Consultancy on Teaching, Learning & Research in Nigeria's Tertiary Institution Post Pandemic/COVID

SRFP/NCC/RD/05/2021

Final Report

Synopsis on Teaching, Learning & Research in Nigerian Tertiary Institutions;
Findings from Field Survey Exercise;
Technology-Enhanced Tertiary Education Landscape;
Impacts & Roles of Telecommunications Industry in supporting e-Learning;
Conceptual Framework for Transition & Sustainability of e-Learning in Nigeria;
e-Learning Support Initiatives;
Conclusion & Recommendations.

Submitted to

Nigerian Communications Commission

NIGERIAN COMMUNICATIONS COMMISSION

By Perazim Development and Planning Limited.

PERAZIM Development & Planning Ltd.

2023

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Version:	1.0
Status:	Final Project Report
Date of Issue:	2nd March, 2023
Author:	Perazim Development & Planning Limited

Document	Version	Date	Description
Submission Copy	1.0	2nd March, 2023	Final Project Report

List of Abbreviations and Acronyms

ACE	Africa Centre of Excellence
ACETEL	Africa Centre of Excellence on Technology Enhanced Learning
ADAPTI	Advanced Digital Awareness Programme for Tertiary Institutions
AI	Artificial Intelligence
API	Application Program Interface
ASID	Africa Safer Internet Day
AR	Augmented Reality
ASUU	Academic Staff Union of Universities
BMAS	Benchmark Minimum Academic Standards
CAPI	Computer Assisted Personal Interviews
CCMAS	Core Curriculum and Minimum Academic Standards
CEO	Chief Executive Officer
COVID-19	Coronavirus Disease of 2019
CSO	Civil Society Organizations
CSV	Comma Separated Version
DB	Database
DBI	Digital Bridge Institute
DODeL	Directorate of Open, Distance and E-learning
DOS	Denial of Service
ECC	Emergency Communication Centre
EdTech	Educational Technology
e-Learning	Electronic Learning
EiEWG	Education in Emergencies Working Group Nigeria
FCT	Federal Capital Territory
GDP	Gross Domestic Product
GPS	Global Positioning System
HND	Higher National Diploma
ICT	Information and Communications Technology
IOS	iPhone Operating System
LMS	Learning Management System
LRCN	Librarians' registration council of Nigeria
MDC	Mobile Data Collection
MIS	Management Information System
MOODLE	Modular Object-Oriented Dynamic Learning
MPLS	Multiprotocol Label Switching
NBTE	National Board of Technical Education
NC	North Central
NCC	Nigerian Communications Commission
NCCE	National Commission for Colleges of Education

NCDC	Nigeria Centre for Disease Control
NDPR	Nigeria Data Protection Regulation
NE	North East
NESG	Nigeria Economic Submit Group
NgREN	Nigeria Research and Education Network
NITDA	National Information Technology Development Agency
NOUN	National Open University of Nigeria
NUC	National Universities Commission
NUS	Nigerian University System
NUS	Nigerian University System
NUSOER	Nigerian University System Open Educational Resources
NW	North West
ODL	Open and Distance Learning
OER	Open Educational Resources
PgD	Post Graduate Diploma
PhD	Doctor of Philosophy
PHP	Hypertext Pre-Processor
R&D	Research and Development
REN	Research and Education Network
REST	Representational State Transfer
RoP	Right of Passage
SAAS	Software as a Service
SAV	SPSS Data File Format
SDG	Sustainable Development Goals
SE	South East
SPSS	Statistical Package for Social Sciences
SS	South-South
SW	South West
SWOT	Strength, Weakness, Opportunities and Threats
TEL	Technology-Enhanced Learning
TEP	The Education Partnership
TETFund	Tertiary Education Trust Fund
TRCN	Teachers Registration Council of Nigeria
TTT	Train the Trainer
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund
VC	Vice Chancellor
VR	Virtual Reality
XLS	Microsoft Excel Spreadsheet
XSS	Cross-site Scripting

Executive Summary

Synopsis

The outbreak of the COVID-19 pandemic stirred a paradigm shift in the teaching, learning and research methods used by tertiary institutions globally. The effects of the pandemic exposed numerous limitations of the predominant traditional face-to-face teaching & learning technique.

Most Nigerian tertiary institutions were not prepared nor equipped for continuity of teaching, learning and research activities; just a few were able to adapt to the 'new normal' of teaching and learning using e-learning solutions and ICT tools.

This necessitated the need is to examine and provide new solutions for teaching and learning post-COVID to improve learning outcomes and the quality of tertiary education in Nigeria.

This project focuses on "*Teaching, Learning & Research in Nigeria's Tertiary Institutions Post Pandemic/COVID*" with a primary objective of developing a workable framework that will sustain innovative research, teaching and e-learning platform in Nigeria tertiary institution that impacts academia but also addresses local socio-economic challenges post-COVID. The period for the study is from 2015 to 2020.

Methodology

Project implementation was achieved through a combination of methods. These includes:

a. Review of documentations, reports and publications relevant to the project such as Nigeria National Education Policy (Revised edition - 2014), National Policy on ICT in Education (2019), OER Policy for Higher Education in Nigeria; published by NUC, National Minimum Standards and Establishment of Institutions Act 2018, Benchmark for Minimum Academic Standards (BMAS); published by the National Universities Commission (NUC), Nigeria Certificate in Education - Minimum Standards for General Education (Revised edition - 2020), Ministry of Education's COVID-19 response strategy etc.

b. **Stratified sampling** and field survey of students, lecturers and researchers in Nigerian Tertiary institutions across the 36 states of the Federation and FCT. A total of 12,235 respondents across 74 tertiary institutions were sampled. All categories of Nigerian tertiary institutions were sampled and at least one tertiary institution was sampled per state. A CAPI software tool was used for quantitative data collection; all gathered quantitative data were analysed to deduce findings.

c. Qualitative Survey, Data Collection and Analysis was also done to validate and complement findings from the quantitative analysis. Key stakeholders in the Nigerian tertiary education space were engaged and interviewed to obtain data across different viewpoints on the research study. Some interviewees include: NUC, NCCE, TETFund, NCC, DBI, LRCN, TRCN, ACETEL, etc.

d. Study of Nigerian tertiary Institution curriculum as defined in the revised copies of minimum academic standards for universities, polytechnics and colleges of education in Nigeria.
e. Review of Open Education Resource (OER) and e-learning tools popularly used by Nigerian tertiary institutions.

Preliminary Findings on Teaching, Learning and Research in Nigerian Tertiary Institutions

There are about 554 tertiary institutions in Nigeria offering different courses around 13 major fields of discipline (faculties). Over 90% of students and lecturers are connected to the national electricity grid, can use the internet & a computer, have access to a computer connected to the internet and own a smartphone. 83% of respondents own a desktop computer or laptop. Only 63% of respondents affirmed to take part in e-learning for teaching and learning purposes; 79% of respondents attested to having a campus-wide network within their tertiary institution.

Over 85% of respondents knew how to use the internet before COVID-19 with at least 73% of respondents having access to the internet and over 94% owning a smartphone before the pandemic. About 65% of students and 83% of lecturers owned a laptop before COVID; 18% of students do not own a laptop. Only 50% of students and lecturers commenced e-learning activities online before the pandemic. 24% of students and 27% of lecturers have never engaged in online e-learning activities.

73% of respondents affirmed that COVID-19 brought academic activities to a complete halt in their tertiary institution. In the last 3 to 5 years, TETFund and Administration of Tertiary institutions have been the major facilitators in the provision of ICT infrastructure to Nigeria tertiary Institutions.

At least 53% of students and teachers frequently use desktop, computers and laptops for academic purposes and about 70% frequently use the internet for same purpose. The internet is the most frequently used ICT asset for educational purposes. No fewer than 44% of respondents sometimes use LMS, interactive whiteboards and virtual meeting tools for teaching, learning and research purposes.

About 80% of students and lecturers consume between 1GB to 20GB of data monthly. 21% of students use between 11GB to 15GB of data monthly representing the highest frequency for students while 26% of lecturers use between 6GB to 10GB monthly - representing the highest frequency for lecturers & administrators. About 80% of students and lecturers spend below N10,000 monthly for data subscription. Nigerian students and lecturers spent more time online for academic activities during COVID-19.

36% of respondents confirmed that there is no usage of OER or e-learning systems in their institution. Google Classroom, Moodle and other foreign LMS solutions are commonly used by institutions practicing e-learning. A comparative analysis of commonly used LMS was

performed and an assessment of available OERs in tertiary institutions was also conducted. Less than 45% of respondents rated the level of effectiveness of their institution's e-learning/LMS solutions and adoption policy as being just "Effective". Robustness limitations, course management and assessment related issues amongst others, are the top three (3) limitations of the use and adoption of deployed e-learning systems in Nigerian tertiary institutions.

Slow internet bandwidth, power supply issues, internet subscription cost, lack of technical & managerial support and lack of e-learning knowledge are the top 5 barriers/challenges to the use and adoption of e-learning systems in Nigerian tertiary institutions.

About 80% of respondents agreed or strongly agreed that ICT has improved student and lecturer digital literacy levels, increased use of internet for academic and non-academic activities and improved the overall teaching and learning experience in Nigerian tertiary institutions.

Components of the current Nigerian tertiary education curriculum that require update to allow for alignment with e-learning include: Practical and laboratory courses and topics, Volume of coursework, Student Assessment & examination model and Course timetable design and structure.

Tertiary education regulators have commenced creation and implementation of different policies that will support the adoption and adaptation of e-learning in Nigerian tertiary institutions as well review of current curriculum. The World Bank group has also contributed immensely in promoting open and distance learning through its ACE program in Nigerian; currently, there are 25 ACE centres in Nigeria.

The major interventions by NCC to support teaching, learning and research in Nigerian tertiary institutions include: facilitation of broadband penetration, ADAPTI programme, Wireless Cloud, DBI, promotion of innovation in EdTech and funding of telecommunications-based research innovation.

A SWOT analysis of the e-learning landscape in Nigerian tertiary institutions was also done. Access to stable electricity & ICT tools, reliable broadband and digital literacy were identified as key determinants for use of ICT for teaching, learning and research in Nigerian tertiary institutions.

Conceptual Framework for Transition and Sustainability of e-Learning in Nigerian Tertiary Institutions

A conceptual framework for transition and sustainability of e-learning in Nigerian tertiary institutions was developed. The framework consists of two domains: transition and sustainability. The transition domain involves the provision of key enablers such as: regulations & policies, curriculum review, ICT facilities, cybersecurity, broadband access and digital literacy. The sustainability domain relies on two key activities: Monitoring & enforcement and Periodic assessments, upgrades and updates.

Curriculum-Update Initiatives to Support e-Learning

a. Collaborative review, update and implementation of new tertiary education curriculum that allows for seamless support of e-learning. (All tertiary education regulators are finalizing their updated curriculum in this regard).
b. Introduction of new a course type: "e-learning" in tertiary education curriculum - for courses that will only be delivered and assessed via e-learning methods. (The current course types in tertiary institutions are: theory, practical and fieldwork).
c. Segmentation of theory-based course contents to allow for blended learning (e.g. 60% physical learning and 40% e-learning).
d. Use of virtual labs, simulators, alternative-to-practical, augmented reality (AR), virtual reality (VR) for delivery of practical-based courses.

