and use of digital libraries is becoming a necessity. Henderson, Selwyn and Aston (2017) averred that digital technology plays a significant role in student engagement, making it a central feature that defines student educational

experience. However, providing skilled educators has become a pathway for reducing the limitation of online teaching and learning, including minimal exposure to effective teaching practices and lower-quality interactions (Dumford & Miller, 2018). Online teaching and learning require competencies and an understanding of strategies that will endear teachers to adapt technology to align with the achievement of learning outcomes.

Bond and Bedenlier (2019) define student engagement as the energy and effort students apply in the learning community, with behavioural, cognitive, or affective engagement being the observable indicators over time. Although the level of engagement comes to play through the observable actions of students, these actions are shaped by internal influences, the learning environment, learning activities, and relationships between student-student, student-content, and student-lecturer. An engaged student is most likely to be inquisitive, interested, and connected to the learning content and activities if the lecturer presents content and activities centred on students' interests and expectations. It has been established that a higher level of engagement improves learning outcomes and better academic achievement (Zehner, 2011; Cheong & Ong, 2016).

As student engagement with physical libraries becomes impossible due to the pandemic, digital libraries have become increasingly popular for students, providing more convenience and accessibility. However, promoting student engagement in digital libraries has also become crucial for facilitating learning and promoting academic success. Lecturers can help enhance the learning experience and encourage students to become more actively involved in their studies by providing students with easy access to digital resources and implementing effective engagement strategies. According to Wang and Liu (2020:259), "Student engagement in digital libraries has been found to be positively related to their perceived usefulness, satisfaction, and learning performance". Nevertheless, some students struggle without face-to-face interactions, personalised assistance, and physical resources. Many physical libraries offer virtual reference and chat services, online access to e-books and journals, and curb-side pickup of physical materials to address these challenges. Some libraries have adopted hybrid models that combine in-person and online services to provide the best of both worlds. Ultimately, the pandemic has disrupted student engagement with physical libraries, but it has also highlighted the need to adapt and embrace new technologies to support learning and engagement. Webb et al. (2008) proposed that libraries can promote student engagement by providing a variety of learning resources and opportunities for collaboration through workshops, events, and other interactive programmes that encourage students to explore and engage with new ideas and perspectives.

The COVID-19 pandemic has revealed significant inequalities in the education system, and students who lack access to digital tools may struggle to keep pace with their peers and find it challenging to make up for lost time. Although there may be disparities in the availability and accessibility of ICT tools for students, a lack of engaging course content and learner-centred activities delivered by instructors during remote learning can also contribute to further inequalities in the quality of teaching and learning, both during and after the pandemic. Having to engage students on university learning management systems (LMS), digital libraries, and other platforms like Zoom, Google Classroom, Microsoft Teams, and others require the provision of opportunities for learners to be involved in discussions, tasks, and activities that connect curriculum content to real-life scenarios. Based on the preceding, this study investigates the extent to which lecturers have leveraged students' ICT skills to support engagement in on-learning spaces.

Research questions

- In what ways have students accessed ICT support for online learning?
- How often do lecturers leverage on ICT skills of students to support engagement in online learning?

Hypothesis

No significant relationship exists between students' ICT skills and engagement in online learning spaces.

Statement of the problem

In a bid to minimise learning gaps during the lockdowns that characterised the COVID-19 pandemic, alternative learning modes that entailed the use of digital devices, applications, digital libraries, and the Internet were adopted. However, students and their lecturers became overwhelmed with challenges ranging from the availability and accessibility of ICT devices to Internet connectivity and coupled with the need to embrace engaging teaching and learning strategies. These challenges are due to the uncertainties embedded in the need to embrace a new pathway to instruction and delivery of learning content to students in a space that was considered non-traditional. The online mode of learning requires lecturers and students to have the necessary ICT skills to function optimally using the technological devices and available resources, but this seems insufficient. Having students log into classes only to mute and then get involved in other non-academic activities is a sign of disengagement, which might lower the achievement of learning outcomes.

