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INFORMATION AND COMMUNICATION TECHNOLOGY AS A BLENDED-LEARNING TOOL FOR SUSTAINABLE DEVELOPMENT FOR UNIVERSITY STUDENTS

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Abstract
The integration of Information and Communication Technology (ICT) as a blended-learning tool into traditional classroom-based teaching and learning has been shown to improve students' academic performance at globe and is essential to economic development. These claims were investigated in a sample of undergraduate students at the faculty of Education, University of Ibadan, Nigeria. Based on the goals of the research, a purposeful sample of students was chosen. It used a mixed-method survey design. A total of 117 students completed the online survey (quantitative component); while a focus group interview with 4 students (qualitative component) was conducted. The findings showed significant barriers to, and affordances of, the use of ICT as a blended-learning tool. In addition, the study discusses student access to ICT devices and internet facilities on campus, student proficiency in using these devices and facilities, and the impact these have on students' academic activities. Finally, conclusions and recommendations are discussed in the context of graduate career opportunities and national economic sustainable development.

Keywords: Information and communication technologies in education, blended learning, virtual learning, university students, sustainable development

INTRODUCTION

Globally, the use of Information and Communication Technology (ICT) as a blended-learning tool has been shown to enhance teaching and learning; and ICT use has been positively correlation with the student academic performance (Kayode, 2019:26; Bader et.al., 2021:27; Govender & Kayode, 2020:3). The outbreak of COVID-19 destabilized all sectors of the economy globally – including the university education sector. In the present competitive global economy, ICT is recognised as fundamental to various advancements, including the possibility of a change to conventional schooling (Onodugo, 2015:22). ICT in learning allows for increased e-learning opportunities, online classes and limitless practical workspace. These advantages have become critical in education as the COVID-19 pandemic forces social distancing (Kayode & Maleshoane, 2021:112). In early 2020, all schools and universities were shut down globally, especially in African countries for the safety of citizens during the COVID-19 pandemic. The outbreak of COVID-19 impacted all sectors of the economy, and universities in Nigeria were no exception (Kpae, 2020; Siddique et al., 2021; Audu & Joel, 2020). The academic sector was not spared these challenges, and the integration of blended learning has surfaced as a viable alternative to classroom-based education.

The role of Information and Communication Technologies (ICT) in knowledge sharing has been acknowledged, not only within educational institutions, but across different facets of society (Kayode & Ekpenyong, 2021:5). The outbreak of the Covid-19 pandemic made the role of ICT more integrated in the teaching and learning, especially at university level.

According to Ghazi (2019). ICT extend students' attention and have brought about revolutionary changes in the scope of education in the last few years. ICT have changed many aspects of how we live and, when used for blended-learning, have greatly impacted students' academic performance, additionally allowing them to learn at their own place (Naidu and Razali, 2019). Information and Communication Technologies consist of hardware, software, networks and media for collection, storage, processing, transmission and presentation of information (voice, data, text, images) and related services. ICTs can be divided into two parts - Information and Communication Infrastructure (ICI), which refers to physical telecommunications systems and networks (cellular, broadcast, cable, satellite, postal), the services that utilize those (Internet, voice, mail, radio, television); and Information Technology (IT) that refers to the hardware and software of information collection, storage, processing and presentation.

As with other developing countries, the use of ICT with the traditional education was not fully integrated in most institutions in Nigeria but now integrating ICT into its teaching and learning across all educational sectors (Govender & Kayode, 2020:126). ICT for effective teaching and learning is essential as it provides opportunities for educators and learners to collaborate effectively. While technology has been integrated in most institutions in Nigerian, it is believed that there is still a long way to go (Bello & Ibi, 2016; Kayode et. al., 2020). Unfortunately, there is a dearth of local research on the impact of ICT as a blended-learning tool and support structure for basic services for sustainable development in Nigerian institutions (Kumar, Krishnamurthi, Bhatia, Kaushik, Ahuja, Nayyar & Masud 2021; Owoeye & Olatunde, 2011; Kayode, 2019:33). Thus, this study was undertaken to address the following research questions and hypotheses.

