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African Institute for Science Policy and Innovation
International Biennial Conference

Conference Proceedings

VOLUME 2

2nd AISPI International Biennial Conference on Harnessing Science, Technology and Innovation for Inclusive Development in an Uncertain Future, 2021

Learning Technologies: An alternative for teaching and teaching and learning among pre-tertiary learners during covid-19 pandemic in Nigeria

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Abstract

The COVID-19 pandemic has caused disruptions to socio-economic life in all economies of the world, including education sector. This article presents learning technologies deployed during COVID-19 pandemic among Nigeria's pre-tertiary institutions, through the perspective of technology acceptance model. The data used for this study were sourced from the World Bank's Living Standards Measurement Study – Integrated Surveys on Agriculture (LSMS-ISA). Three rounds of data were collected from 1,950 households through the Survey Solutions software for Computer Assisted Telephone Interview deployed to track the implication of COVID-19 pandemic in Nigeria. The data were analyzed with frequency, percentage and Chi-square. The study concludes that new streams of learning technologies were adopted by learners, and they engaged in different education activities. The household of the students had different contacts with their tutors, while the adoption of learning technologies was significantly different between Urban and Rural areas except Radio technology.

Keywords: Learning technologies, COVID-19, Pre-tertiary institutions

Selected and peer-reviewed by ASIPI, Obafemi Awolowo University, Ile-Ife, Nigeria.
Published 2024 by Koozakar LLC. Norcross GA 30071, United States.
https://doi.org/10.69798/27365961

1.0 Introduction

Coronavirus (COVID-19) was officially confirmed on the 27th of February, 2020 in Nigeria by the Virology Laboratory (VL) of Lagos University Teaching Hospital (LASU) which is part of the Laboratory Network of the Nigeria Centre for Disease Control (NCDC). Due to the upsurge in confirmed cases of COVID-19 in Nigeria, the Federal government introduced non-pharmaceutical measures as part of preventive measures to curtail the escalation of the infection rate of the virus. Among these were the constant use of alcohol-based sanitizers; staying at home; maintaining physical/social distancing of at least two (2) meters; regular wearing of face masks; regular hand washing with antiseptic soap and water; rubbing of hands with alcohol-based sanitizers; coughing and sneezing into flexed elbow or tissues and immediate disposing of the used tissue; frequent cleaning of touched surfaces and objects; fumigation with disinfectants or decontaminators; and the closure of learning institutions (NCDC, 2020).

The approval of closure of all learning institutions in Nigeria was on March 19th, 2020 by the Federal Ministry of Education (FMoE) (Nlebem, 2020). The Education system of Nigeria was disrupted due to sudden closure of all learning institutions in Nigeria. Learning modes, accessibility to education-related activities, parenting routines among others were also significantly banned (TEP & NESG, 2020). The closure forced students to stay at home, instigating relevant stakeholders to swiftly adjust and develop mechanisms to minimize the potential learning gaps that might emerge from the pandemic lockdown. The sudden closure of learning institutions affected 36,400,000 pre-tertiary school learners in Nigeria, including inhabitants of internally displaced camps (UNESCO, 2020). The Coronavirus pandemic further exacerbated challenges of Nigeria education system (Obiakor and Adeniran, 2020). However, COVID-19 pandemic showed the need to embrace and deploy cutting-edge learning technologies in the Nations educational system (Onyema *et al*., 2020) as a means of ameliorating the challenges posed on education in Nigeria.