As stakeholders in the educational sector battle with opportunities to increase access to technological devices and connectivity, the need to ensure that learning outcomes are achieved by delivering engaging content and experiences has become very important. This study, therefore, examined the extent to which ICT skills have enhanced students' engagement in online learning spaces.

Literature review

ICT and connectivity support for online learning

Recently, online learning has become increasingly popular, particularly due to the COVID-19 pandemic. However, access to ICT facilities and reliable Internet connectivity is non-negotiable for students to effectively participate in online learning. Davis, Gough and Taylor (2019) assert that poor connectivity can lead to losing interest and motivation for online learning and difficulties accessing course materials and communicating with instructors and peers. Furthermore, Pokhrel and Chhetri (2021) assert that ICT support is essential in facilitating effective and efficient online learning, particularly for students who may not have access to the necessary equipment or technical expertise. Without access to these facilities that support learning, the teaching-learning process will be dragged down, especially in virtual learning spaces where technology determines engagement. In addition to ICT facilities, a stable supply of electricity is essential for students to participate in online learning. Power outages and blackouts can interrupt online classes, leading to missed lectures and assignments. In a study conducted by Oyediran, Omoare, Owoyemi, Adejobi & Fasasi (2020), it was found that a lack of consistent electricity supply was a major limitation that adversely affected students' ability to participate in online classes during the COVID-19 pandemic.

Student engagement in online learning spaces

Student engagement is the intention of students to participate in learning activities. These engagements are vital to the teaching-learning process, and it is assumed that an interactive relationship exists between teaching strategies, student engagement, and academic achievement. This assumption is based on the conclusions of an array of studies that student engagement leads to high-quality education, increases student retention, and also enhances the institution's reputation (Ashwin & McVitty, 2015; Kuh, Kinzie, Buckley, Bridges & Hayek, 2006).

Chapman (2019) identifies three main criteria of student engagement that lecturers should consider when planning their teaching strategy,

including cognitive criteria, behavioural criteria, and affective criteria. The cognitive criteria are the extent to which students pay attention and expend mental effort during the learning task; the behavioural criteria address the active response of the students when learning is in session, and the affective criteria focus on the student's emotional reactions to the learning task. Engagement with ICT can be enhanced by possessing certain cognitive requirements. These requirements include digital and information literacy, critical thinking, problem-solving, creativity, collaboration, and communication. Wang and Liu (2020) identify these requirements as important factors that enable individuals to use digital technology effectively and take full advantage of its benefits.

Popovich and Neel (2005) observe that the introduction of online teaching in universities has led to increased enrolment of students, elimination of overcrowded classrooms, and improved student retention rate. However, Bawa (2016) raised concerns about the low retention rate of many online or distance education programmes, stating that online and distance courses have a 10% to 20% failed retention rate. As COVID-19 presents the opportunity for massive migration from face-to-face to online learning spaces, lecturers should be aware that teaching and engagement strategies that work well in the face-to-face learning spaces could fail in the online classroom, and excellent lecturers could find themselves struggling to identify with students online (Boon, 2015). Orlando and Attard (2015), however, conclude that teaching with technology is not a one-size-fits-all approach; therefore, there is a need for awareness in terms of teaching styles and activities that will foster feedback, support collaborative learning, and enhance student participation.

ICT devices in online learning spaces seem to demand a new level of skill for engaging students effectively. Goldhammer, Gniewosz, and Zylka (2016) aver that ICT engagement is the major conditioning personal characteristic that affects the development and adaptation of ICT skills in learning environments. Ainley and Armatas (2006) argue that the connection between the learner and the learning environment is central to understanding how virtual learning environments have motivated or engaged students in online spaces. However, it has also become expedient to know that having the competencies required for behavioral engagement is critical for learning outcomes to be achieved. Behavioural engagement entails participation in terms of sharing and the use of technological devices and tools for content sharing and hands-on activities that promote active learning. Therefore, strategies for adapting teaching to better meet the needs of students require increasing the speed at which information is presented; providing opportunities for multi-tasking and interactive learning; and presenting information through a variety of media (Jukes & Dosaj, 2005). Salmon (2012)

advocates interventions such as 'weaving' discussion threads together to stimulate student engagement; such activity, while possible without ICT, is one that ICT has made compellingly easy.