Research questions:

1. Which ICT tools are available for blended-learning for students' use in each Department in the Faculty of Education in the University of Ibadan?
2. How Proficient are students in utilizing ICT for blended-learning during the COVID pandemic in the Faculty of Education, in the University of Ibadan?
3. How has the integration of blended-learning digital tools (ICT) impacted students' investment of time into ICT for economic sustainability in community development in Nigeria?

Hypotheses:

1. There is no significant difference in the availability of ICT tools between male and female students.
2. There is no significant difference in the competent utilization of ICT based on educational background.
3. The utilization of ICT tools has no significant impact on student's time invested in the use of ICT for economically sustainable community development.

REVIEW OF THE LITERATURE

According to Irele and Kayode (2020), the use of ICTs or digital tools has a positive influence on the education. While we could not gather much data in person due to COVID-19 pandemic, the

current reality is that social media matters more in today's digitally driven world, and we used these platforms for data collection. The integration of ICT in blended learning is essential for the achievement of the UN 2030 agenda for sustainable development, the goal of which is to promote economic growth globally (Richards, 2021; Govender & Kayode, 2020; Favale et. al., 2020; Kayode & Maleshoane, 2021:113).

ICT for blended learning during this COVID-19 pandemic has advantageously propelled teaching and learning onto digital platforms, since research shows that e-learning correlates positively with academic performance, and assists students and lecturers with e-books, e-journals, audio visual materials and services (Jeong, 2011; Ocholla & Ocholla, 2020; Kayode et.al., 2020)

According to Mpungose (2020), blended learning (such as e-learning) is an instruction that takes place over the internet and is alternatively called online learning. Studies show that ICT use in blended learning and e-learning started with the evolution of the Web from Web 0 (a read-only site) to 4.0.

With the use of e-learning platforms, course content is readily available online. However, it must be accessed through technological hardware such computer laptops, Android phones and software resources (such as software applications); as well as Learning Management System (LMS) and social media platforms (Kayode & Govender, 2021; Rodrigues et al., 2019). Also Victor & Segun (2020:11), stress that the use of technological tools such as computers, internet services, and others facilities improve the teaching and learning of oral English in most schools.

With the travel restrictions and social distancing in place due to the COVID-19 pandemic, face-to-face activities in classroom-based contexts have become challenging. The integration of blended-learning provides an alternative for teaching and learning (Kayode & Maleshoane, 2021:112).

Previous studies in the field of education show that students use digital technologies and social media in their everyday lives and that greater use of such technologies in academic contexts would lead to increased preparation and engagement (Govender & Kayode, 2020:325; DeGennaro, 2008, Rambe, 2009).

During times of disruption, online and digital education provide a viable solution to ensure continuation of service delivery – both academic and administrative support.

ICT in Education

According to Ratheeswari (2018), ICTs affect all aspects of life, including education. They are advancing changes in working conditions, dealing with and exchanging data resources, teaching-learning approaches, etc. One region in which the impact of ICT is vast is in the area of education. ICTs are making significant differences in teaching approaches and methods of learning.

Lawrence and Tar (2018) have stated that three crucial characteristics are needed to develop good quality teaching and learning with ICT – autonomy, capability and creativity. Autonomy means that students take control of their learning through their use of ICT. In this way, they become more capable of working independently and with others. Students can work in collaboration with peers or in groups on specific tasks. Through collaborative learning with ICT, the students have more opportunities to build new knowledge and integrate it with their background knowledge, thus becoming more confident at taking risks and learning from their mistakes (Kayode, 2019:18).

Further, Dubey (2020) concluded that ICT fosters autonomy by allowing educators to create their material, thus providing more control over course content than in a traditional classroom setting. Once students are more familiar and confident with the learning processes, they can develop the capacity to apply and transfer knowledge while using new technology with efficiency and effectiveness. According to Mikrel (2011), ICTs have upgraded the learning climate to make it dynamic, collaborative, imaginative, integrative and evaluative, which is a benefit over traditional techniques.