Before the emergence of COVID-19, a limited number of pre-tertiary institutions in Nigeria had deployed and maintained learning technologies and virtual science laboratories to perform virtual experiments and bridge the communication gap between students and instructors (Abbey *et al*., 2020). Furthermore, children in standard private schools experienced little disruption in learning, because most of the standardized private schools were equipped with ICT infrastructure that facilitate remote learning (Samuel, 2020). Although, during and after the COVID-19 pandemic lockdown, efforts have been geared towards promoting learning by public, private partnership (PPP) such as governments, the private sector, and key education stakeholders. These efforts range from adoption of "low technological solutions that do not require Internet-enabled devices (radio and television), to high technological options that require Internet-enabled devices (virtual classrooms, video conferencing, animated lessons and online resource(s) libraries)". The swift intervention of the FMoE and the Universal Basic Education Commission (UBEC) manifested in the setting up of the Nigeria Education Sector COVID-19 Response Strategy (FMoE, 2020). The response strategy comprises plans to learn from home programme (LHP), which was aimed at reducing the learning gap during the lockdown (TEP & NESG, 2020). In addition, FMoE in collaboration with educational technology companies via LHP flung virtual learning platforms and provided access to e-learning resources.

2.0 Statement of the Problem

Conscious efforts of the United Nations through the agreed Millennium Development Goals had the intention to guarantee that by 2025, children irrespective of their location will complete a full course of primary schooling (UNESCO, 2020). Likewise, efforts of the Nigerian Government through the Compulsory, Free, Universal Basic Education Act of 2004 which is to ensure that all children of school age be enrolled compulsorily in school. However, studies have shown that there is an increase in the number of students that drop-out from schools in Nigeria (Benjamin and Christiana, 2018) and low level of students' enrolment. Also, globally, more than 1.2 billion children were out of school (World Economic Forum, 2020).

Given the increase in the number of out-of-school children, which was exacerbated by COVID-19 pandemic lockdown, several efforts have been geared towards ameliorating the negative effects of the lockdown on the number of out-of-school children in Nigeria through different learning technologies. Although, studies have been carried out on different learning technologies deployed (Rao and Sridhar, 2020; Kumar and Sridhar, 2020), there is dearth of recent panel data studies on learning technologies deployed in pre-tertiary institutions in Nigeria.

This study will contribute to the body of knowledge on the deployment of learning technology with the following objectives:

(i) Examine the types of learning technologies adopted during the COVID-19 pandemic in pre-tertiary institutions in Nigeria;
(ii) Investigate the types of educational activities the students engaged in during the pandemic;
(iii) Describe the types of contact the students had with teachers during the pandemic; and
(iv) Evaluate the effects of location on the type of learning technologies adopted during the COVID-19 pandemic in Nigeria.

3.0 Literature Review

Based on the background of the COVID-19 outbreak around the world, several policy initiatives are being initiated by governments to curtail the spread of COVID-19 without trading off continuous learning and teaching activities in developed countries. Educators tend to more easily adapt and use extensive Internet facilities with remarkable speed in developed countries like the USA. Information technology (IT) tools powered by advanced artificial intelligence like Skype, WhatsApp, Microsoft Teams, Zoom, and Google classroom are commonly in use to teach various subjects as well as to serve as a platform of interaction between teachers and students/learners (Ekong, 2020). Technology remains the bridge to link educational gaps that the impromptu closure of schools during Coronavirus pandemics has created and has the potential to enable education from the comfort of home (Onyema *et al*., 2020) using digital technologies.

In Nigeria, the Federal Government through the FMoE ordered closure of all learning institutions on 19th March, 2020 following the outbreak of COVID-19 and also to curtail its spread. Since then, the Nigerian education sector suffered from the occurrence of pandemic, leading to the suspension of physical classes in Nigeria. In response to the education emergency posed by the pandemic lockdown, public and private partnerships implemented various digital learning technologies to ameliorate the negative implication of the sudden closure of learning institutions in Nigeria. Furthermore, the suspension of physical classes in all the learning institutions enhanced the adoption of digital learning technologies in place of traditional teaching and learning styles (Korkmaz and Toraman, 2020; Ali, 2020). Some learning channels were lunched on various satellite networks (Samuel, 2020) such as radio, television, and online platforms to reach out to a large number of students (Onyema *et al*., 2020). In support of that, as of April 2020, many states in Nigeria have adopted television-radio means of communicating with students, whereby teachers air educational programmes of their respective subjects and topics to students who listen and watch from the comfort of their homes (Samuel, 2020).