Digital libraries as online learning spaces

Digital libraries have become increasingly important as online learning spaces due to their accessibility and availability of resources (Paynter et al, 2020). Libraries have evolved from traditional brick-and-mortar structures to virtual settings with the rise of online education, giving students access to a wide range of digital resources and services around the clock (Harisanty et al., 2023). Salmon (2020) avers that digital libraries have gained popularity as online learning spaces, offering students an array of digital resources, materials, and tools. Digital libraries provide various benefits as online learning spaces, such as flexibility, convenience, and accessibility. They allow students to access resources from anywhere, anytime, which helps them study and learn at their own pace. Digital libraries also enable personalised learning opportunities as students can select resources and materials that suit their learning preferences and goals. There are multiple methods to measure student engagement in online libraries, including tracking the frequency of visits, the length of time spent on the platform, and the number of resources accessed (Gibson & Cho, 2020). According to Salmon (2020), different factors can affect how involved students are with online libraries, including the convenience of access, how easy it is to use, and the availability of resources. Wang, Li and Zhang (2021) conducted research and discovered that implementing gamification strategies, such as awards, badges, and leaderboards, can boost student engagement when using online libraries.

Methodology

In carrying out this research, a descriptive survey research design that entailed using mixed methods was employed. The population for the study comprised all undergraduate and postgraduate students of tertiary institutions such as universities, polytechnics, and colleges of education in Lagos and Ogun State, Nigeria. A researcher designed a "students' ICT support and engagement in online learning spaces" online survey questionnaire, and a focus group discussion guide was used to collect quantitative and qualitative data, respectively. The sample comprised one hundred and seven undergraduate and postgraduate students purposively selected for the online survey, while the focus group discussion had two groups of eight students. The focus group was conducted online using the WhatsApp platform. The goal was to provide deeper insights into the level of engagement and device availability of the students during the pandemic. Cronbach's alpha coefficient test of reliability

was applied to measure the internal consistency of the questionnaire, using the IBM® SPSS® Statistics 23.0 to ensure reliability at an alpha level of 0.05. The analysis gave an alpha coefficient of 0.957 which was considered high enough to justify its use for the study. Both instruments went through face and content validation by experts in the field of ICT and online education. Quantitative data responses were rated on a four-point Likert-type scale with the coding of four, three, two, and one, respectively. The criterion mean was set at 2.5 for the quantitative data and was analysed using descriptive and inferential statistics. The hypothesis was tested using the Pearson product-moment correlation coefficient, which is a measure of the linear relationship between two variables. In this case, the Pearson correlation coefficient is used to examine the strength and direction of the relationship between students' ICT skills and their engagement in online learning. Data from the focus group discussion were transcribed manually. Emerging themes and patterns in the data are identified through a careful reading of the transcribed text. The identified themes and patterns were then grouped to form broader categories, which were used to develop a comprehensive understanding of the subject of the study.

Results

Demographic characteristics of participants

This section shows the demographic characteristic and data of participants.

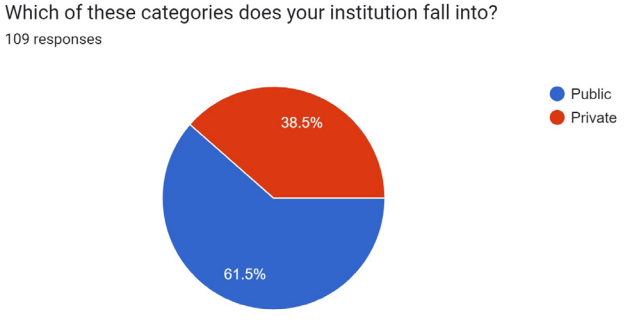

Figure 12.1: Category of institution of participants

Figure 12.1 shows that 66 (62%) of the participants were students of public institutions, while 41 (38%) were students of private institutions. There were more respondents from public institutions than from private institutions.