Digital Economy Policy Initiatives to Support e-Learning

a. Prioritize provision of solid, service and soft infrastructure to Nigerian tertiary institutions in line with pillars 3, 4 and 6 of the current National Digital Economy Policy and Strategy (NDEPS) 2020 – 2030.
b. Promote digital literacy and skills for lecturers and students in Nigerian tertiary institutions through special capacity development programmes. this can be modelled as a continuous professional development programme and continuous learning programme for lecturers and students respectively. This aligns with pillar 2 of NDEPS 2020 – 2030.
c. Facilitate access to and use of new and emerging technologies for e-learning in tertiary institutions.
d. Subsidize cost of telecommunication services for tertiary institutions and surrounding environments to reduce barriers for e-learning.
e. Promote "Collocation" of telecommunication infrastructure to increase broadband penetration in locations with tertiary institutions.
f. Reduce (or eliminate) taxation and charges applicable in the provision of telecommunication services to tertiary institutions.
g. Drive transition from use of conventional power to use of renewal energy (e.g. solar, wind, biogas, etc) for powering key ICT infrastructure in tertiary institutions. This will enhance access to electricity to promote sustainable e-learning.
h. Encourage and promote strategic domestic and international partnerships aimed at providing ICT tools for lecturers and students at subsidized rates.
i. Introduction of specialized annual programs (such as Competitions, Technology Fairs and Expos) that will strengthen the linkages between government, academia and industry in technology enhanced learning.
j. Introduction of a ranking and reward system to recognize compliant and innovative tertiary institutions in the e-learning space.

Conclusion

There has been a paradigm shift in the teaching, learning and research methods used in Nigerian tertiary institutions. This transition was accelerated by the COVID-19 pandemic which exposed the limitations of traditional teaching methods. Digital education has become a new reality in the Nigerian education system. The integration of technology to learning will promote attainment of SDG 4: "*Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all*".

ICT tools, digital literacy, broadband and access to electricity are key determinants for use of ICT for teaching and learning. The technology-enhanced learning landscape in Nigerian tertiary institutions is currently marred by poor infrastructure, slow internet bandwidth, high internet access costs, digital literacy issues among others.

The developed conceptual framework for transition and sustainability of e-learning features key enablers (ICT facilities, Broadband Access and Digital Literacy) as well as sustainability components (Regulation & Policies, Curriculum Review). Cybersecurity is also essential to provide a safe cyberspace for lecturers and students. The implementation of this framework will help address the current limitations of e-learning and assure a reliable blended-learning regime in Nigerian tertiary institutions.

Recommendations

The recommendations are grouped per key stakeholder category and are enumerated as follows:

1. **Government**
   a. Increase budget allocation and public spending on education especially for provision of robust infrastructure.
   b. Drive policy formulation, implementation and enforcement to promote and sustain blended learning at all levels of education.
   c. Facilitate formulation of regulations to promote reduced taxation and charges for provision and access to telecommunication services in tertiary education locations.
   d. Sponsor R&D programmes for production of indigenous digital tools for e-learning.
   e. Promote and drive awareness on importance and benefits of blended learning.
   f. Drive implementation of the national cybersecurity policy.
2. **Tertiary Education Regulators**
   a. Fast track the update and introduction of new tertiary education curriculum which aligns with e-learning.
   b. Drive awareness on the National Policy on ICT in Education (2019) and OER Policy for Higher Education in Nigeria.
   c. The accreditation requirements for approval of new tertiary institutions should include existence of robust ICT infrastructure capable of supporting e-learning.

d. Strengthen and enforce the accreditation checklist for existing Nigerian tertiary institutions to contain components that ensures ICT compliance and support for e-learning (i.e. infrastructure, personnel and actual usage).
e. Promote and drive awareness on importance and benefits of blended learning.

3. Tertiary Institutions

a. Institute, implement and enforce a campus-wide ICT policy that supports e-learning.
b. Increase ICT budget allocation and expenditure.
c. Facilitate capacity building of current staff and students for improved digital literacy and skills.
d. Proficiency in ICT should be one of the eligibility criteria for admission of new students into Nigerian tertiary institutions.
e. Proficiency in ICT should be one of the eligibility criteria for employment of new lecturers by Nigerian tertiary institutions.
f. Prioritize ICT infrastructure when applying for grants and interventions.
g. Institute a reward scheme for ICT-compliant departments and faculties to promote adoption.
h. Promote access to OER for students and lecturers.
i. Seek external funding from developmental banks to provide key infrastructure aimed at accelerating transition to blended learning.
j. Promote and drive awareness on importance and benefits of blended learning.
k. Promotion of campus-wide cybersecurity policies and a strict compliance regime.

4. Lecturers and Students

a. Embrace and adoption of e-learning as part of tertiary education.
b. Conscious personal development in digital literacy and skills.

5. Telecommunications Industry

a. Development and sustainability of telecommunication infrastructure especially in locations with tertiary institutions.
b. Strengthen and sustain linkages with Academia via improved collaborations.
c. Improve access to technology and telecommunication services via provision of ICT tools, interventions, special plans for academia and quick transition to new & emerging technologies.
d. Effective Regulation of the telecommunication industry (consumer protection, consumer education, fair pricing, etc.).
e. Promotion and constant improvement of cybersecurity of ICT and telecommunications infrastructure.

1. Background and Introduction

1.1 Synopsis

The traditional method of teaching and learning which involves tutors and learners to be in the same physical location has for long been the predominant method of teaching and learning practiced in most Nigerian tertiary institutions. Today, there is an ongoing paradigm shift from the traditional methods to technology-enhanced learning (TEL); this transition was greatly stimulated by the COVID-19 pandemic.

The global outbreak of the Corona Virus Disease of 2019 (COVID-19) brought about a new way of life for humans all over the world. It totally changed our 'normal habits' and thus resulted in a 'new normal'.

The announcement of the first COVID-19 case in Lagos, Nigeria on the 27th of February 2020, accelerated the introduction and enforcement of COVID-19 prevention and safety measures in Nigeria. Some of these included: movement restrictions, travel restrictions, wearing of nose masks, social distancing, gathering limits, use of sanitizers, regular washing of hands etc.

Although these measures helped to control the spread of the virus, they however had an adverse effect on teaching, learning and research practices in all hierarchies of educational institutions in Nigeria because all schools were ordered by the government to shut down – this brought about an abrupt and almost complete halt to academic activities in tertiary institutions amongst others.

Only a few Nigerian tertiary institutions with teaching and learning reliability frameworks in the form of e-Learning infrastructure were able to continue academic activities online. This sudden switch from traditional to electronic learning was commendable but also had its set of challenges such as high cost of operation, lack of e-learning knowledge on the part of lecturer and students, difficulties in tracking student engagements, declining quality of learning experience, malpractice in student assessment, etc.

Tertiary institutions without any form of e-Learning infrastructure started seeking ways to bridge the teaching and learning gaps created by the COVID-19 pandemic; this resulted in a huge switch in learning, teaching and research

methods used by Nigerian tertiary institutions as well as an increased demand for ICT infrastructure toolkits to support the growing e-Learning needs.

The Nigerian Communications Commission (NCC) have in recent years sponsored the implementation of numerous programmes and plans aimed at ensuring provision of telecommunication and ICT services in Nigeria. Most of these implementations have been driven by the Commission's commitment to innovation and an informed decision-making process inspired by outcomes of research and development (R&D) activities.

This project focuses on "Teaching, Learning & Research in Nigeria's Tertiary Institution Post Pandemic/COVID"**.** The following sections highlights the aim and objectives as well as scope of work for the study.

1.2 Project Aim and Objectives

To develop a workable framework that will sustain innovative Research, Teaching and E-Learning platform in Nigerian Tertiary Institution that impacts academia but also addresses local socio-economic challenges post-COVID (2015 -2020).
This framework shall achieve the following:

a. Provide an insight into the impact of ICT in teaching and learning in Nigerian Tertiary Institution.
b. Understudy the benefits and challenges of ICT in teaching and learning Post-COVID for both lecturers and students.
c. Understudy Tertiary Institutions curriculum and align them with new teaching solutions for students post Pandemic/COVID.
d. Provide effective ways or guideline for monitoring students' engagement to make teaching and e-learning successful.
e. Recommend approaches for easy shift to new innovative teaching solutions for teaching professionals and students.

1.3 Project Scope

The scope of work covers the period of year 2015 to 2020. The study shall provide answers to and cover the following areas:

a. What necessary actions and policies should Nigerian Governments make on teaching and learning in Nigeria Tertiary Institutions post-COVID-19?
b. Types of engagements and actions by the Federal Ministry of Education, National Universities Commission, National Board for Technical Education, National Commission for Colleges of Education, International Organizations, Civil Society, Education professionals, as well as learners and Stakeholders at all levels during COVID-19 pandemic;
c. Efficient digital economy policies that would have long-term impact for the tertiary education in Nigeria;
d. Impact and role of Nigerian Telecommunications industry during and after the COVID-19 pandemic capable to supporting e-learning; and
e. Identify Open educational resources and open access digital tools available to teachers and students as well as recommend solutions on adoption and adaptation to the Nigerian education ecosystem.

2. COVID-19 Pandemic and Tertiary Education in Nigeria

2.1 Nigerian Tertiary Institutions

Nigerian tertiary institutions comprise of universities, polytechnics, colleges of education and specialized institutions regulated by different government agencies. As at 1st September 2022, there were 554 tertiary institutions in Nigeria (117 universities, 165 polytechnics, 229 colleges of education and 53 specialized tertiary institutes in Nigeria). The table below enumerates the number of Nigerian tertiary institutions, their corresponding regulators and the number of institutions.

Table 1: Tertiary Institutions in Nigeria

SN	Institution Category	Regulator	Number of Institutions
1.	Federal University	NUC	49
2.	State University	NUC	57
3.	Private University	NUC	11
4.	Federal Polytechnic	NBTE	40
5.	State Polytechnic	NBTE	49
6.	Private Polytechnic	NBTE	76
7.	College of Education	NCCE	219
8.	Specialized Institutions	Different Organizations	53
		Total	**554**

Source: NUC, NBTE, NCCE, Federal Ministry of Education, etc.

2.2 Major Fields of Discipline in Tertiary Education in Nigeria

The Benchmark Minimum Academic Standards (BMAS) published by the National Universities Commission (NUC) lists thirteen (13) major **fields of discipline** (faculties) in Nigerian tertiary institutions. These fields are:

a. Administration; Management and Management Technology.
b. Agriculture, Forestry, Fisheries and Home Economics.
c. Arts.
d. Basic Medical and Health Science.
e. Education.
f. Engineering and Technology.
g. Environmental Sciences.
h. Law.
i. Pharmaceutical Sciences.
j. Medicine and Dentistry.
k. Science (Natural, Applied, Physical, Biological)
l. Social Sciences.
m. Veterinary Medicine

Source: https://nuc.edu.ng/wp-content/uploads/2015/09/Education%20Draft%20BMAS.pdf

2.3 Teaching & Learning Methods in Nigerian Tertiary Institutions

There are four (4) popular teaching methods for tertiary commonly namely:

a. Teacher-centred method
b. Student-centred method
c. Content-focused method and
d. Interactive/participative method.

These teaching methods are adopted in Nigerian tertiary institutions; the following sections highlights how these methods apply.

a. Teacher-centred Method:

This is the commonest and most popular method of teaching; it is the **widely adopted and most used method of teaching in Nigerian tertiary institutions**. It typically involves the teacher being present in the classroom with his/her prepared note. As the lecture progresses, the students take notes as dictated by the lecturer; provisions are allowed for question sessions by the students and the lecturer can also ask any student he/she deems fit a question.

b. Learner-centred/Student-Centred Method:

In this method, the teacher serves as the facilitator and students are expected to perform most of the activities. Using this method, lecturers tend to find out the level of knowledge that the students have for their course. It is usually applied in scenarios where students are required to perform practical lessons, hands-on exercises, laboratory experiments or presentations.

c. Content-focused Method:

This method puts emphasis of what is being taught/learnt; the students and lecturers must conform to the content of the lecture. In this method, the content cannot be altered; they are usually sacrosanct. Examples include: lessons on scientific laws, engineering principles, linguistics, etc.

d. Interactive/Participative Method:

This method is a combination of the three methods enumerated above. In the interactive method, contributions are encouraged from learners based on the lecturer's assessment of the learning situation. Discussion sessions, excursions, open quizzes and group assignments are techniques typically used in this method of teaching.