Furthermore, the significance of ICTs in education for developing countries centres on upskilling educators as well as students; introducing more effective teaching methods; investing in ICT for schools to create educational networks; improving the overall standard of education by reducing the quality gap between urban and rural schools, and between developing and developed nations. Important objectives would be the initiation of smart schools to foster self-paced, self-assessed and self-directed learning through the application of ICTs, and developing ICT policy for education and training (Malik, 2018). Furthermore, Noor-UI Amin (2013), points out that ICTs (such as, multimedia computer software) that combine text, sound and colourful moving images can be used to provide challenging and authentic content to engage students in the learning process.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) have created and used the "One Laptop Per Child" (OLPC) initiative as a means of closing the digital divide

between developed and developing nations on the use of ICT. (Steeves & Kwami, 2017). Yanguas (2020) explains that although this action continues to dominate the education agenda for many international organisations and countries, the actual implementation and practice of this "One laptop per child" initiative have not yielded significant results, especially in less-developed countries.

The integration of digital tools into traditional face-to-face education, known as blended learning, has meaningfully affected many features of education systems globally. Technology and ICT skills have become the new literacy for a technology-empowered learning environment, ICT can work in various ways, as follows: Kayode, 2019: 42; Thompson (2016:236).

- It can be used to prepare students for further instruction and for lifelong learning in their studies and future careers.
- It can give access to data and correspondence outside the study hall, e.g., through the web.
- It can be utilized to help instructor improvement by means of outside networks.
- It can uphold, and possibly change, the measure of learning and education.

ICT in blended learning

The technology that has developed alongside traditional learning is blended learning (e-learning) which simply means to fuse online learning with traditional methods of learning. This development has influenced the mode of teaching and learning in the classroom. Blended learning enables students to learn independently without depending on notes taken from their teachers in the classroom; it improves their ability to apply the information and new skills learnt from ICT to their academic performance. Guvhu (2018), affirmed that the innovative use of e-tools in traditional learning empowers teachers to easily develop their own course content materials and, furthermore, assists students in improving their creativity through the use of multimedia, internet and other ICT tools.

Blended learning courses (also known as hybrid or mixed-mode courses) are classes where a portion of the traditional face-to-face instruction is replaced by web-based online learning approaches. It is a training approach that combines different learning techniques. In the standard educational model, blended learning often refers to the use of laboratory equipment or computers to complement the class sessions and strengthen the teaching process through practice and the

application of theories learnt. The term e-learning derives from electronically-supported learning or learning with, and through, the employment of technologies. Other commonly used terms are online learning, computer-assisted learning or ICT in education. E-learning incorporates both the content (curriculum) and instruction (pedagogy). E-learning has become a term representing a replacement model of education that incorporates a "bionetwork" of networked communities and a range of learning resources.

This development brings hope to the likelihood of colleges being able to use new technologies to 'leapfrog' over several of their problematic issues, such as: shortage of academics and textbooks; low attainment levels; and to coach their students in technologies needed for the 21st century, e.g., creativity and problem solving (Cheung & Slavin, (2013:282; Pandey & Pande, 2014). E-learning settings and technologies available for use in colleges are abundant, but each comes with its own benefits and applications. Usually, the best practice would be a combination of technologies that take specific contexts and learning needs into account. Examples are multimedia classrooms, computer labs, single station personal computers, microcomputers, laptops or notebooks, small and personal devices (tablets, mobile phone/smartphone, e-readers).

Tools Used for Blended Learning Internet

According to Jakubakynov, et.al. (2021). the use of the internet has empowered scholars and researchers to exchange ideas and knowledge in various specialisations; and it brings educators and students together within and across borders, worldwide. Before the internet, ARPANET (precursor to the modern internet) had been created by the Advanced Research Projects Agency Network, founded in December 1969 by the US Department of Defence. Its purpose was to share military intelligence and research with university sources. ARPANET was decentralised in a 'network to networks' controlled by different organisations using shared internet standards, which were developed by Robert Kahn and Vincent Cerf on 1 January 1983, and switched to TCP/IP, giving birth to modern internet applications such as email and Telnet (Kayode, 2019:29).

Email communication

Plant and Fish (2015) state that email is the most crucial internet tool used by the workforce, teachers and students. Kayode (2019:48) observed that, as a result of the ever-present access to

digital tools that students have, courses have evolved to where they are now taught in a 'hybrid' mode – in which teaching and learning take place both face-to-face and online. This is a form of communication that allow students to join other learners across the globe in easily accessing information regarding their studies by way of discussion of mutual educational interests through peer groups online to enrich students' campus-based learning (Greenhow & Lewin, 2016; Yilmaz & Orhan, 2010). Email provides the fastest tool to communicate with other students and for teachers to send course-related information to students via the school email. Electronic mail is an asynchronous interactive tool allowing teachers to send information to students via group email, or for learners send requests for urgent information to the teacher or fellow learners.