Federal Ministry of Education (FMoE) in Nigeria also introduced online/virtual learning platforms and other e-learning resources whose links were displayed on the websites of FMoE. Besides, the Federal Government in partnership with a telecoms company to provide free data access to online learning repositories. The online platforms provided learning materials on STEM education (TEP & NESG, 2020). This means that the COVID-19 pandemic lockdown necessitates swift adoption of learning technologies in educational sector in Nigeria. The mainstream learning system in classroom was succeeded by a new stream of virtual learning modalities; from physical and textbook learning oriented instructional materials to digital learning devices or television-based learning which is augmented with online learning (Kado *et al*., 2020).

Thus, the surge of COVID-19 and the lockdown increased the demand for online education, though online teaching requires technical expertise than teaching face-to-face (Lawal, 2020). The technology was pivotal

to teacher-student linkages and communication during COVID-19 lockdown, isolation, and quarantine (Onyema *et al*., 2020). However, with the help of technology, students and teachers were effectively academically engaged during the coronavirus lockdown. The adopted learning technology has adversely dealt with the socio-economic status of Nigeria's populace which was evident from the quantum of finance expended by parents on education. The sudden interruption of the education system in Nigeria as a result of the pandemic led parents to have a shift in their plans and strategies to finance the education of their children (Samuel, 2020).

With the innovation of the online classes during the lockdown, some parents were forced to procure laptops, android phones, television cables, and other means of communication to ensure that their wards move on with the various platforms designed for teachers to reach out to their students, even though not every home in Nigeria could afford the purchase and monthly subscriptions of satellite/television cables networks (Samuel, 2020). Hence, adoption of technology-enhanced learning became imperative during COVID-19 pandemic lockdown, due to high rate of COVID-19 infection (Ali, 2020). The impact of digitalization in learning is increasingly becoming conspicuous and has recently continued to grow and attract interest at an unprecedented rate. Today, digital learning is no longer a luxury, but rather a necessity in education and career development. Acquisition of knowledge and skills using electronic technologies such as computer, Internet, and phones gives an opportunity to access and share learning materials in various formats and has provided easy access to learning and promoted flexibility in learning from anywhere and anytime without place and time constraints (Rao and Sridhar, 2020; Kumar and Sridhar, 2020) except for technology failure and financial constraints.

The emergence of the pandemic has revealed the vulnerabilities in the education system globally and it is clearer now that society needs a flexible and robust educational system more than ever due to benefits that accrue to such an educational system. Many institutions or organizations deploying technology enhanced learning gain significant returns from their new stream of leaning technology investments such as reduced cost of transportation, enhanced customer support, human resources overhead, and regulatory compliance. In addition, it has a velocity advantage by being able to reach a large number of learners in a shorter time. Despite the awareness and effectiveness of deploying technology in learning, there are challenges attached to new stream of learning technologies in the educational systems of developing countries especially Nigeria. Such challenges are rising cost of technological infrastructure, lack of practices and capabilities, and level of student achievement and improvement (UNICEF, 2020). The digital divide exists as a formidable obstacle to equate educational systems in rural and urban areas.

This is due to the complexity of technology-enhanced learning system which needs a balance between technical issues such as the creation, utilization and support of technology-enhanced learning facilities and other organizational and pedagogical considerations (Jacobson and Wilensky, 2006). Consequently, the use of technology enhanced learning systems by teachers and students may not be optimally effective as disadvantaged students may experience difficulty in obtaining the technological advantages it offers. Nevertheless, adopting new streams of learning technologies is strategic in nature hence, pre-tertiary institutions need to adopt frameworks that encompass all aspects of learning or benchmarking processes to be able to identify their strengths and points of improvement (Iskander and Daflous, 2013). Thus, assessing e-learning frameworks provide guidelines for improving learning usability, reducing number of failed projects, and maintaining workflow processes to assessing quality issues (Penicina, 2011). The rapid development of Information and Communications Technology (ICT) and the rising complexity that comes with its growing potential explains why integration of technology in education continues to receive special attention, particularly in the wake of the COVID-19 pandemic.