Generally, the type of course, mode of learning and the prevalent teaching policies determines the teaching methods adopted for a tertiary institution.

2.4 COVID-19 Pandemic in Nigeria

According to the Nigeria Centre for Disease Control (NCDC), as at 9th September, 2022, there were 264,014 confirmed COVID-19 cases in Nigeria; 257,510 have been discharged, 3,356 cases are still active and 3,148 deaths have been recorded.

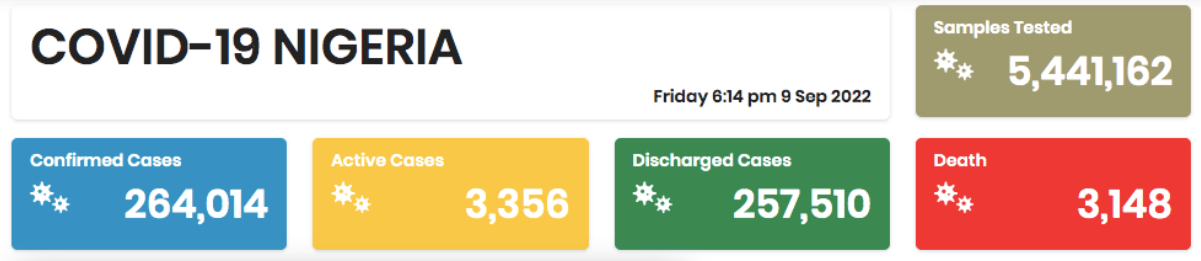

Figure 1: Statistics on COVID-19 Cases in Nigeria

Source: NCDC - https://covid19.ncdc.gov.ng/

A presidential task force on COVID-19 was setup by Mr. President to coordinate multi-sectoral inter-governmental efforts to contain the spread of the virus in Nigeria.

2.4.1 Timeline of COVID-19 in Nigeria

The figure below summarizes the timeline of COVID-19 in Nigeria especially as it affected the socio-economic activities.

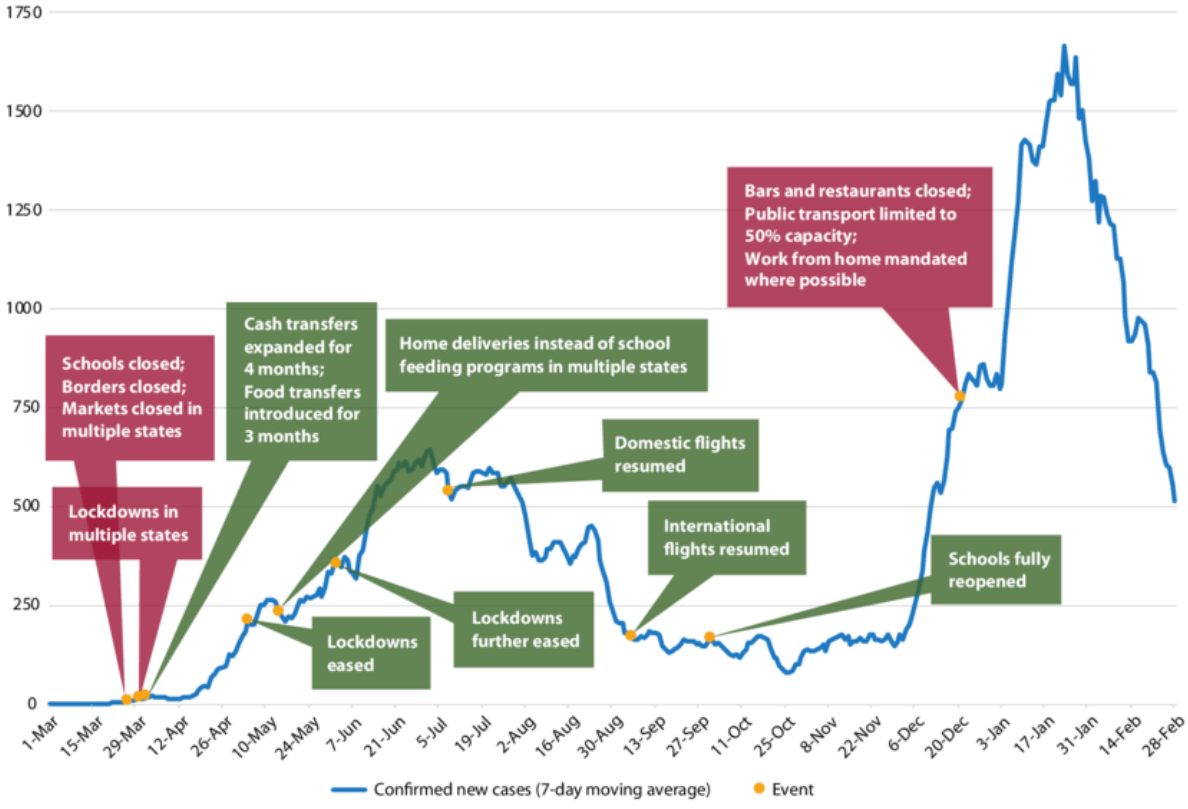

Figure 2: Timeline of COVID-19 in Nigeria

Source: COVID-19 Case Numbers from Dong, Du & Gardner (2020)

2.4.2 Impacts of COVID-19 on Tertiary Education & Research in Nigeria

The impacts of COVID-19 on tertiary education in Nigeria are enumerated below:

a. Disruption of academic activities for six (6) months across tertiary institutions from March 2020 to September 2020.
b. Restricted physical movements and travels.
c. Necessary but hasty transition to e-Learning across many tertiary institutions.
d. Steep learning curve for students and lecturers on use of e-Learning tools.
e. Spike in data subscription due to surge in virtual learning.
f. Reduced social interaction between students and lecturers due to COVID-19 safety protocols such as use of face masks, observation of social distance and human gathering limits of 50 persons.
g. Herculean tracking and assessment of students due to the virtual nature of learning adopted.
h. Cessation of all research activities requiring laboratory work, physical interaction and field survey.

2.5 Transition to Blended Learning

2.5.1 Blended Learning

Technology-Enhanced Learning (TEL) or e-Learning is the application of digital technologies to teaching and learning. TEL leverages technology to extend the frontiers of traditional teaching and learning methods by breaking its barriers and limitations. Blended learning is achieved through the fusion of traditional learning and e-Learning; both methods have their unique advantages as shown below.

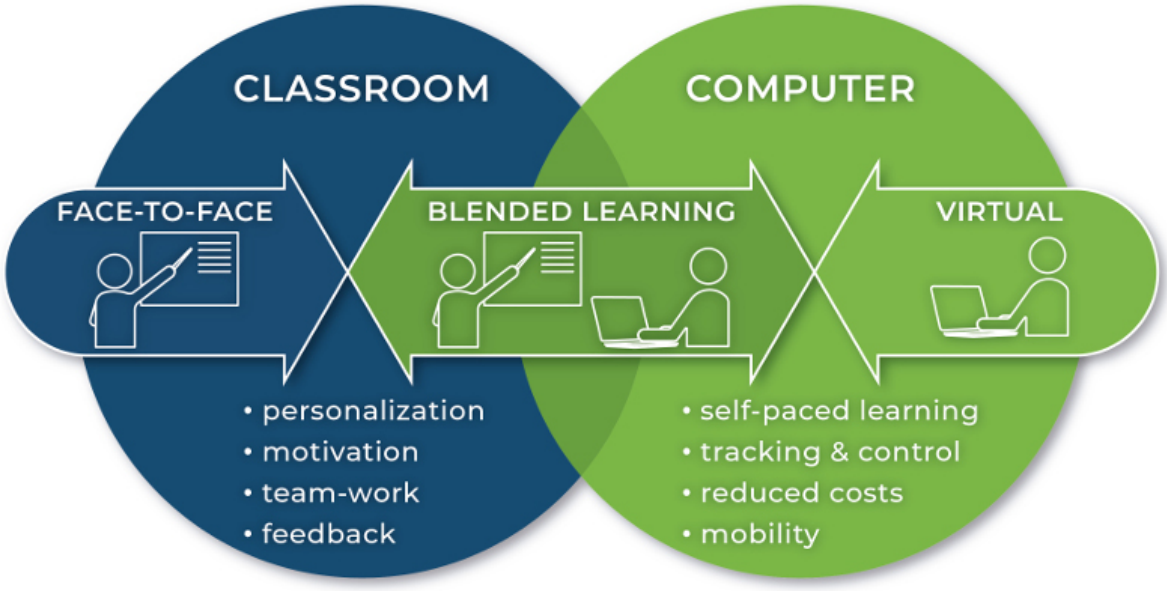

Figure 3: Blended Learning Model
Source: MIT Centre - https://mit-center.eu/en/study/blended_learning

Using blended learning, institutions can derive benefits from the traditional and electronic teaching and learning techniques.

F. Okocha (2016) revealed that performance expectancy, effort expectancy, social influence, facilitating conditions and gender influence are key determinants for adoption of blended learning in tertiary institutions.

Israel Regha (2017) noted that: "*Poor power supply, inadequate skilled manpower, poor internet connectivity and corruption by government officials are among the identified challenges of adopting blended learning into the Nigerian educational sector*".

2.5.2 Nigeria's Journey to Blended Learning

Following the spread of the virus and its abrupt disruption of educational activities in the country (and globally), the regulators, institutions and developmental agencies in the Nigerian tertiary education space saw the need for transition to digital education. At that time (year 2020), no one knew how long the pandemic was going to last and cease its crippling effects on socio-economic activities in Nigeria.

A good number of public tertiary institutions struggled to transition to virtual learning due to several reasons: lack of adequate and requisite infrastructure to support e-learning, shortage of digital skills, slow internet speeds, problem of erratic power supply, etc. A few of the institutions improvised by using communication and collaboration tools such as Microsoft Teams, Zoom, Google Meet, Telegram and WhatsApp for online lessons.

Upon easing of the lockdown and resumption of schools across the country in October 2020, there was a wide awakening across tertiary institutions and tertiary education regulators on the need for blended learning by review of tertiary education curriculum. A. T. Agbele and E.A. Oyelade (2020), noted that: "*The catastrophe posed by coronavirus on education in Nigerian has revealed to us the benefits of online/virtual teaching*".

In April 2021, Dr. Dimitri Sanga, officer in charge of the Abuja regional of UNESCO, charged that "*COVID-19 is a wake-up call for Nigeria to innovate*"

The figure below shows the flow adopted by most Nigerian tertiary institutions for transition to blended learning.