Synchronous and asynchronous Tools

Kayode (2019:18) points out that the use of synchronous and asynchronous tools in teaching and learning creates new skills for students and enabled blended learning and teaching in most campuses in Nigeria during lockdown. According to Bower, Dalgarno, Kennedy, Lee and Kenney (2015), blended learning combines the use of asynchronous and synchronous methods of education with the flexibility for use by both teachers and students. Using cloud tools helps keep records for reference purposes for future occurrences. Use of Kahoot as an e-learning tool during blended learning can assist the teacher to develop new methods for assessing student performance. E.g., by giving group quiz tests during classroom lectures with learners gathered around a common screen.

WhatsApp tools

According to Nyagorme, P., Qua-Enoo, A. A., Bervell, B., & Arkorful, V. (2017:24). WhatsApp enhances smooth instant messaging in the educational environment, using smartphone applications for most devices and operating systems such as Apple's iOS and Android. WhatsApp has been part of an innovative technology to make social media impactful, popular and regularly used among students for their studies (Kayode & Maleshoane, 2021:111).

Studies have shown that the use of technology in traditional education has influenced and transformed teaching and learning (Teo, Zhou, Fan & Huang, 2019; Crompton & Traxler, 2019; Elsaadani, 2013). This provides opportunities for students and teachers to integrate new skills and technological advances through blended learning, which has been examined in this study with a

focus on the CBT skills and academic performance of undergraduate students in Nigerian universities. In this study, the researcher argues that the thoughtful use of blended learning to support traditional education is critical to the attainment of rich learning; and those hands-on technologies support students' academic performance – especially during periods of lockdown.

METHODOLOGY

This study employed a descriptive survey design using mixed methods (quantitative and qualitative data) in order to combine and compare both quantitative and qualitative data. The population was comprised of undergraduate students in all departments in the Faculty of Education at the University of Ibadan, Nigeria.

Online survey questionnaires and focus group interview were adopted. The instrument was trial-tested at another Faculty of Education in Ekiti State with undergraduates that were not part of this study. Cronbach-alpha reliability was computed to a reliability coefficient of 0.78. The data that was valid for the analysis were subjected to descriptive statistics involving frequency, mean and standard deviation. Pearson Correlation Matrix and Analysis of Variance was used to test the research hypotheses at a 0.05 level of significance.

Figure 1 below illustrates the mixed-methods research design used in this study (Creswell, 2014).

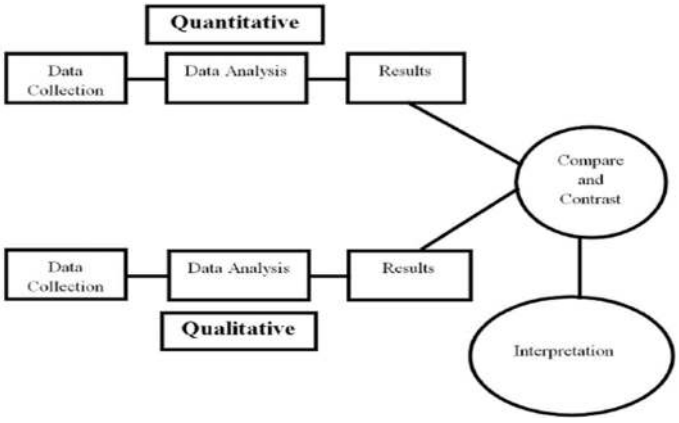

Figure 1: The mixed-methods research design used in this study (Creswell, 2014, cited in Kayode, 2019).

Data sources and Research Ethics

This research used both primary and secondary data. According to Flynn and Korcuska (2018), primary data refers to the data that the researcher as an individual obtains from the field, whereas secondary data consists of existing information from external sources. The primary data used was derived from participants. The researcher used structured Likert-scale questionnaires for the survey. An online survey method (a self-administered questionnaire) was used together with focus-group interviews.

A letter of participation was given to the participants to ascertain if they were interested and willing to participate. All participants showed their enthusiasm to participate in the research study and signed a consent letter. Anonymity was assured. The focus-group interviewees voluntarily agreed to participate in the interviews (Kim, Sefcik & Bradway, 2017). Participants were free to withdraw at any time without penalty.