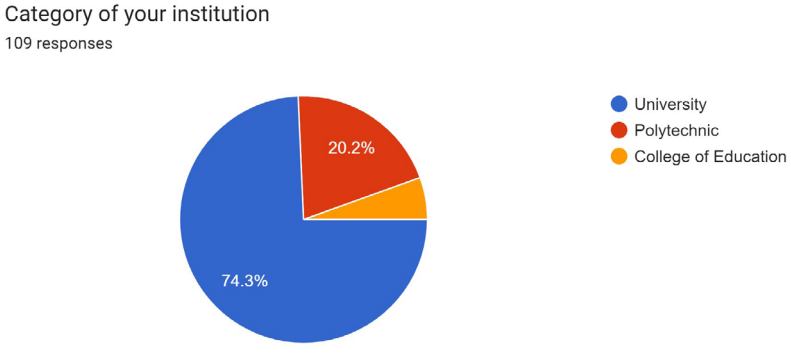

Figure 12.2: Type of institution

Figure 12.2 indicates that respondents included 79 from universities (74%), 22 from polytechnics (21%), and 6 from colleges of education (6%) students, with university students being the majority and college of education students being the least.

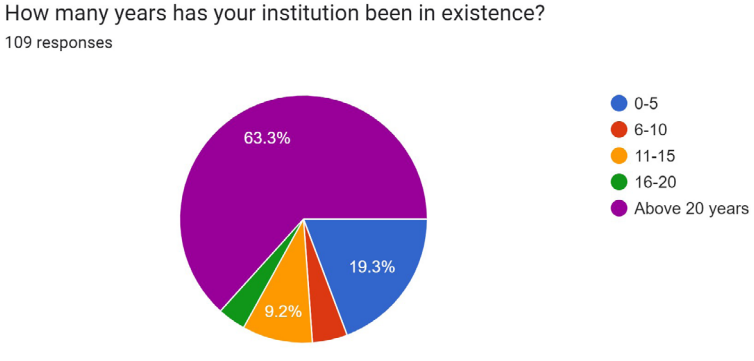

Figure 12.3: Age of institution

Figure 12.3 shows that 20 (19%) of respondents were from institutions that had been in existence from 0 to 5 years; 5 (5%) were from institutions between 6 to 10 years, 10 (9%) from institutions between 11 to 15 years, 4 (4%) from institutions between 16-20 and then 68 (64%) from institutions founded over twenty years ago.

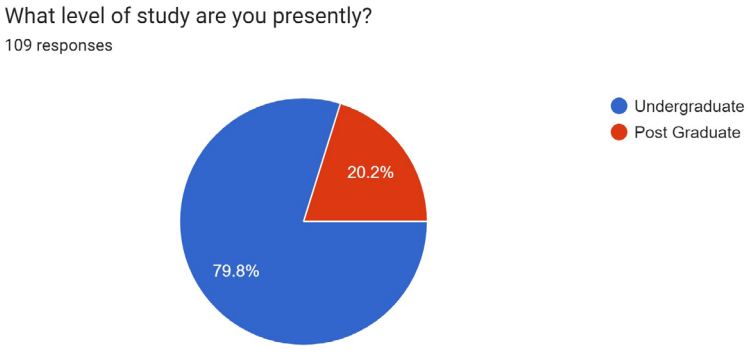

Figure 12.4: Student academic level

Figure 12.4 shows that 86 (80%) of respondents were undergraduates, while 21 (20%) were postgraduates.

Research Question 1: In what ways have students accessed ICT support for online learning?