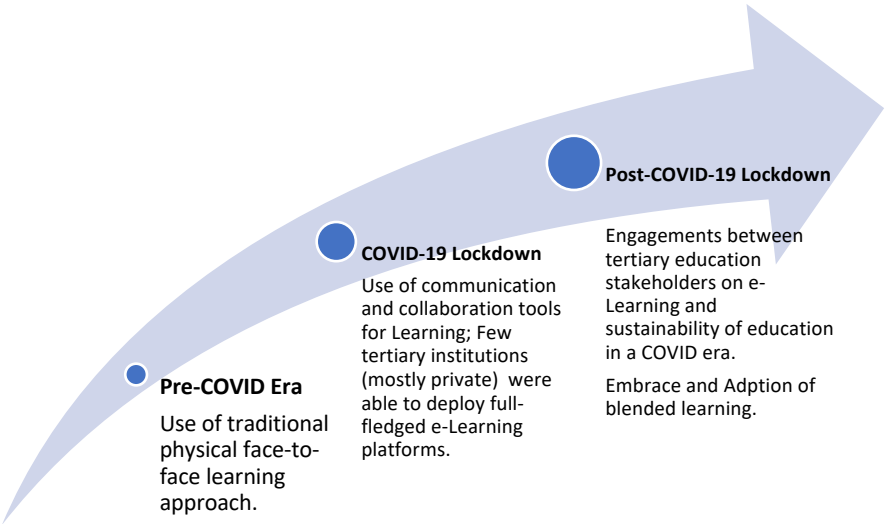

Figure 4: Transition Journey to Blended Learning by Most Nigerian Tertiary Institutions

3. Preliminary Findings and Analysis from Field Survey Exercise

3.1 Synopsis on Approach and Methodology

A Combination of methods were used for project implementation. These are:

a. **Review of Reference Documentations and Reports** related to the research study. Examples include:
   1. Learning in a Pandemic: Nigeria's response to teaching and learning during the COVID-19 pandemic; published by The Education Partnership (TEP) Centre, Nigeria & The Nigeria Economic Submit Group (NESG)- 2020
   2. Coordinated COVID-19 Response Strategy 2020; published by the Federal Ministry of Education.
   3. Nigeria National Education Policy (Revised edition - 2014); published by the Federal Ministry of Education.
   4. National Policy on ICT in Education (2019); published by the Federal Ministry of Education.
   5. OER Policy for Higher Education in Nigeria; published by NUC.
   6. National Minimum Standards and Establishment of Institutions Act 2018.
   7. Benchmark for Minimum Academic Standards (BMAS); published by the National Universities Commission (NUC)
   8. Nigeria Certificate in Education - Minimum Standards for General Education (Revised edition - 2020)
   9. Nigeria Education Sector COVID-19 Response Strategy 2020; published by the North East Education in Emergencies Working Group (EiEWG).
   10. Several published articles, papers and reports on the subject matters.

b. **Quantitative Field Survey, Data Collection and Analysis** of students, lecturers and researchers in Nigerian Tertiary institutions across the 36 states of the Federation and FCT using the **stratified sampling technique**. This was done to gather primary data from the field for the research study; **all categories of tertiary institutions were sampled and at least one tertiary institution was sampled per state in Nigeria**. The Yamane's formula for sample size computation was used to determine the minimum sample size for the study

$$n = \frac{\mathbf{N}}{\mathbf{1} + \mathbf{N}(e)^2}$$

Where:

n = minimum Sample Size

N = Total Population

e = Precision Level for defined Confidence level (95%)

The National Universities Commission (NUC) in January 2022, revealed that "*Nigeria currently has only 100,000 academic staff members teaching and supervising about 2.1 million students in universities across the country*".

This sets the minimum target population size as 2,200,000; substituting into the formula gives the following:

$$\boldsymbol{minimum\ \ Sample\ Size}, \boldsymbol{n} = \frac{\mathbf{2,200,000}}{\mathbf{1 + 2,200,000(0.01)^2}} = \mathbf{9,954}$$

This served as minimum sample size for the quantitative survey. 160 respondents (i.e. 110 students & 50 lecturers) were selected per institution nationwide. Computer-Aided Personal Interview (CAPI) software tool was used for scripting and coding the survey questions which was delivered via the Mobile Data Collection (MDC) method.

Qualitative Survey, Data Collection and Analysis was also done to validate and complement findings from the quantitative analysis. Key stakeholders in the Nigerian tertiary education space were engaged and interviewed to obtain data across different viewpoints on the research study. Some interviewees include:

1. Directorate of Open Distance and e-Learning (DoDEL) at the National Universities Commission (NUC).
2. Directorate of Special Projects (DSP) at National Universities Commission (NUC).
3. National Commission for Colleges of Education (NCCE).
4. Tertiary Education Division (Universities, Polytechnics and College of Education Departments) at the Federal Ministry of Education.
5. Research and Development Department at TETFund.
6. Projects Department, Nigerian Communications Commission (NCC).
7. R&D Department, Nigerian Communications Commission (NCC).
8. Digital Bridge Institute (DBI).
9. Librarians' Registration council of Nigeria (LRCN).
10. Teachers Registration Council of Nigeria (TRCN).
11. Directors of Centre for Distance and E-Learning in Nigerian tertiary institutions
12. Heads of Management Information system (MIS) and ICT Departments in Nigerian tertiary institutions.
13. Administrators in Nigerian tertiary institutions.
14. Africa Centre of Excellence on Technology-Enhanced Learning (ACETEL) at the National Open University of Nigeria (NOUN).
15. Tertiary Education Trust Fund (TETFund).

c. **Study of Nigerian Tertiary Institution Curriculum** in the revised copies of minimum academic standards for universities, polytechnics and colleges of education in Nigeria.

d. **Review of Open Education Resource (OER) and e-Learning Tools** popularly used by Nigerian tertiary institutions.

3.2 Findings from Quantitative Field Survey

A total of 12,235 respondents across 74 tertiary institutions were sampled across the 36 states of the federation and FCT. All categories of Nigerian tertiary institutions were sampled; at least one tertiary institution was sampled per state.

70% of respondents were students (300 level and above) while 30% of respondents were lecturers, researchers and administrators. The following sections highlight the preliminary findings from the quantitative field survey exercise.

3.2.1 Respondent Categories and Distribution

Table 1: Respondent Categories and Distribution

Institution	Number of Institutions	Students Sampled	Lecturers & Administrators Sampled	Total Sampled	Frequency (%)
Federal University	18	2,241	979	3,220	26.32
State University	14	1,634	712	2,346	19.17
Private University	12	1,389	625	2,014	16.46
Polytechnic	12	1,401	561	1,962	16.04
College of Education	12	1,362	523	1,885	15.41
Specialized Institutions	6	575	233	808	6.60
Total	**74**	**8,602**	**3,633**	**12,235**	**100.00**

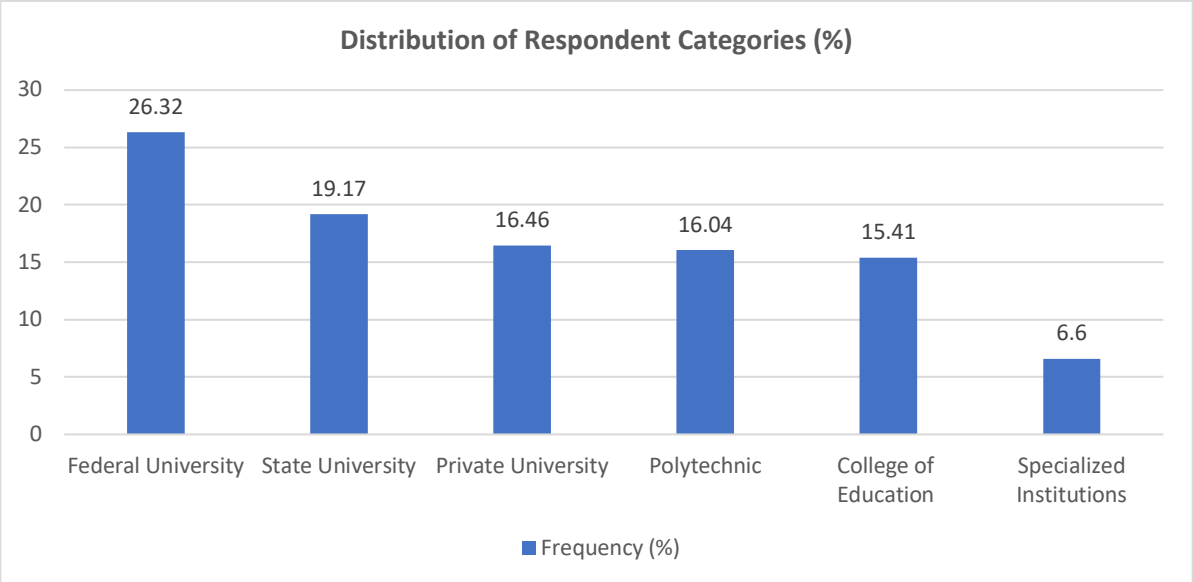

Figure 5: Respondent Distribution by Institution Type

3.2.2 Geographic Coverage

The figure below shows the geographic location of respondents sampled.

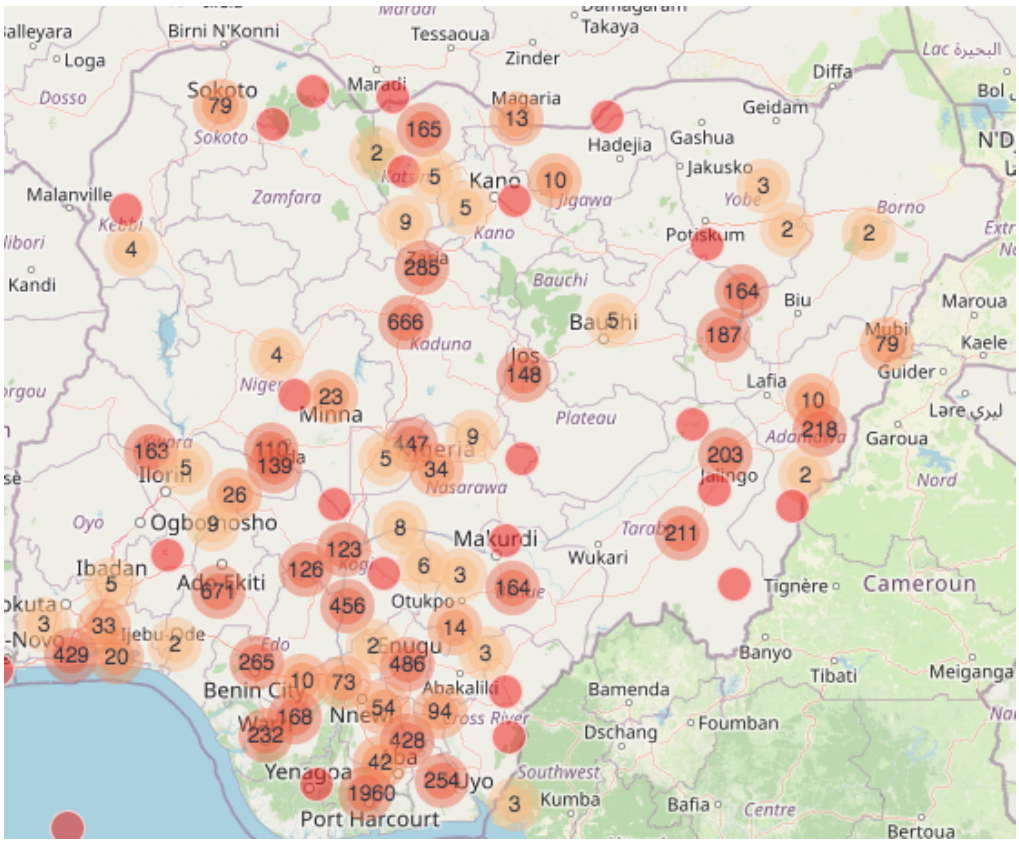

Figure 6: Geographic Location of Respondents
Source: Backend of CAPI Data Collection Software

3.2.3 Demographic and Socioeconomic Attributes of Respondents

3.2.3.1 Gender Distribution

Table 2: Gender Distribution by Institution Type

Gender	Institution Type						Total (%)
	Federal University (%)	State University (%)	Private University (%)	Polytechnic (%)	College of Education (%)	Specialized Institutions (%)	
Male	14.34	10.13	8.65	9.35	8.42	4.04	**54.92**
Female	11.97	9.05	7.81	6.69	6.99	2.57	**45.08**
Total (%)	**26.32**	**19.17**	**16.46**	**16.04**	**15.41**	**6.60**	**100.00**

Table 3: Gender Distribution for Students and Lecturers

Gender	Students (%)	Lecturers & Administrators (%)
Male	53.44	58.44
Female	46.56	41.56
Total (%)	**100.00**	**100.00**