RESULTS AND DISCUSSION

Demographic Information on gender

Data collected provided useful information on respondents' gender. The obtained results are presented in Table 1.

Table 1: Gender

	Frequency	Percent
Female	82	70.1
Male	35	29.9
Total	117	100.0

Data on the gender of respondents revealed that the majority (70.1%) of the respondents were female; whereas the minority (29.9%) were male (Table 1).

Demographic Information on background

Data collected provided useful information on respondents' background. The obtained results are presented in Table 2.

Table 2: Background

Item	Frequency	Percent
Rural	23	19.7
Semi-Urban	42	35.9
Urban	52	44.4
Total	**117**	**100.0**

The above table reveals that the greater number (44.4%) of the respondents were from urban areas; whereas 35.9% and 19.7% were from semi-urban and rural areas, respectively. This defined that most students were from Urban background.

Research Questions

Research Question 1: Which ICT tools are available for blended learning for students' use in each Department, Faculty of Education, University of Ibadan?
Data obtained from the online questionnaire survey were used to answer the research question. The results are presented in Table 3.

Table 3: Availability of ICT tools in your Department

Item	Available	Fairly Available	Not Available	Total
Projector	23.9	48.7	27.4	100
Digital camera	9.4	23.9	66.7	100
Mobile phone	71.8	12.8	15.4	100
Internet provided in the campus	14.5	53.0	32.5	100
Personal laptop	24.8	25.6	49.6	100
Computer/PC in my Department	21.4	37.6	41.0	100
Printer	39.3	37.6	23.1	100
Photocopier	37.6	40.2	22.2	100
Web boards	15.4	40.2	44.4	100
Scanner	24.8	40.2	35.0	100
Interactive whiteboard	50.4	35.9	13.7	100

The results show that mobile phones (71.8%), printer (39.3%) and interactive whiteboard (50.4%) were the most available. Projector (48.7%), internet provided on campus (53%), photocopiers (40.2%) and scanner s(40.2%) were fairly available; whereas digital cameras (66.7%), personal laptops (49.6%), computer/pc in department (41%) and web boards (44.4%) were the least available.

Research Question 2: How proficient are students in utilizing ICT for blended learning during the COVID pandemic in the Faculty of Education, University of Ibadan?

Data obtained from the online questionnaire survey were used to answer the research question. The results are presented in Table 4.

Table 4: How would you describe your ICT skills

Skill	Frequency	Percent
High	14	12.0
Low	18	15.4
Moderate	85	72.6
Total	**117**	**100.0**

The result on students' competence in utilizing ICT tools revealed that the majority (72.6%) of the students were moderately skilled in the use of ICT tools; 15.4% had low competence whereas 12% were highly skilled.

Research Question 3: How has the integration of blended-learning digital tools (ICT) impacted students' investment of time into ICT for economic sustainability in community development?

Data obtained from the online questionnaire survey were used to answer the research question. The results are presented in Table 5.

Table 5: Students' Investment of time into ICT for economic sustainability in community development

Item	0-2 hours	3-5 hours	6-8 hours	More than 8 hours
How many hours daily are you connected to the internet?	13.7	22.2	28.2	35.9

The result obtained revealed that the majority of students (35.9%) invested more than 8 hours daily in the use of internet facilities; 28.2% invested 6-8 hours daily; 22.2% invested 3-5 hours daily; whereas 13.7% invested only a couple (0-2) hours daily in the use of internet facilities. This shows that integration of blended-learning digital tools encourages students to invest large amount time in ICTs.

Research Hypotheses

HO_1: There is no significant difference in the availability of ICT tools between male and female students.

Data obtained from the online questionnaire survey were used to answer this research hypothesis. The results obtained are shown in Table 6.