In order to properly evaluate the effectiveness of these learning technologies, various evaluation approaches have been developed such as: benchmarking (Williams *et al*., 2012), impact-oriented evaluation (Ruiz *et al*., 2006) and performance evaluation of software features-oriented systems (Martínez-Caro *et al*., 2015). Moreover, the widespread deployment of technology-enhanced learning in pre-tertiary institutions all over

the world have led to a huge growth in the development of E-learning models. Such models are focused on the assessment of technology-enhanced learning systems at the expense of providing guidelines on how to improve the current learning practices. The infrastructural demand and support needed to adopt and sustain technology-enhanced learning is huge and deficient in some part of the world. The World Bank (2020) is aware and mindful of the fact that few education systems, even the highest performing, may not be well equipped to successfully deliver technology enhanced learning for all students at such a large scale. As such, technological advances often outpace the ability of decision makers to keep up considering the cost and infrastructure support (World Bank, 2020). It is very important to establish that delivering an effective technology enhanced learning requires appropriate technological support in terms of infrastructure, tools as well as hardware and software support systems (Ali, 2020).

There is no doubt that integration of technology as an instructional device in academics has escalated at a rapid rate, and there has been an exponential increasing interest in the development and deployment of multimedia-enhanced content through the use of ICT to enhance the quality of teaching and learning globally (Smith and Judd, 2020; UNESCO, 2020; World Bank, 2020). Multimedia contents combine text, graphics, audio, and animations. The appropriate use of multimedia-enhanced content in educational contexts provide several benefits. In particular, there is a need to accelerate the pace of technology iteration and optimize the technical application of technology enhanced learning considering the alarming impact of COVID-19 pandemic.

Moreso, it has been established that learning remotely using technology enhanced platforms drained many students, reduced their interest, and the perceived heavy workload negatively swayed their motivation (Niemi and Kousa, 2020), while subsequent lack of interaction and communication in technology-inclined learning can possibly lead students' to feel isolated, worry unduly and develop unstructured educational habits.
Technology acceptance model (TAM) is appropriate for this study due to the idiosyncratic nature of the theory such as perceive ease of use, perceive usefulness, and attitude towards use of the technology. The closure of learning institutions in Nigeria as one of non-pharmaceutical ways of combating COVID-19 pandemic necessitate the need to adopt the new streams of learning technologies in the educational sector in Nigeria. This shows that the adopted new stream of learning technologies is perceived useful. The ease of use of technology is perhaps considered in the attitude towards the acceptance of learning technology in the educational system in Nigeria.

4.0 Research Methodology

The data used for this study were extracted from the World Bank's Living Standards Measurement Study – Integrated Surveys on Agriculture (LSMS-ISA). The survey was conducted by the National Bureau of Statistics (NBS) in partnership with the Bill and Melinda Gates Foundation (BMGF) and the World Bank (WB). The 2019/2020 LSMS-ISA data for Nigeria, also known as 2019/2020 General Household Survey-Panel (GHS-P) include three rounds of COVID-19 National Longitudinal Phone Survey (COVID-19 NLPS). The data for the three rounds; round one (20th of April - 11th May), round two (June 2nd - 6th) and round three (July 2nd - 16th) were collected subsequently in 2020. The first round was conducted when the federally mandated pandemic lockdown was in full effect. The second and the third rounds were conducted after some of the COVID-19 pandemic lockdown restrictions on movement were lifted. The ability to follow the same households over time makes the GHS-Panel a powerful tool for studying and understanding the role of COVID-19 pandemic lockdown on the children's education in Nigeria.