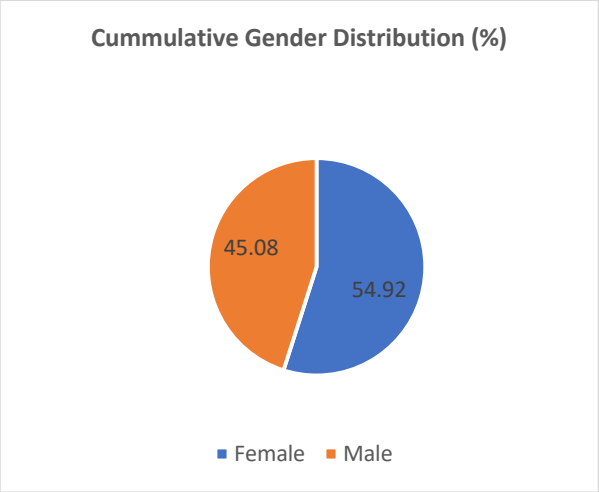

Figure 7: Cumulative Gender Distribution

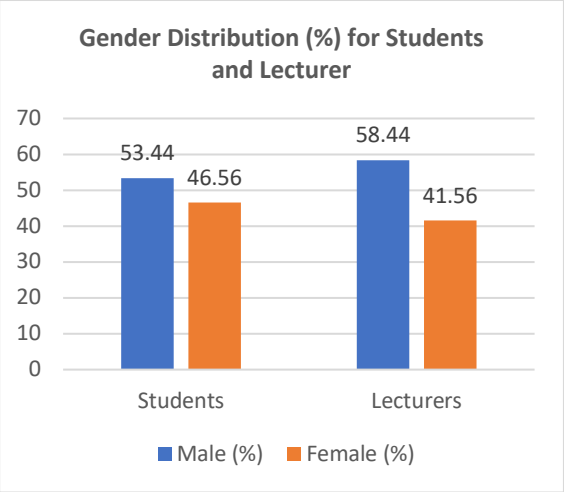

Figure 8: Gender Distribution for Students and Lecturers

3.2.3.2 Age Distribution

Table 4: Age Distribution

Age Bracket (Years)	Frequency (%)
Below 18	0.51
18 - 20	15.15
21 - 25	38.91
26 - 30	17.59
31 -35	5.73
36 - 40	5.93
41 - 45	6.02
46 - 50	6.68
51 - 55	3.05
56 - 60	1.08
61 - 65	0.31
Above 65	0.05
Total	**100.00**

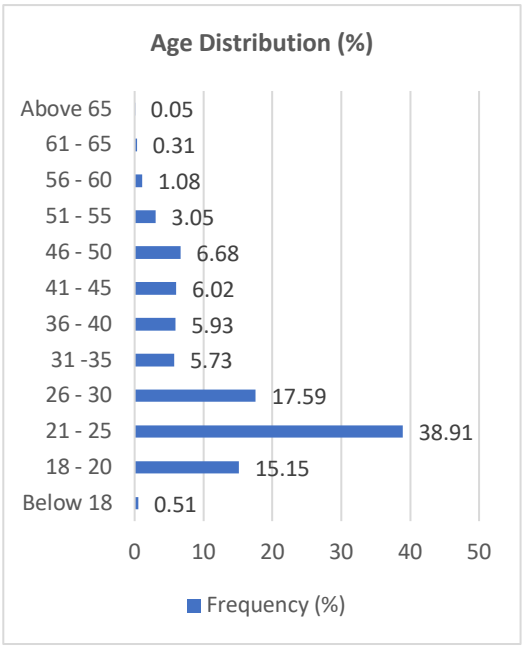

Figure 9: Age Distribution

3.2.3.3 Year of Study (Students)

Table 5: Year of Study

Level of Study	Frequency (%)
300 Level	66.12
400 Level	28.70
500 Level	4.28
above 500 Level	0.90
Total	**100.00**

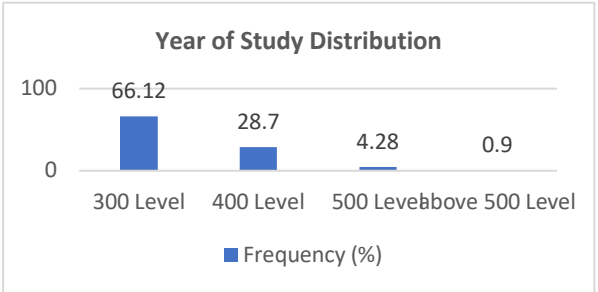

Figure 10: Year of Study distribution

3.2.3.4 Length of Academic Service (Lecturers and Administrators)

Table 6: Length of Service

Length of Service (Years)	Frequency (%)
Less than 5	30.14
6 – 10	33.55
11 – 15	19.68
16 – 20	10.05
21 – 25	4.27
26 – 30	1.68
Total	**100.00**

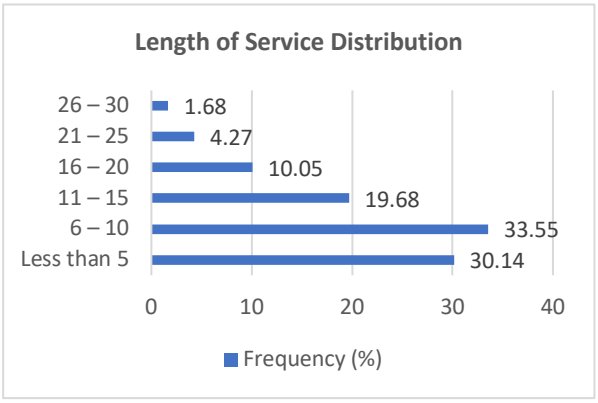

Figure 11: Year of Study Distribution

3.2.3.5 Highest Qualification (Lecturers and Administrators)

Table 7: Highest Qualification

Qualification Type	Frequency (%)
HND	16.85
Bachelors	10.49
Masters	38.89
PgD	6.00
PhD	27.77
HND	16.85
Total	**100.00**

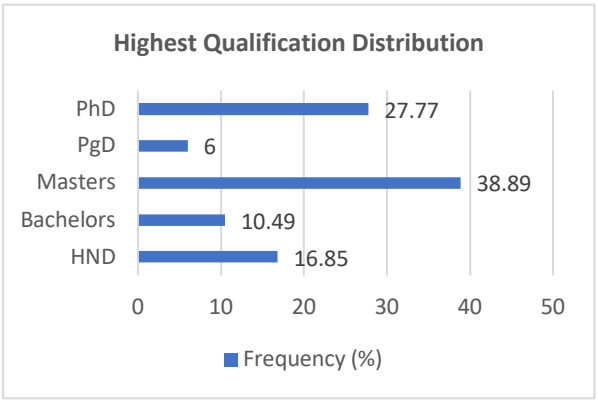

Figure 12: Highest Qualification Distribution

About 67% of lecturers and administrators have Masters and PhD as their highest qualification.

3.2.3.5 Marital Status (Lecturers and Administrators)

Table 8: Marital Status Distribution

Marital Status	Frequency (%)
Single (Never Married)	70.77
Married (Monogamous)	26.25
Married (Polygamous)	2.03
Separated	0.51
Divorced	0.30
Informal/Loose Union	0.14
Total	**100.00**

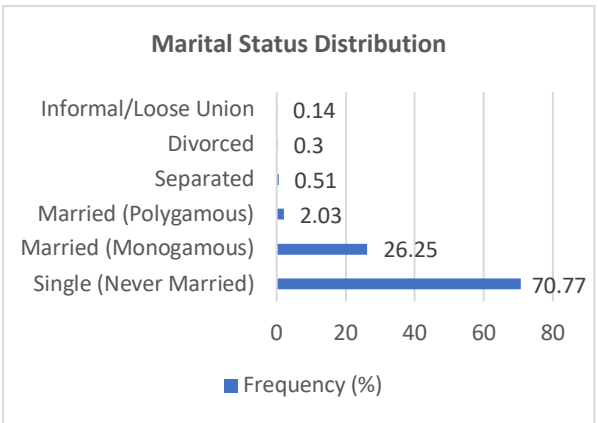

Figure 13: Year of study distribution

3.2.3.6 Monthly Stipend (Students)

Table 9: Students Monthly Stipend

Monthly Stipend	Frequency (%)
below N10,000	5.45
N10,000 – N19,999	19.62
N20,000 – N29,999	35.07
N30,000 – N39,999	17.77
N40,000 – N49,999	10.49
N50,000 – N59,999	4.32
N60,000 – N69,999	3.72
N70,000 – N79,999	2.33
N80,000 – N89,999	0.93
N90,000 – N99,999	0.06
N100,000 and above	0.23
Total	**100.00**

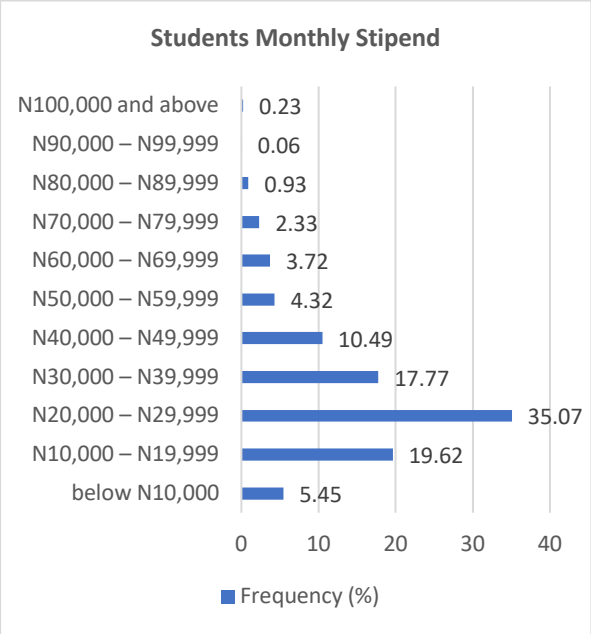

Figure 14: Student Monthly Stipend Distribution

60% of student get below thirty thousand Naira (N30,000.00) monthly as their stipend.

3.2.3.7 Monthly Salary (Lecturers and Administrators)

Table 10: Lecturers' Monthly Salary

Monthly Stipend	Frequency (%)
below N100,000	27.72
N100,000 – N199,999	32.78
N200,000 – N299,999	23.92
N300,000 – N399,999	10.82
N400,000 – N499,999	3.22
N500,000 – N599,999	1.40
N600,000 and above	0.14
Total	**100.00**

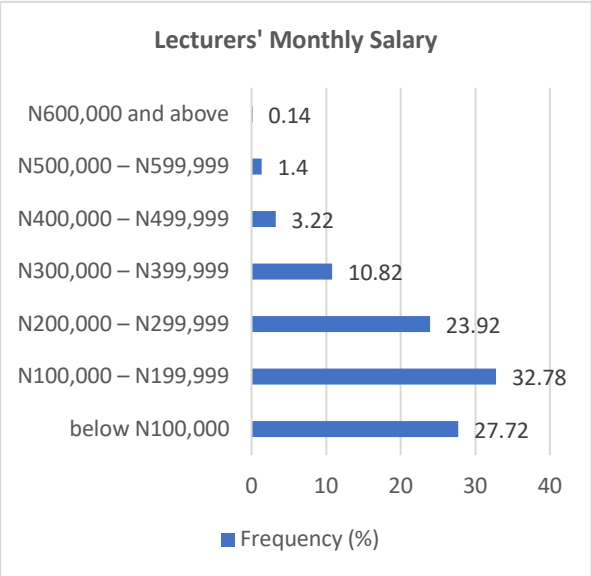

Figure 15: Student Monthly Stipend Distribution

84% of lecturers earn below N300,000.00 monthly as salary; the average monthly salary for lecturers is about N183,000.00