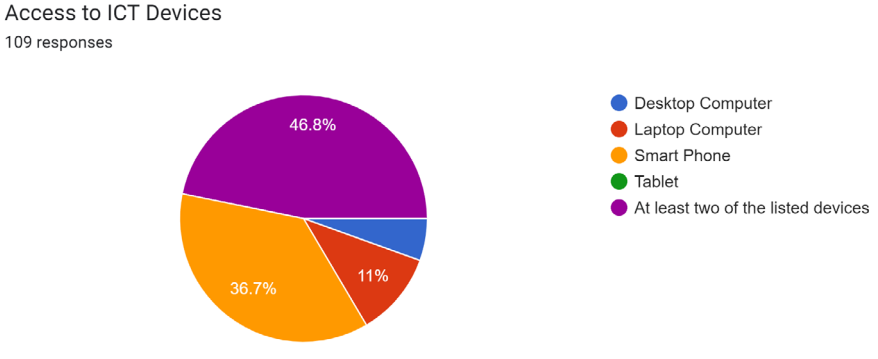

Figure 12.5: ICT access

Figure 12.5 shows the various ICT devices which students have access to. The data shows that 49 (46%) students had access to at least two desktop computers, smartphones, laptops or tablets. A significant number of students, 40 (37%), also accessed online learning spaces via a smartphone.

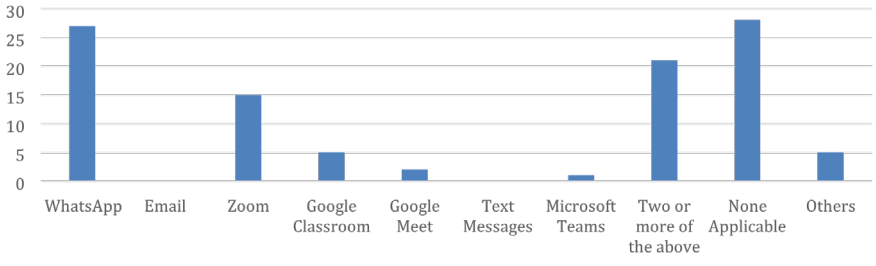

Figure 12.6: Online Teaching-Learning platform

Figure 12.6 shows that most of the students participated in online learning through the WhatsApp platform, while none of the students utilised text messages and email as a platform for learning.

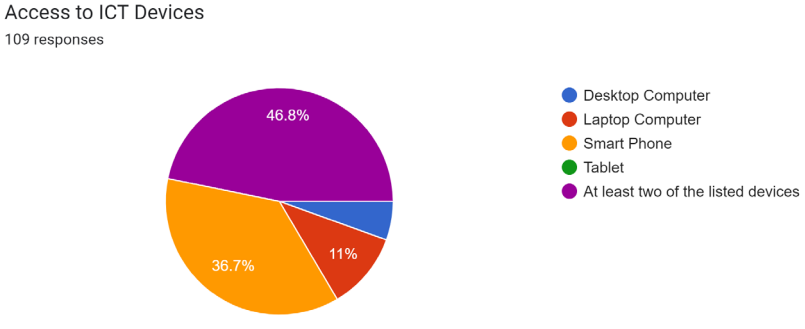

Figure 12.7: Ownership of ICT devices

Figure 12.7 indicates that 55 (51%) of the respondents owned a personal smartphone, while 40 (37%) owned at least two desktop computers, smartphones, laptops, or tablets.

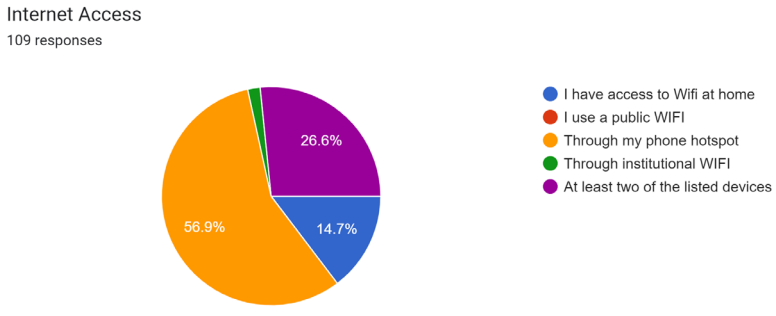

Figure 12.8: Internet access.

Figure 12.8 indicates that a significant number of respondents, 61 (57%), accessed the Internet via a personal phone hotspot, while only 2 (2%) had access to institutional Wi-Fi.