The sample size of 1,950 households which is nationally representative were successfully interviewed out of 3,000 households that were randomly selected from 4,394 of 2018/2019 (Wave 4) GHS Panel. The high-frequency phone survey was conducted through the Survey Solutions software for Computer Assisted Telephone Interview so as to track the implication of COVID-19 pandemic. These high-frequency phone surveys covered different key important (KI) headings and some of it include knowledge regarding the spread of COVID-19; prices and access to food and non-food necessities; education; employment and

income losses; food insecurity; and subjective wellbeing. This study is particularly interested in tracking the impacts of COVID-19 on children's education in Nigeria which are measured and coded in similar ways in all the attributed rounds.

The some of the variables used in this study were coded yes or no and measured thus: 1) learning technologies adopted was measured with mobile learning apps, Television *(Educational Programs)*, Radio *(Educational Programs).* 2) the type of education activities was measured with completion of assignment, personal study, teaching by parent or other household member, and scheduling meetings with teachers (Tutor). 3) the type of contact the pre-tertiary students' household had with teachers was measured with SMS, online applications, email, telephone (audio), WhatsApp, Facebook, and Household visit by teacher/Tutor. 4) the effects of sector on the type of learning technologies adopted in pre-tertiary institutions in Nigeria. Sector was measured with Rural and Urban.

The data were analyzed with descriptive statistics such as frequency, percentages and cross-tabulation and inferential statistics such as Chi-Square. The justification for using Chi-Square is that response variable *(type of technologies adopted; TV, Radio and mobile learning)* was coded dichotomously (*yes and no)* while the factor variable was also designed as Rural and Urban and dichotomously coded as 1 and 2. The data used in this study were analyzed with STATA 12 (Statistical Software Package 12).

5.0 Results and Discussion

Objective One: the type of learning technologies adopted during COVID-19 lockdown in Nigeria

Table 1 shows that the students used mobile learning apps for learning in round one (92.61%), round two (81.30%) and in round three (76.81%). This indicate that students in primary and secondary schools deployed mobile learning apps as one of their learning technologies during the pandemic period. Furthermore, the Table also shows that students of primary/secondary school watched educational TV programs in round one (81.84%), round two (67.62%) and round three (61.87%). This implies that Television (TV) is another learning technology adopted in the midst of pandemic lockdown. In addition, Table 1 shows that students of primary/secondary school listened to educational programs on Radio in round one (80.46%), round two (57.81%) and round three (56.03%). This implies that Radio is another learning technology adopted in the midst of pandemic lockdown. This study conforms to previous scholars' deposition on the adoption of new stream of learning technologies (Rao and Sridhar, 2020; Kumar and Sridhar, 2020; Samuel, 2020; Onyema *et al*., 2020 and Kado *et al*., 2020).

Table 1: The Type of Learning Technologies Adopted

Learning Technologies Adopted	Rounds	Yes	No	Total
Used mobile learning apps	1	877 (92.61)	70 (7.39)	947 (100)
	2	713 (81.30)	164 (18.70)	877 (100)
	3	586 (76.81)	185 (23.99)	771 (100)
Watched Educational TV Programs	1	775 (81.84)	172 (18.16)	947 (100)
	2	593 (67.62)	284 (32.38)	877 (100)
	3	477 (61.87)	294 (38.13)	771 (100)
Listened to educational programs on Radio	1	762 (80.46)	185 (19.54)	947 (100)
	2	507 (57.81)	370 (42.19)	877 (100)
	3	432 (56.03)	339 (43.97)	771 (100)

Critically speaking, it is obvious in Table 1 that the level of learning technologies adopted in both round two and round three were relatively low to round one. In one way, the low level of learning technology adoption in COVID-19 rounds two and three perhaps be attributed to the lifting of some of the COVID-19 pandemic lockdown restrictions on movement. In spite of that, some non-pharmaceutical measures were

still in place to combat the spread of COVID-19 such as social/physical distancing, appropriate use of face mask constant washing of hands and the use of alcoholic-based sanitizers to mention a few.