3.2.3.8 Fields of Discipline

Table 11: Fields of Discipline Distribution

Area of Discipline	Frequency (%)
Administration; Management and Management Technology	7.66
Agriculture, Forestry, Fisheries and Home Economics	8.21
Arts	8.21
Basic Medical and Health Science	3.72
Education	18.76
Engineering and Technology	10.76
Environmental Sciences	5.21
Law	4.45
Medicine and Dentistry	2.16
MIS/ICT Unit	1.81
Pharmaceutical Sciences	2.21
Science (Natural, Applied, Physical, Biological)	10.49
Social Sciences	9.08
Veterinary Medicine	0.84
Others	6.43
Total	**100.00**

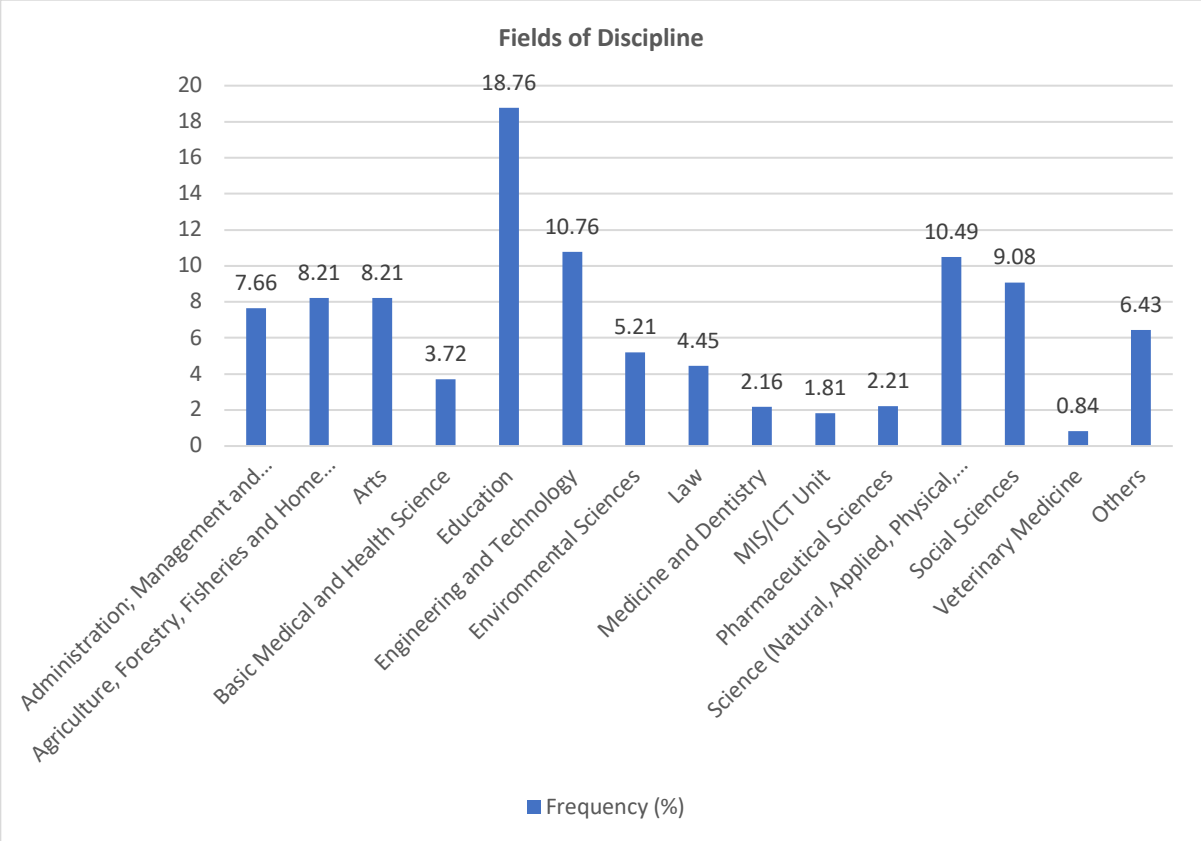

Figure 16: Fields of Discipline Distribution

3.2.4 Ownership of Basic ICT Assets, Access to ICT & Digital Literacy Level

Analysis of ownership of basic ICT assets, access to ICT and digital literacy levels is shown below.

Table 12:Ownership pf Basic ICT Assets, Access to ICT and Digital Literacy Level

	Student		Lecturers & Administrators		Cumulative Average	
QUESTION	YES	NO	YES	NO	YES	NO
Do you have access to power supply from an electricity distribution company?	97.35	2.65	98.43	1.57	97.67	2.33
Do you have access to backup or alternative power supply?	78.54	21.46	92.54	7.46	82.70	17.30
Do you own a personal computer (Desktop or Laptop)?	79.83	20.17	91.11	8.89	83.18	16.82
Do you have access to a computer connected to the internet?	87.60	12.40	95.98	4.02	90.09	9.91
Do you own a smartphone or tablet?	98.87	1.13	99.64	0.36	99.10	0.90
Do you know how to use a computer?	93.97	6.03	98.21	1.79	95.23	4.77
Can you use the internet?	99.22	0.78	99.72	0.28	99.37	0.63
Do you access the internet with your phone?	99.13	0.87	99.64	0.36	99.28	0.72
Do you have an email address?	99.21	0.79	99.48	0.52	99.29	0.71
Do you currently (teach or learn) any of your courses online?	63.59	36.41	60.91	39.09	62.80	37.20
Does your school have a campus-wide internet network?	78.47	21.53	79.30	20.70	78.72	21.28
Does your institution have ICT labs and computer centres?	97.44	2.56	97.83	2.17	97.56	2.44
Has your institution enforced any e-Learning policy?	67.48	32.52	63.69	36.31	66.36	33.64

Over 90% of students and lecturers are connected to the national electricity grid, can use the internet, can use a computer, have access to a computer connected to the internet and own a smartphone. 83% of respondents own a desktop computer or laptop. Only 63% of respondents affirmed to take part in e-learning for teaching and learning; 79% of respondents attested to having a campus-wide network within their tertiary institution.

3.2.5 Timeline of Ownership of ICT Assets, Access to ICT & Digital Literacy

Table 13: Timeline of ownership of Ownership of ICT Assets, Access to ICT and Digital Literacy

	Before COVID		During COVID		After COVID		Never	
Question	Students	Lecturers & Admins	Students	Lecturers & Admins	Students	Lecturers & Admins	Student	Lecturers & Admins
From what time have you owned a personal computer?	64.60	83.32	8.63	4.46	9.22	6.30	17.55	5.92
From what time have you owned a Smartphone?	94.27	98.35	3.95	1.32	1.28	0.14	0.50	0.19
From what time have you had access to a computer connected to the internet?	73.98	84.83	7.73	4.87	7.79	6.17	10.50	4.13
When did you known/learn how to use the internet?	86.67	90.06	6.52	3.94	5.72	5.39	1.09	0.61
When did you start personal e-Learning activities online?	50.43	57.83	21.63	17.04	10.95	8.59	16.98	16.54
When did you start taking (teach, learn) academic courses online?	47.63	50.76	20.36	13.96	7.95	7.87	24.06	27.42

Over 85% of respondents knew how to use the internet before COVID-19 with at least 73% of respondents having access to the internet and over 94% owning a smartphone before the pandemic. About 65% of students and 83% of lecturers owned a laptop before COVID; about 18% of students do not own a laptop. Only 50% of student and lecturers commenced e-learning activities online before the pandemic. 24% of students and 27% of lecturers have never engaged in online e-learning activities.

Table 14: Timeline of availability of ICT facilities & e-learning policies in Nigerian Tertiary Institutions

Question	Before COVID	During COVID	After COVID	Never	Total
When was the campus-wide internet network in your school launched?	73.89	6.40	3.76	15.95	100.00
When were the ICT labs and computer centres in your school launched?	88.30	4.65	5.38	1.68	100.00
When did your institution enforce its e-Learning policy?	42.60	16.51	10.63	30.26	100.00

Most institutions had campus wide network and ICT labs before the COVID-19 pandemic, about 16% of respondents affirmed that their institution have never had a campus-wide network. 30% of respondents revealed that e-Learning policy is yet to be enforced in their institution.

3.2.6 Impact of COVID-19 on Educational Activities

Question: *Did Teaching, Learning and Research come to a complete halt in your institution during the COVID era due to the various COVID restrictions*?

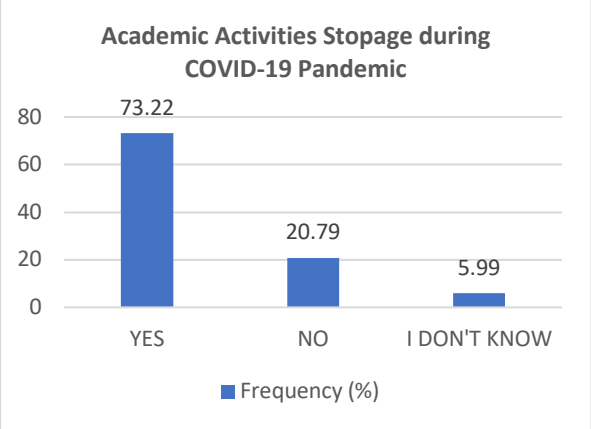

Figure 17: Impact of COVID-19 on Halt of academic activities

73% of respondents affirmed that COVID-19 brought academic activities to a complete halt in their tertiary institution.

3.2.7 Major Facilitators in Provision of ICT Infrastructure to Tertiary Institutions

***Question**: Who are the major facilitators in the provision of ICT infrastructure to your institution in the last 3 to 5 years?*

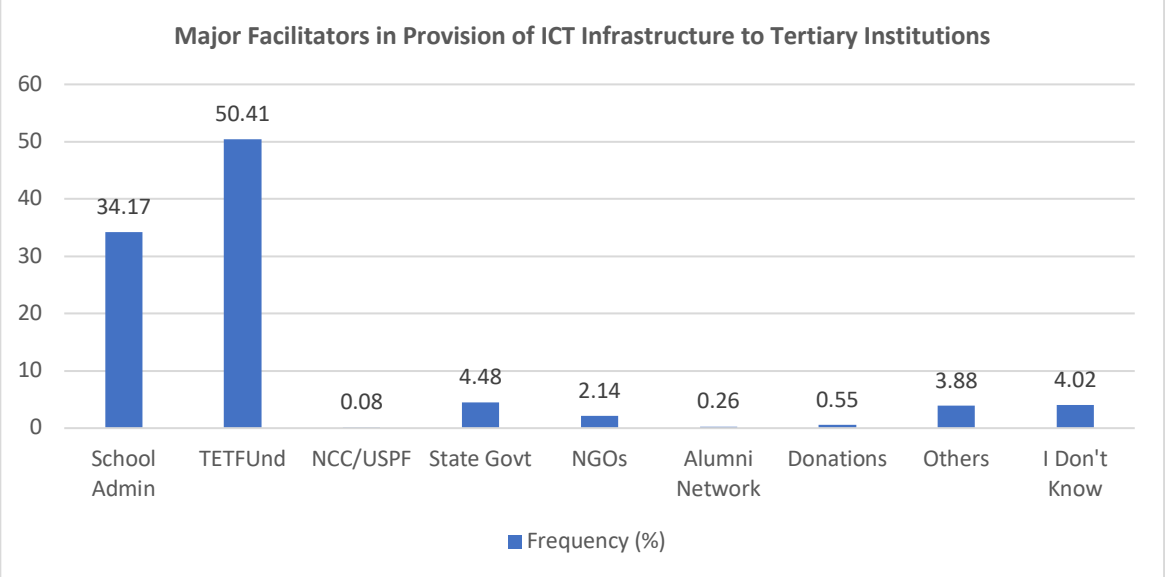

Figure 18: Major facilitators for provision of ICT infrastructure to tertiary institutions

In the last 3 to 5 years, TETFund and Administration of Tertiary institutions have been the major facilitators in the provision of ICT infrastructure to Nigeria Tertiary Institutions.