Research Question 2: How often do lecturers leverage on ICT skills of students to support engagement in online learning?

The information in Table 12.1 shows how lecturers leverage on ICT skills of students to support engagement in online learning during the COVID-19 pandemic.

Hypothesis Ho1: There is no significant relationship between students' ICT skills and engagement in online learning spaces.

Table 12.2: Relationship between students' ICT skills and engagement in online learning

	N	Mean	SD	R	P	Remark	Decision
ICT Support	107	2.44	0.93	0.71*	0.01	Significant	Ho1 rejected
Student Engagement		2.44	0.93				

*Correlation is significant at a 0.05 level (two-tailed).

The information in Table 12.2 shows the relationship between ICT skills and the engagement of tertiary institution students. The result of the tested

Table 12.1: Frequencies, percentages, means, and standard deviations (SD) of the responses on ICT skills in Lagos and Ogun States Higher Institutions (N=107)

S/N	During the COVID-19 online learning experience, students were given an opportunity to:	Always	Often	Sometimes	Never	Mean	SD
1	Design and build a web page	14 (13.1%)	30 (28.0%)	8 (7.5%)	55 (51.4%)	2.03	1.15
2	Create and present content with PowerPoint.	13 (12.1%)	40 (37.4%)	13 (12.1%)	41 (38.3%)	2.23	1.10
3	Create and present an audio or video	20 (18.7%)	36 (33.6%)	14 (13.1%)	37 (34.6%)	2.36	1.14
4	Download or access online audio or video recordings of lectures they could not attend	38 (35.5%)	28 (26.2%)	17 (15.9%)	24 (22.4%)	2.75	1.17
5	Download or access online audio or video recordings to revise the content of lectures already attended	33 (30.8%)	31 (29.0%)	16 (15.0%)	2 7(25.2%)	2.65	1.17
6	Download or access online audio or video recordings of additional content related to coursework from the library	31 (29.0%)	32 (29.9%)	17 (15.9%)	27 (25.2%)	2.63	1.15
7	Use a social networking platform (e.g., Facebook) to communicate / collaborate with other students on the course	38 (35.5%)	26 (24.3%)	13 (12.1%)	30 (28.0%)	2.67	1.23
8	Create and keep a personal blog as part of course requirements	18 (16.8%)	27 (25.2%)	13 (12.1%)	49 (45.8%)	2.13	1.17
9	Contribute to another blog as part of a course requirement	13 (12.1%)	35 (32.7%)	14 (13.1%)	45 (42.1%)	2.15	1.11

S/N	During the COVID-19 online learning experience, students were given an opportunity to:	Always	Often	Sometimes	Never	Mean	SD
10	Use the Web to share digital files related to a course (e.g., sharing photos, audio files, movies, digital documents or websites)	27 (25.2%)	28 (26.2%)	27 (25.2%)	25 (23.4%)	2.53	1.11
11	Use Web-conferencing or video chat to collaborate with other students taking the course	30 (28.0%)	26 (24.3%)	22 (20.6%)	29 (27.1%)	2.53	1.17
12	Receive pre-class discussion questions from lecturer via text message on personal mobile phone	23 (21.5%)	31 (29.0%)	22 (20.6%)	31 (29.0%)	2.43	1.13
13.	Learn about the technological tools to be used in class	27 (25.2%)	25 (23.4%)	20 (18.7%)	35 (32.7%)	2.41	1.19

Key: Always (4), Often (3), Sometimes (2), Never (1), St.Dev.=Standard Deviation

hypothesis shows that there was a positive and significant relationship between ICT skills and engagement of tertiary institution students in Lagos and Ogun States ($r = 0.71^*$, $P = .01 < 0.05$). Thus, the null hypothesis of no significant relationship between students' ICT skills and engagement in online learning was rejected. Based on these results, it can be concluded that students with better ICT skills tend to have higher engagement in online learning.