In another way, the increase in the price of electricity and PMS (Premium Motor Spirit) and VAT (Value Added Tax) experienced in Nigeria during pandemic period perhaps further exacerbated the dearth of the use of TV and radio by children for learning. Hence, the resultant effect of the identified increase in the cost of living or perhaps decrease in the quality of life (QOL) of the learners' parents.

Objective two: The type of educational activities the students engaged in during COVID-19 Lockdown in Nigeria

Table 2 shows that majority of the students (92.93%) of the households surveyed were attending primary/secondary before the pandemic lock down, which necessitated the closure of schools to curtail the spread of the disease. This indicates that the number of out-of-school children is was low before the lockdown. Meanwhile, reduction in the number of out-of-school children through compulsory free primary education means the efforts of Nigerian government through the Free Universal Basic Education Act of 2004 is yielding positive result.

Table 2: Type of education activities the students engaged during COVID-19 Lockdown

Education activities the students	Rounds	Yes (%)	No (%)	Total
Were any of the Children attending Primary/secondary school before closed	1	1485 (92.93)	113 (7.07)	1598 (100)
	2	-	-	-
	3	-	-	-
Have the children been engaged in any educational activities in the past 7 days	1	947 (63.86)	536 (36.14)	1483 (100)
	2	877 (64.16)	490 (35.84)	1367 (100)
	3	771 (57.03)	581 (42.97)	1352 (100)
Completed assignments provided by the teacher	1	785 (82.89)	162 (17.11)	947 (100)
	2	588 (67.05)	289 (32.95)	771 (100)
	3	478 (62.00)	293 (38.00)	771 (100)
Studying/Reading on their own	1	319 (33.69)	628 (66.31)	947 (100)
	2	185 (21.09)	692 (78.91)	877 (100)
	3	170 (22.05)	601 (77.95)	771 (100)
Taught by parent or other household member	1	401 (42.34)	546 (57.66)	947 (100)
	2	222 (25.31)	655 (74.69)	877 (100)
	3	210 (27.24)	561 (72.76)	771 (100)
Session/meeting with Lesson Teacher (Tutor)	1	799 (84.37)	148 (15.63)	947 (100)
	2	604 (68.87)	273 (31.13)	877 (100)
	3	430 (55.77)	341 (44.23)	771 (100)

Table 2 further shows that in round one, about 64% of the children were engaged in one educational activity or the other in the period under review while only 36.14% were not engaged in any educational activities. Additionally, in round two, about 65% of the children were engaged in educational activities in the period reviewed and only 35.84% of the children were not engaged in any educational activities. Also, in the third round, 57.03% of the children were engaged in educational activities while 42.97% of the children were not engaged in any educational activities. Descriptively, the table shows that the number of children engaged in educational activities through the use of learning technologies during COVID-19 pandemic is low relatively to the proportion of children attending primary/secondary before the pandemic lock down.

Table 2 shows that in round one, about 83% of the students completed assignment provided by their teacher 67.05% of the students completed assignments provided by their teacher in round 2 while in round three, 62% of the students completed assignments provided by their teachers. By implication, the students are

still engaging in educational activities by completing the assignment provided by the teacher before, during and after the pandemic lockdown. Nevertheless, the level of assignment completion reduced drastically in round two and three. Perhaps, this can be attributed to the report of Niemi and Kousa (2020) that learning remotely using technology enhanced platforms drained many students, reduced their interest, and the perceived heavy workload negatively swayed their motivation.

Table 2 also shows that in round one, 33.69% of the students read/studied on their own, Also, in round two, 21.09 % of the students read/studied on their own while in round three, 22.05 % of the students read/studied on their own. By implication, the proportion of students that read/studied on their own is very small. It seems the students are not used to studying/reading on their own except when they are being monitored or engaged by their tutors. Although, it is important to know that the students will be distracted at home unlike when they are in school and monitored by their tutors. Table 2 shows that in round one, 42.34% of the students were taught by parents or other household member. In round two, and round three 25.31% and 27.24 % respectively of the students were taught by parent or other household member. By implication, the proportion of students that were taught by parent or other household member is very small, it seems the parent or other household member of the student were too busy to teach the students. This might be one of the justifications why the students are not reading/studying on their own because the parent and other household member are too busy to teach the students to developing personal study characteristics.