3.2.8 Use of ICT for Teaching, Learning and Research

3.2.8.1 Use of ICT Assets

Table 15: Use of ICT Assets for Teaching, Learning and Research

ICT Assets	Frequently		Sometimes		Never	
	Students	Lecturers & Admins	Students	Lecturers & Admins	Students	Lecturers & Admins
Desktop Computer, Laptop	53.38	57.42	37.67	40.05	8.95	2.53
Projectors	16.71	20.48	59.02	65.26	24.27	14.26
Interactive Whiteboards	24.78	27.11	41.03	49.55	34.19	23.34
Learning Management System (LMS)	21.20	21.28	44.34	43.57	34.46	35.15
Internet	70.41	69.09	28.16	30.44	1.43	0.47
Meeting & Video Conferencing Tools (e.g. Zoom, Teams, etc.)	21.91	28.74	55.50	58.49	22.59	12.77

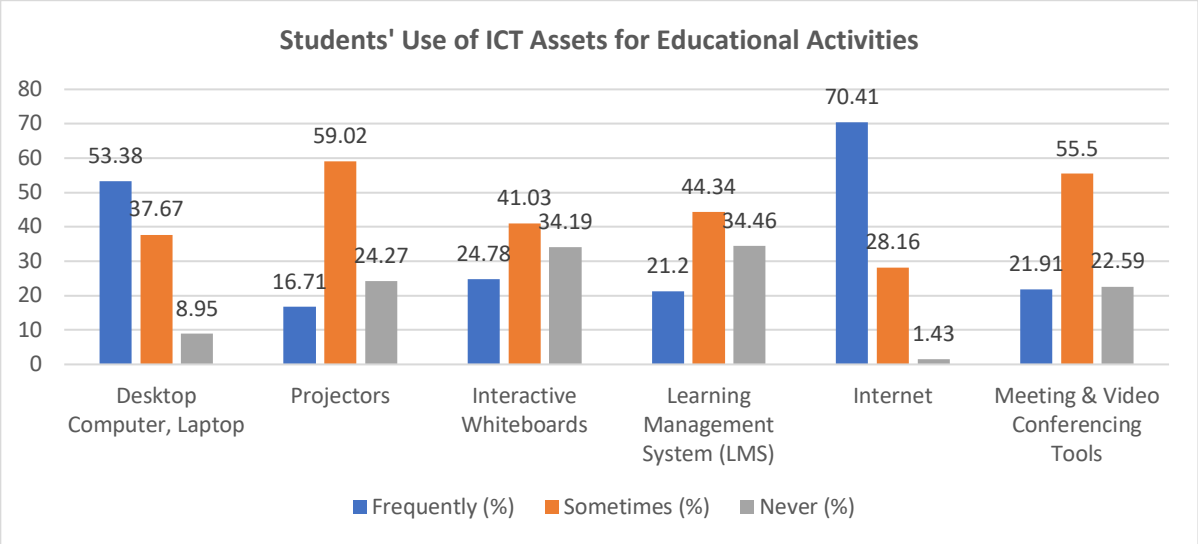

Figure 19: Students' Use of ICT Assets for Educational Activities

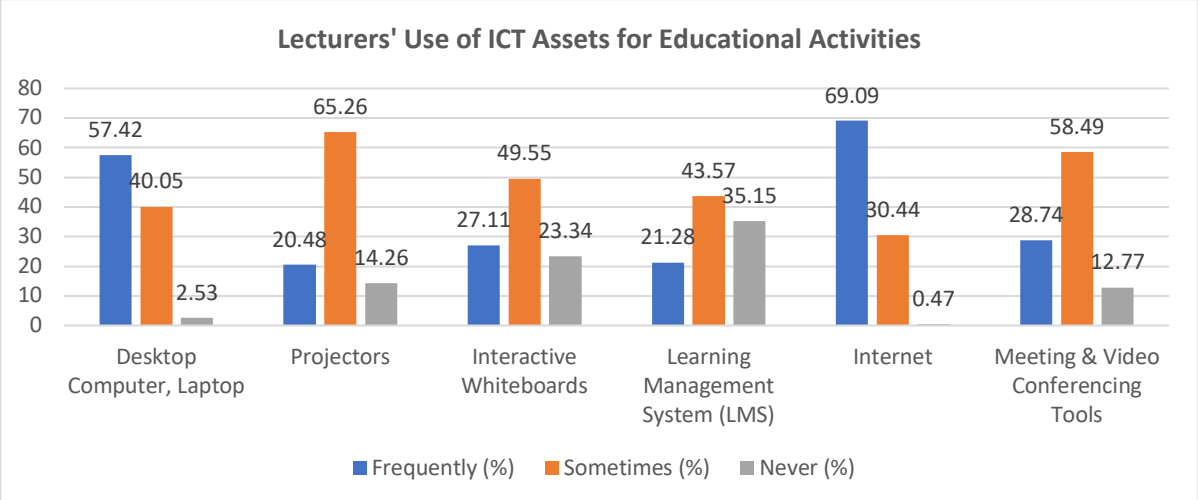

Figure 20: Lecturers' Use of ICT Assets for Educational Activities

At least 53% of students and teachers frequently use desktop, computers and laptops for academic purposes and about 70% frequently use the internet for same purpose. The internet is the most frequently used ICT asset for educational purposes. No fewer than 44% of respondents sometimes use LMS, interactive whiteboards and virtual meeting tools for teaching, learning and research purposes.

3.2.8.2 Monthly Bandwidth Consumption

Table 16: Monthly Bandwidth Consumption

Bandwidth (GB)	Students	Lecturers & Admins
None	1.03	1.02
below 5	19.59	10.13
6 - 10	20.37	25.98
11 - 15	21.31	21.28
16 - 20	19.70	20.59
21 - 25	11.61	12.41
26 - 30	3.08	4.38
Above 30	3.30	4.21
Total	**100.00**	**100.00**

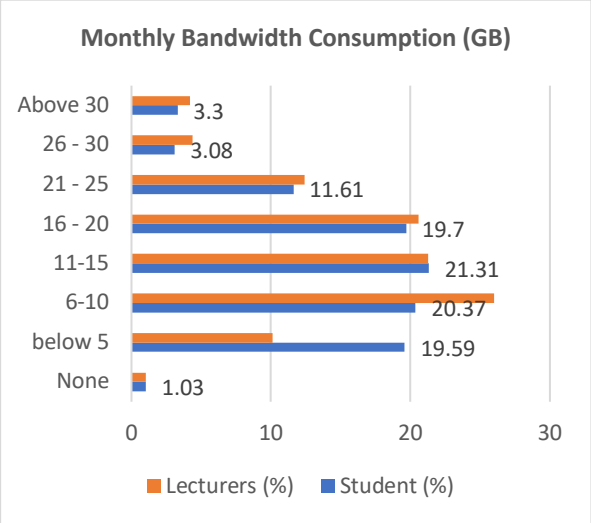

Figure 21: Monthly Bandwidth Consumption

About 80% of students and lecturers consume between 1GB to 20GB of data monthly. 21% of students use between 11GB – 15GB of data monthly representing the highest frequency for students while 26% of lecturers use between 6GB – 10GB monthly - representing the highest frequency for lecturers & administrators.

3.2.8.3 Monthly Expense on Data

Table 17: Monthly Expenditure on Data

Amount	Students	Lecturers & Admins
Zero	0.95	0.91
Below N5,000	49.01	33.61
N5,000 - N9,999	34.77	44.32
N10,000 - N14,999	10.88	14.48
N15,000 - N19,999	3.42	4.46
N20,000 - N24,999	0.71	1.57
N25,000 & Above	0.26	0.66
Total	**100.00**	**100.00**

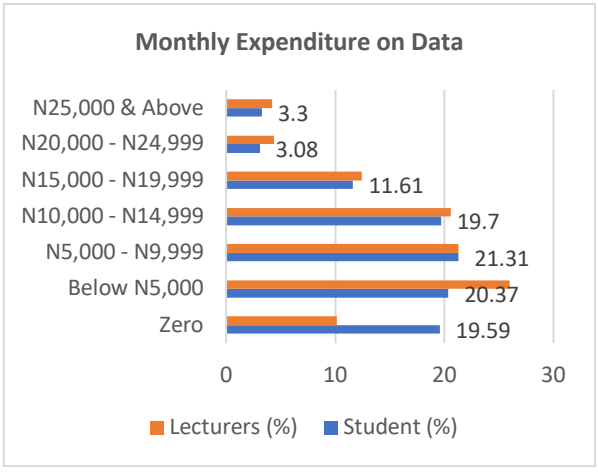

Figure 22: Monthly Expenditure on Data

About 80% of students and lecturers spend below N10,000 monthly for data subscription.

3.2.8.4 Timeline for Most Use of Internet for Academic Activities

Table 18: Time for most use of Internet for Academics

Timeline	Students	Lecturers & Admins
Never	10.36	10.02
Before COVID	24.89	27.31
During COVID	45.66	43.44
Post-COVID	19.09	19.24
Total	**100.00**	**100.00**

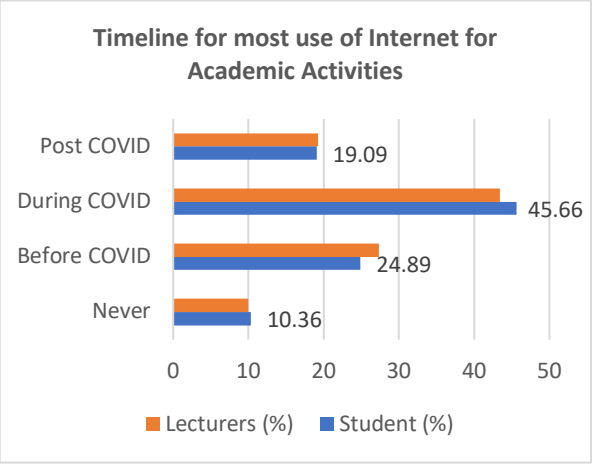

Figure 23: Timeline for most use of internet for academic activities.

Students and lecturers spent more time online for academic activities during COVID-19.

3.2.8.5 Use of OER and e-Learning Systems

Table 19: Use of OER and e-Learning System by Nigerian Tertiary institutions

OER and e-Learning Systems	Frequency (%)
None	36.13
Google Classroom	33.87
Microsoft Team Suite	4.21
Moodle	5.03
Canvas LMS	0.19
EdModo	1.65
Blackboard Learn (7) Talent LMS	0.16
Other (indigenous)	1.05
Others (Custom built)	2.50
Others (Foreign)	14.36
Others (off the Shelf)	0.85
Total	100.00

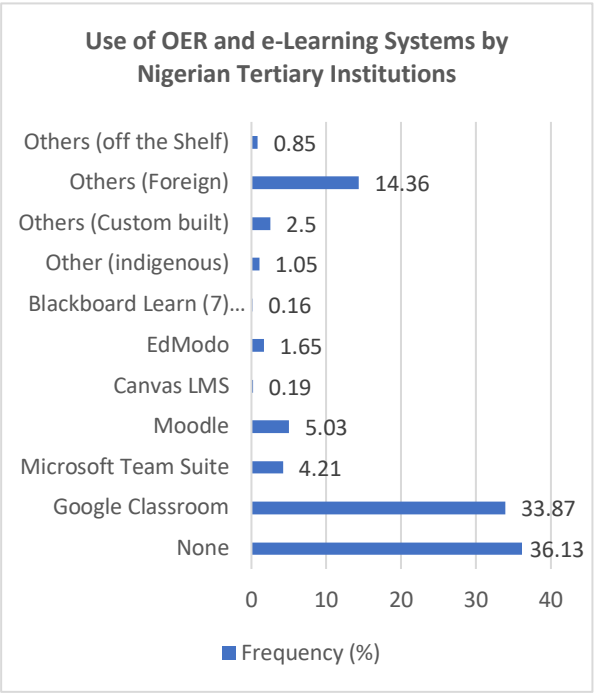

Figure 24: Use of OER & e-Learning Systems

36% of respondents confirmed that there is no usage of OER or e-learning systems in their institution. Google Classroom, Moodle and other foreign LMS solutions are commonly used by institutions practicing e-learning.