Table 6: T-test statistics between male and female students on the availability of ICT tools

Item	Gender	N	Mean	Std. Dev.	t	Df	F	Sig.
Projector	Male	**35**	**2.00**	**.728**	**1.826**	**115**	**4.324**	**.040**
	Female	82	1.72	.774	1.873	68.122		
Digital camera	Male	35	1.89	.832	1.296	115	.137	.712
	Female	82	1.67	.817	1.286	63.263		
Mobile phone	Male	35	1.89	.718	.497	115	.051	.821
	Female	82	1.82	.669	.483	60.366		

Internet provided on campus	Male	35	2.57	.739	.069	115	.057	.812
	Female	82	2.56	.755	.070	65.589		
Personal laptop	Male	35	1.49	.702	.623	115	.829	.364
	Female	82	1.40	.645	.602	59.700		
Computer/PC in department	Male	35	2.11	.631	1.468	115	2.410	.123
	Female	82	1.90	.747	1.571	75.505		
Printer	Male	35	2.29	.710	1.276	115	.465	.497
	Female	82	2.09	.804	1.342	72.333		
Photocopier	Male	35	2.37	.690	1.954	115	.071	.790
	Female	82	2.07	.782	2.056	72.423		
Web board	Male	35	1.71	.710	.048	115	.141	.708
	Female	82	1.71	.728	.048	65.827		
Scanner	Male	35	2.17	.747	2.575	115	.163	.687
	Female	82	1.78	.754	2.585	64.853		
Interactive whiteboard	Male	35	2.11	.718	-.131	115	.781	.379
	Female	82	2.13	.766	-.134	68.264		

The results of the T-test revealed p-values of 0.04 to 0.821 at $p<0.05$ (Table 6) which show no significant difference between male and female students in the use of available ICT tools, except for projector. Therefore, the null hypothesis was accepted.

HO_2: There is no significant difference in the competent utilization of ICT based on background

Data obtained from the online questionnaire survey were used to answer the research hypothesis. The results obtained are shown in Table 7.

Table 7: ANOVA results

	Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**
Between Groups	.338	2	.169	.612	.544
Within Groups	31.525	114	.277		
Total	**31.863**	**116**			

The ANOVA results revealed a p-value of 0.544 at $p<0.05$ (Table 7). This shows that there is no significant difference in the competent utilization of ICT base on background. Therefore, the null hypothesis was rejected.

HO_3: Students' competence in the utilization of ICT tools has no significant impact on the time invested by students in the use of ICT

Data obtained from the online questionnaire survey were used to answer the research hypothesis. The result obtained are shown in Table 8.

Table 8: Regression Analysis of the impact of students' competence in the utilization of ICT tools on the time invested by students

Model	**-2 Log Likelihood**	**Chi-Square**	**df**	**Sig.**
Intercept only	32.599			
Final	31.197	1.402	2	.496

The result obtained from the regression analysis revealed a p-value of 0.496 at $p<0.05$ implying no significant impact. Therefore, the null hypothesis was accepted.

Results of the Focus-Group Interview

In line with scholarship that shows that themes can be discovered through data expressions (Michaelides, 2011), the following theme and a sample of student's quotes reflect how ICT as a blended-learning tool can support face-to-face classroom learning and improve the students' skills for sustainable development.

Theme: High, low and moderate student skill in the use of ICT as a blended learning tool

The statements from the students coded under this theme shows that all participants support online blended learning as really helping them with their academic work. This is strongly supported by the literature (e.g., Pun, 2013). The respondents expressed the following views to support the use of ICT in blended learning and how it affects them positively:

"Thank you for the question. Yes! I'm moderately skilled using google meet, zoom and other online applications that our lecturers used to deliver their lectures online e.g. LMS, and I do learn on myself through the help of my colleagues. During the lockdown with YouTube" (FG:P2).

Another participant said that most students did not have internet connectivity at home:

"I have low skilled in the use of ICT gadget because most times we don't have access to internet facilities at home during this COVID-19 lockdown, also power failure and inadequate resources affected the smooth of online lectures. But I purchased data for internet sometime." (FG:P4)

This qualitative data supported the quantitative results obtained to answer Research Question 2.