Table 2 shows that in round one, about 84.37% of the students scheduled meetings with their lesson teacher. Also, in round two, 68.87% of the students scheduled meeting with their lesson teachers while in round three, 55.77% of the students scheduled meeting with their lesson teachers. By implication, the students are still engaging in educational activities by scheduling meetings with their lesson teachers in the pandemic lockdown periods. Given this, it is justifiable to say that one of the reasons the students are not reading/studying on their own is because they often scheduled meetings with their lesson teachers. Nevertheless, the law of diminishing returns may be setting in on the part of children scheduling meetings with their teachers in round two and round three. This might be attributed to laxity on the part of the parent or other member of the household to monitor the children's education during COVID-19 pandemic. Obviously, such lackadaisical attitude on the part of parents or other member of the household will negatively affect the academic performance of the children. Although, this study did not consider the academic performance of the children due to lack of academic performance evaluation data for the period.

Objective three: The type of contact the pre-tertiary students' household had with teachers

This implies that students or anyone of the household are not really contacting their teachers in the midst of COVID-19 pandemic. Furthermore, Table 3 shows that although, the children or anyone else in the household are not really contacting their teachers but when they do, it is through SMS in round one (87.80%) and round two (72.50%), online applications in round one (95.59%) and round two (84.68%); Email in round one (98.31%) and round two (86.44%); Telephone (audio) in round one (42.37%) and round two (41.06%); WhatsApp in round one (88.47%) and round two (76.03%); Facebook in round one (96.61%) and round two (85.85%); household visits by teacher/tutor in round one (64.75%) and round two (50.88%). Despite the fact that students or anyone of the household are not really contacting their teachers in the midst of COVID-19 pandemic but if they do, they use different applications/technologies.

Objective Four: The effects of sector on the type of learning technologies adopted

Table 4 shows the cross-tabulation of sector and adoption of learning technologies in the pre-tertiary institutions in Nigeria. The table shows that about 60% of the respondents from rural areas adopted mobile learning apps while 40.53% of the remaining respondents from urban areas adopted mobile learning apps. It is however, inferred from the Chi-Square ($X^2 = 13.9116$; $P = 0.000$) that there is significant difference in mobile learning apps adopted between children of pre-tertiary institutions from urban and rural area in Nigeria.

Table 3: The type of contact the pre-tertiary students' household had with Teachers

The medium contact with teachers	Rounds	Yes (%)	No (%)	Total
Are the children or anyone else in the household in contact with their teachers	1	296 (19.96)	1187 (80)	1483 (100)
	2	509 (37.23)	858 (62.77)	1367 (100)
	3	-	-	-
SMS	1	259 (87.80)	36 (12.20)	295 (100)
	2	369 (72.50)	140 (27.50)	509 (100)
	3	-	-	-
Online applications	1	282 (95.59)	13 (4.41)	295 (100)
	2	431 (84.68)	78 (15.32)	509 (100)
	3	-	-	-
Email	1	290 (98.31)	5 (1.69)	295 (100)
	2	440 (86.44)	69 (13.56)	509 (100)
	3	-	-	-
Telephone (audio)	1	125 (42.37)	170 (57.63)	295 (100)
	2	209 (41.06)	300 (58.94)	509 (100)
	3	-	-	-
WhatsApp	1	261 (88.47)	34 (11.53)	295 (100)
	2	387 (76.03)	122 (23.97)	509 (100)
	3	-	-	-
Facebook	1	285 (96.61)	10 (3.39)	295 (100)
	2	437 (85.85)	72 (14.15)	509 (100)
	3	-	-	-
Household visit by teacher/Tutor	1	191 (64.75)	104 (35.25)	295 (100)
	2	259 (50.88)	250 (49.12)	509 (100)
	3	-	-	-