Discussion of findings

Findings in this study showed that a significant number of students accessed ICT support, especially devices and Internet access, through personal efforts using personal mobile phones and devices. Obviously, there were limited opportunities in terms of institutional support for data, devices, and Internet access. This is likely to be the result of the abrupt emergence of COVID-19, which suddenly required institutions to plan amid numerous uncertainties. Beyond the sudden nature of the pandemic, it is not a hidden fact that provisions such as devices and mobile data for learning purposes are solely the responsibility of students in higher education institutions of learning in Nigeria. In some institutions, particularly in public-owned institutions, access to networks is limited to certain parts of the school, which may not be convenient for students at certain times. This way, some students patronise cybercafés for Internet access to work on assignments or to download information. Indigent students will certainly find it difficult to cope with this situation and sometimes may have to wait to use their friends' facilities. This is in agreement with the study of Agbebaku and Ajegbelen (2016), who found that many university lecturers and students visit cybercafés within and around their institutions to make use of Internet facilities, while the ones who can pay for private modems buy for their personal use. While this might be acceptable before the COVID-19 era, infrastructural support for students and lecturers is non-negotiable in the COVID-19 and post-COVID-19 era. A conversation from the focus group discussion affirms this result. One of the respondents, a 300-level student in a public university, had this to say:

> *Although our lecturers often schedule us for online lectures through WhatsApp and sometimes Google Meet, we often do not have enough data to connect, and even when we connect, sometimes, the lectures seem so boring, so we log in and then use our time for other activities while the lectures are going on.*

This statement seems to suggest that students do not find online classes engaging hence the need for targeted efforts by lecturers.

The test of the hypothesis showed a significant relationship between ICT skills and students' engagement in online learning spaces. This relationship shows that lecturers have opportunities to leverage students' ICT skills to support active learning activities that will promote better learning outcomes. When students are actively engaged, they tend to be connected and eventually utilise what has been learned in problem-solving. ICT skills are important for online learning spaces, including digital libraries. By engaging students through Microsoft PowerPoint presentations, conducting online research, sharing ideas through the whiteboard, and engaging in group conversations on online discussion platforms, students can learn deeply and thereby take ownership of learning. It is, however, pertinent to note that lecturers are saddled with the task of presenting the opportunity for such activities to the students, thereby making a case for continual professional development on online teaching strategies that engage students effectively. ICT skills are essential for students to effectively use digital libraries. These skills can help students search for information efficiently, navigate the digital library, evaluate information quality, use technical features, and collaborate effectively. The inability to perform these tasks can have an adverse effect on learning outcomes.

The lack of these skills can pose very frustrating challenges to students and cause some form of disengagement from learning. Such disengagement leads to students logging in for classes and leaving while still logged in to engage in other things perceived as more important. Students often interact regularly with personal devices, which presents an opportunity for facilitators of learning to utilise the same devices for learning activities. In this regard, lecturers and students should be trained in ICT skills to enable engagement in every form of online learning. According to Dennen, Bagdy, Arslan, Choi & Liu (2022), collaborative course development and teaching can help minimise pedagogical and technological tasks that will endear instructors to focus on meeting the unique needs of students and also maximise student engagement in non-pandemic times.

Conclusion

The skills that students possess in the field of ICT are valuable assets that can assist lecturers in delivering stimulating content and activities that promote the attainment of learning objectives. Nevertheless, it is imperative that both lecturers and students undergo continuous training and professional development in ICT skills to ensure active participation in online learning. During non-pandemic times, collaborative course development and teaching can enhance student engagement, and it is vital to provide infrastructural

support for students and lecturers to guarantee fair access to education in online environments.

Recommendations

- Leaders of higher institutions need to provide data to relevant government agencies to engage in partnerships that will breed home-grown solutions to the challenges of access facing the students, especially in access to ICT devices, connectivity, and skills in teaching and learning.
- Lecturers should make concerted efforts to up-skill such that learning will be engaging for the students in online and offline learning spaces.
- Digital libraries should provide opportunities for collaboration and knowledge-sharing amongst users. This could include discussion forums, online communities, and shared workspaces where users can collaborate on projects or assignments.

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