Theme: Availability of ICT tools for students' use in the campus

> *Actually, ma, its seems there are some availability of ICT tools in the campus but Wi-Fi network was unreliable, hence students depend mostly on their own personal data".*

Another participant responded that ICT gadgets were available in the lecture rooms

> *"I like this question ma, actually there is availability of ICT facilities in our campus but there is lack of regular power supply for our laptops and unstable internet connectivity"*

"I do not think the ICT resources in this campus is available for the use of students, in the department like where we need them and in our lectures class, computers are not adequate for us to use, we students depends on our phone and cybercafé for the continuation of our learning"

CONCLUSION

This study reveals that mobile phones, printers and interactive whiteboards constituted the most available ICT tools for students' utilization on campus. Projectors, internet access on campus, photocopiers and scanners were fairly available; whereas digital cameras, personal laptops, computer/pc and web boards were the least available. No significant difference was found in the availability of ICT tools between male and female students. Students were moderately skilled in the use of ICT tools with no significant difference in their competence based on background. The integration of blended-learning digital tools (ICT) brought about a large time investment by students for economically sustainable community development. There was no significant impact on the time invested by students in the use of ICT for sustainable economic community development due to their competence in the utilization of ICT tools.

From the above, it can be concluded that the impact of digital tools for blended learning on students' time spent using ICT is possibly to the tools' accessibility.

It can also be concluded that students used ICT tools for blended learning to support their traditional face-to-face learning. Additionally, students are committed to internet use and even self-fund their Wi-Fi connections for both personal and educational purposes; and were seen to support community services such as the vaccination rollouts in health centres during the pandemic.

Also, this study revealed that most undergraduate students in Nigerian universities create group pages via WhatsApp to share, interact and exchange information on their studies as part of a social network that connects all students in a class together; as well as with their teachers to access and update new information related to their course of study on their WhatsApp platform group page.

Finally, the study revealed that university students in Nigeria were ready for the change to blend e-learning to contribute to sustainable economic development after their studies in the university. The researchers concluded that digital technological tools could enhance teaching and learning and

improve ICT use among students to support their class activities online and their academic performance.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations can be made:

1. A greater emphasis should be placed on the integration of digital technologies into traditional teaching and learning methods.
2. Adequate preparations should be made to ensure the sustainability of ICT tools on campuses for students' utilization. This will enhance their competence and investment of time into ICT skills development.
3. Integration of blended-learning digital tools (ICT) should be encouraged in institutions of learning to enable students to invest time in ICTs for community-based economic sustainability.
4. Educational institutions should embrace the use of digital tools and technologies, and adapt their facilitation methods and techniques for educators and students.
5. Educators should develop an ICT-based pedagogy to improve virtual teaching and learning.

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REFERENCES

Bader, M., Iversen, S. H., and Burner, T. 2021. Students' perceptions and use of a new digital tool in teacher education. *Nordic Journal of Digital Literacy*, *16*(1), 21-33.

Cheung, A. C., and Slavin, R. E. 2013. Effects of educational technology applications on reading outcomes for struggling readers: A best-evidence synthesis. *Reading Research Quarterly*, *48*(3), 277-299.

Dubey, R., and Tiwari, S. 2020. Role of digital learning in constructivist learning environment. *Developing the next generation learners in this digital era (Vol. I)*, 87.

Ghazi, A. 2019. *Impact of ICT on undergraduate English students with and without prior ICT exposure* (Doctoral dissertation, Brac University).

Govender, D.W. and Kayode, A.E. 2020. Examining Availability and Frequency use of Computer-Based Technology Resources among Students in Nigerian Universities. PONTE, Academic Journal. Apr.2020, Vol.76, Issue 4. doi.org/10.21506/j.ponte.2020.4.26

Guvhu, R. 2018. *Principal leadership and the integration of information and communication technologies for teaching and learning in Zimbabwe* (Doctoral dissertation, University of the Free State).

Jakubakynov, B., Berechikidze, I., Kartashova, O., and Kochetkova, G. 2021. Gifted Students Creativity: The Role of Preliminary Orientation and Individual Learning Strategies. *Thinking Skills and Creativity*, 100883.