Table 4: Sector and adoption of learning technologies

Learning Technologies		Sectors		Total	X^2
		Urban (%)	Rural (%)		
Mobile Learning Apps	0	882 (40.53%)	1294 (59.47%)	2176 (100%)	$X^2 = 13.9116$
	1	211 (50.36%)	208 (49.64%)	419 (100%)	P = 0.000
TV	0	698 (37.83%)	1147 (62.17%)	1845 (100%)	$X^2 = 48.1351$
	1	395 (52.67%)	355 (47.33%)	355 (47.33%)	P = 0.000
Radio	0	725 (42.62%)	976 (57.38%)	1701 (100%)	$X^2 = 0.5115$
	1	368 (41.16%)	526 (58.84%)	894 (100%)	P = 0.475

Key: 0 = Yes, 1 = No; **X^2 =** Chi-Square
-Multiple response is allowed
Radio *(for listening to educational programmes)* as one of the learning technologies during COVID-19 pandemic.

In addition, Table 4 shows that about 62.17% of the children from Rural areas adopted Television (TV) for viewing educational programmes as one of the learning technologies during COVID-19 pandemic while 40.53% of the remaining children from Urban areas also adopted TV *(for viewing educational programmes)* as one of the learning technologies during COVID-19 pandemic. It is however, inferred from the Chi-Square ($X^2 = 48.1351$; P = 0.000) that there is significant difference in the adoption of Television (TV) *(for viewing educational programmes)* between children of pre-tertiary institutions from Urban and Rural area in Nigeria as one of the learning technologies during COVID-19 pandemic. This study supports the idea of report from UNICEF (2020) that "pupils who live in a rural household cannot be reached with some remote learning modalities (UNICEF, 2020)". This means that rural people are at disadvantage amidst adoption of learning technologies in educational sector.

In spite of that, Table 4 further shows that about 57.38% of the children from Rural areas adopted Radio (*listening to educational programmes)* as one of the learning technologies during COVID-19 pandemic while 42.62% of the remaining children from Urban areas also adopted

Table 3 shows that the students or anyone else in the household are not really contacting the school teachers in round one (19.96%), and round two (37.23%).

It is however, inferred from the Chi-Square ($X^2 = 0.5115$; $P = 0.475$) that there is no significant difference in the adoption of Radio *(for listening to educational programmes)* between children of pre-tertiary institutions from Urban and Rural area in Nigeria as one of the learning technologies during COVID-19 pandemic. Perhaps, Radio is easily accessible and affordable by citizens, irrespective of their race, age and gender among others.

6.0 Conclusion and Policy Recommendations

The study concluded that new streams of learning technologies (Mobile learning apps, Radio, Television) were adopted by learners in Nigeria during COVID-19 pandemic, however, unfavorable increase in; electricity tariff, PMS (petroleum motor spirit) and tax during this period, may hamper the frequent use of the new stream of learning technologies. The study further revealed that prior to the pandemic, most children of the households have access to basic education which implied that the free education policy of the government is yielding positive result. Also, the study found that learning was not absolutely disrupted during the period under investigation, though it was not through the traditional teacher-student learning approach. The study also revealed that, the proportion of students that were taught by parent or other household member is very small and that the location of the learners (urban/rural) does have meaningful difference in the adoption of learning technologies except for the adoption of Radio.

The study recommends that the government should further look into how to provide infrastructures that will aid accessibility and affordability of new streams of learning technologies and put in place appropriate policies that will enhance learning. Also, learning remotely should be made interesting by educators. Government should also encourage the educators to making learning fun and lively. Furthermore, students are to be trained to develop personal study characteristics by parents and or another member of the household.

7.0 Area for Further studies

This study did not consider the academic performance of the students. Further studies may consider the academic performance of children during COVID-19 pandemic period. Also, this study did not consider the effectiveness, efficiency and affordability of the learning technologies deployed. Further studies may look into that. Furthermore, the study is limited to quantitative research method however, further study may consider mixed methods in data analysis.

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