Kapoor, K.K., Tamilmani, K., Rana, NP., Patil, P., Dwivedi, Y.K. and Nerur, S. 2018. Advances in social media research: Past, present and future. *Information Systems Frontiers, 20(3), 531-558.*

Kayode A.E and Ekpenyong M. 2021. Social media, university communication and e-learning platforms: a focus on educators and learners' accessibility during post-covid-19 era, in Nigerian Universities. A lead paper presented at 7th Annual International Interdisciplinary Conference on Raising Girl's Ambition (RAGA, 2021).. 12 – 15, October, 2021

Kayode, A.E. and Govender, D.W. 2021. Examining a Mixed-Methods Analysis of Students' Skill Level in the Use of Computer-Based Technology in Nigerian Universities. African Journal of Educational Management (AJEM). **22(2).**

Kayode, A. E. 2019. Examining Computer-based Technology Skill and Academic Performance of Students in Nigerian Universities. Ph.D. Thesis, Department of Computer Science Education, University of KwaZulu-Natal, South Africa. Upload on university-website: *(https://researchspace.ukzn.ac.za+Kayode Aderinsola).*

Kayode, A.E, Irele, A.O., Agunbiade J.F., and George-Kayode, B.O. 2019. ICT for Effectiveness and Job Performance of Staff in the Universities in Nigeria. Texila International Journal of Academic Research. **DOI**: 10.21522/TIJAR.2014.SE.19.02.Art004 Retrieved December, 15, 2021.

Kayode, A.E. and Rapeane-Mathonsi M. 2021. Utilization of social media During COVID-19 pandemic among University Students in Nigeria. A lead paper presented at the 8th European Conference on Social Media - ECSM 2021, University of Central Lancashire, Cyprus (UCLan). 1-3 July. Page 11- 118. DOI:10.21522/TIJAR.2014.SE.19.02.Art004. ISSN: 2520 – 3088

Kumar, A., Krishnamurthi, R., Bhatia, S., Kaushik, K., Ahuja, N. J., Nayyar, A., & Masud, M. (2021). Blended learning tools and practices: A comprehensive analysis. *Ieee Access*, *9*, 85151-85197.

Lawrence, J. E., & Tar, U. A. (2018). Factors that influence teachers' adoption and integration of ICT in teaching/learning process. *Educational Media International*, *55*(1), 79-105.

Lazar, I. M., Panisoara, G., and Panisoara, I. O. 2020. Digital technology adoption scale in the blended learning context in higher education: Development, validation and testing of a specific tool. *PloS one*, *15*(7), e0235957.

Mpungose, C. B. 2020. Emergent transition from face-to-face to online learning in a South African University in the context of the Coronavirus pandemic. *Humanities and Social Sciences Communications*, *7*(1), 1-9.

Naidu, P., and Razali, F. I. 2019. Examining Student Standpoint: Blended Learning as a Beneficial Teaching Approach. *Asian Social Science and Humanities Research Journal (ASHREJ)*, *1*(2), 36-43.

Nyagorme, P., Qua-Enoo, A. A., Bervell, B., and Arkorful, V. 2017 . The awareness and use of electronic learning platforms: A case of a developing country. *World Journal of Computer Application and Technology*, *5*(2), 13-23.

Onodugo, I. C., Amujiri, D. B. A., Asogwa, S. N., and Anyadike, N. 2015. Community development and local governments in Nigeria: A discourse. *International Journal of Research in Economics and Social Sciences*, *5*(9), 286-297.

Ozili, PK., and Arun, T. 2020. Spillover of COVID-19: impact on the Global Economy. *Available at SSRN 3562570*.

Ratheeswari, K. 2018. Information communication technology in education. *Journal of Applied and Advanced research*, *3*(1), 45-47.

Richards, N.U. 2021. 10 SDGs and private public partnerships in Nigeria. *Implementing the Sustainable Development Goals in Nigeria: Barriers, Prospects and Strategies*, 152.

Rodrigues, U. 2020. Political Communication on Social Media Platforms. In *Platform Capitalism in India* (pp. 221-238). Palgrave Macmillan, Cham.

Steeves, H. L., and Kwami, J. 2017. Interrogating gender divides in technology for education and development: The case of the One Laptop per Child Project in Ghana. *Studies in Comparative International Development*, *52*(2), 174-192.

Thompson, B. W. 2016. The connected classroom: Using digital technology to promote learning. *Teaching in nursing: A guide for faculty*, 324-328.

Victor, O.F. and Segun B.J. 2020. Impact of Multimedia Technology on the Teaching and Learning of Oral English in Osun State Secondary Schools, Nigeria. African Journal of Inter/Multidisciplinary Studies. 2(1), 37- 49

Yanguas, M. L. 2020. Technology and educational choices: Evidence from a one-laptop-per-child program. *Economics of Education Review*, *76*, 101984.