3.2.8.6 Effectiveness of e-Learning Systems

Table 20: Level of Effectiveness of Tertiary Institution's e-Learning Systems

Question	Highly Effective	Effective	Undecided	Ineffective	Highly Ineffective	Not Applicable	Total
How effective has your institutions e-Learning/LMS solution being for teaching, learning and research?	8.43	43.62	15.96	12.70	2.15	17.14	100.00
How effective has your institutions e-Learning/LMS policy being for adoption of teaching, learning and research?	7.05	44.71	16.39	12.44	2.24	17.18	100.00

Less than 45% of respondents rated the level of effectiveness of their institution's e-learning/LMS solutions and adoption policy as being just "Effective".

3.2.9 Limitations of Deployed e-learning Systems

Table 21: Limitations of Deployed e-learning Systems

Limitations	Frequency (%)
Not user friendly	4.17
Not Flexible or Customizable	10.57
Not Robust enough	13.95
Course Management related Issues	13.05
Assessment related issues	11.14
Student activity tracking related issues	9.65
Issues with integration and interoperability	9.51
Security related issues	5.76
Others	22.20
Total	100.00

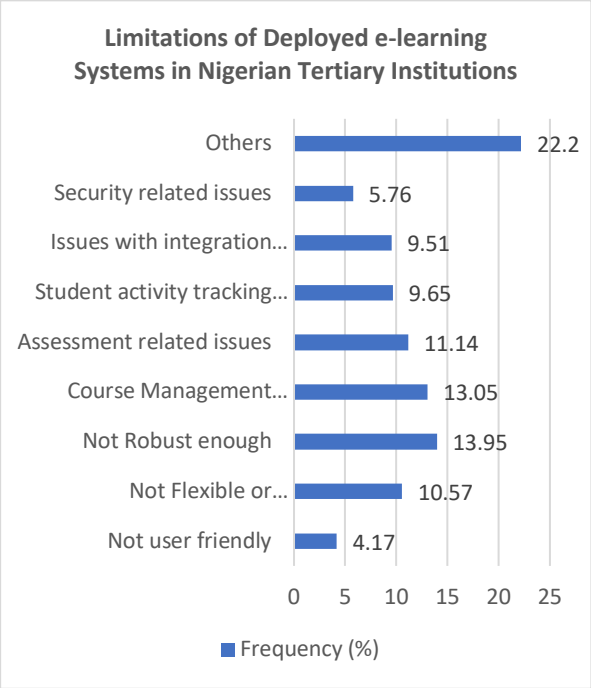

Figure 25: Limitations of Deployed e-Learning System

Robustness limitations, course management and assessment related issues amongst others are the top three (3) limitations of use and adoption of deployed e-learning systems in Nigerian tertiary institutions.

3.2.10Barriers to Use and Adoption of e-learning Systems

Table 22: Barriers to Use and Adoption of e-learning Systems

Barriers/Challenges	Frequency (%)
None	9.65
Lack of e-Learning Knowledge	9.49
Power Supply Issues	11.84
Slow Internet Bandwidth	13.50
Internet subscription Cost	11.64
Lack of Technical and Managerial Support	9.81
Lack of Computing Device	5.93
Resistance to Change	5.81
Lack of publicly accessible ICT centres/labs	3.47
Security related issues	4.37
Privacy related issues	2.30
Issues with integration and interoperability	2.01
Others	10.18
Total	100.00

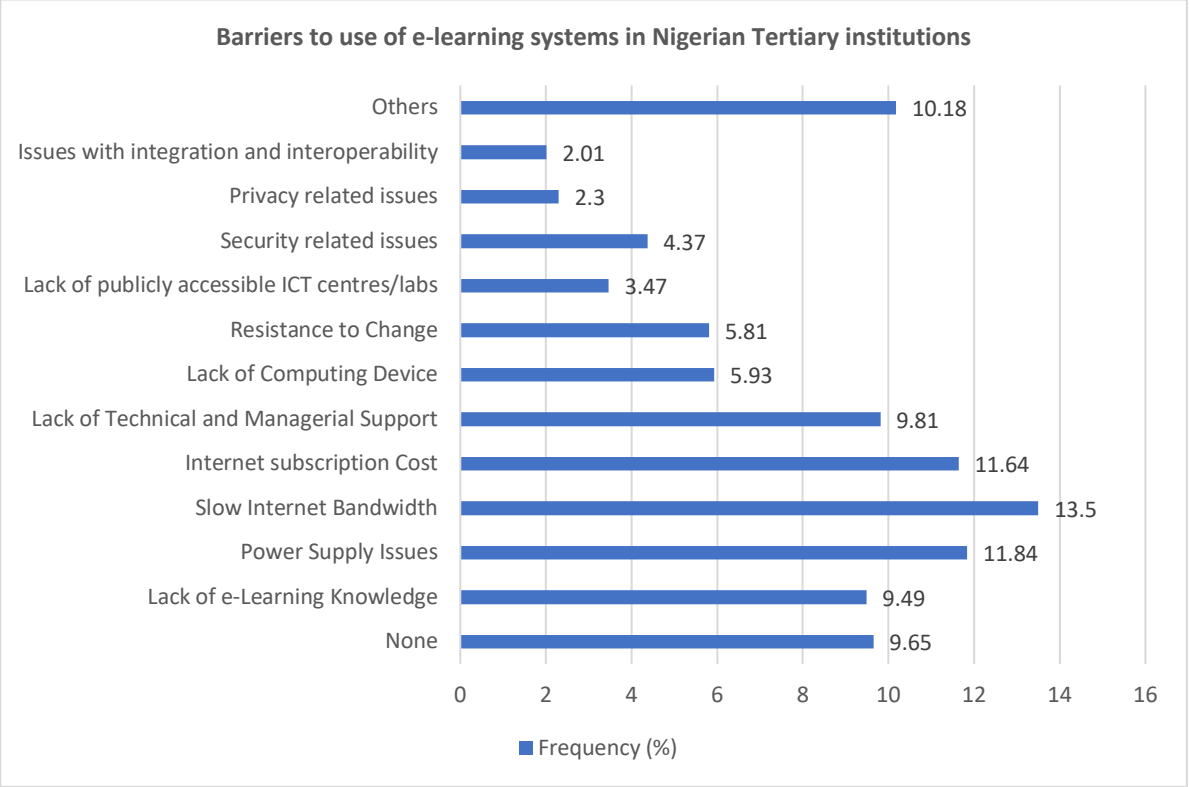

Figure 26: Barriers to use of e-learning systems in Nigerian Tertiary institutions

Slow internet bandwidth, power supply issues, internet subscription cost, lack of technical and managerial support and lack of e-learning knowledge are the top 5 barriers/challenges to use and adoption of e-learning systems in Nigerian tertiary institutions.

3.2.11 Effects of ICT on Teaching, Learning and Research

Table 23: Effects of ICT on Teaching, Learning and Research in Nigerian Tertiary Institutions

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
Digital literacy has improved among the student's population since COVID era.	43.60	41.05	11.88	2.10	1.37	100.00
Digital literacy has improved among the lecturer's population since COVID era.	38.58	40.54	16.45	2.72	1.71	100.00
Use of the internet for academic activities such as searching for academic research materials and publications of research works have increased since the COVID era.	42.27	42.09	11.72	2.31	1.60	100.00
Use of the internet for other non-academic activities such as social media, payment, commerce, News, entertainment has increased since the COVID era.	57.44	34.68	5.08	1.44	1.36	100.00
Use of ICT tools has improved teaching and learning experience.	38.97	45.78	11.67	1.92	1.66	100.00

About 80% of respondents agreed or strongly agreed that ICT has improved student and lecturer digital literacy level, increased use of internet for academic and non-academic activities and improved the overall teaching and learning experience in Nigerian tertiary institutions.

3.2.12 Components of Curriculum that require Update to allow for E-Learning

During the field survey exercise, the following components of the current tertiary education curriculum were identified to require updates that will allow for seamless e-learning.

a. Practical and laboratory courses and topics.
b. Volume of coursework.
c. Student Assessment and examination model.
d. Course timetable design and structure.

3.3 Findings from Qualitative Field Survey

3.3.1 Findings from Interview and Engagement Session with NUC

Table 24: Feedback from Interview and Engagement Session with NUC

SN	Discussion & Question Area	Response/Feedback
1.	Initiatives and Policies put in place during the COVID era to ensure sustainable teaching and learning in tertiary institutions.	a. *"The NUC came up with an e-Learning policy aimed at engineering the use of ICT in teaching and learning by encouraging universities to leverage on learning management systems such as Zoom, Google Classroom, etc."* b. *"The NUC and NOUN provided the Virtual institute for capacity building in Higher Education as an implementation of the 2019 – 2023 blueprint on rapid revitalization of university education in Nigeria. The platform regularly trains lecturers, VCs, NUC staff and other regulators using ODL (Open and Distance Learning)."* c. *"NUC selected NOUN in the competition selection process of the World Bank funded Africa Centre of Excellence on Technology-Enhanced Learning (ACETEL)."*
2.	Frameworks being developed or currently implemented to ensure that the curriculum of tertiary institutions are aligned to meet up with new teaching solutions for students.	*a. "There is a new Core Curriculum Academic Standards (CCMAS) that is to replace the Benchmark Minimum Academic Standards (BMAS) currently in use that integrates elements of e-Learning into the curriculum of the university system."* *b. ACETEL's Open and Distance Learning framework resulted in increase in the NUC approved ODL centers in Nigeria to 14*
3.	Collaborations with key players in the Telecommunications industry to achieve and implement SN 2 above successfully.	*a. "The establishment of Nigerian Research and Education Network (NgREN) was done in partnership with Airtel Nigeria."* *NgREN is a specialized ISP for the research and education community in Nigeria. It is a broadband multi-protocol label switch (MPLS) network providing an elaborate infrastructure backbone to connect universities and other REN (Research & Education Network) worldwide. NgREN also provides LMS and other learning application software to meet these needs.*

4.	Recommendations to improve overall teaching and learning experience in tertiary institutions post-COVID	a. "*By implementing the Blended mode of learning that incorporates elements of e-Learning to enrich the teaching and learning experience. This should be achieved by leveraging on electronic platforms such as LMS and social media platforms to create academic communities for the purposes of collaboration.*" b. "*Universities should ensure that they have elaborate ICT strategic plan which should detail their ICT infrastructure needs*." c. "*NUC should establish a benchmark for ICT deployment in universities.*" *d. "Sensitization and trainings should be organized for university management and staff to encourage them to embrace ICT use in teaching."* *e. "Telecom providers should subsidize charges/fees for product and services to universities".* *f. "Universities should take advantage of NgREN."*

3.3.2 Findings from Interview and Engagement Session with NCCE

Table 25: Feedback from Interview and Engagement Session with NCCE

SN	Discussion & Question Area	Response/Feedback
1.	Initiatives and Policies put in place during the COVID-era to ensure sustainable teaching and learning in tertiary institutions.	a. *"International partnerships on software development and Training the Trainer (TTT) Exercise."* b. *"Last edition of minimum academic standards for Colleges of Education was 2020 (revised)".*
2.	Frameworks being developed or currently implemented to ensure that the curriculum of tertiary institutions are aligned to meet up with new teaching solutions for students.	a. *"A study was conducted on 'Instrument for monitoring of e-Learning Facilities/ was conducted by NCCE in November 2021. Findings from this survey is being considered in management's decision-making process".*
3.	Collaborations with key players in the Telecommunications industry to achieve and implement SN 2 above successfully.	a. *"None for now."*
4.	Recommendations to improve overall teaching and learning experience in tertiary institutions post-COVID	a. *"Policy development to ensure and enforce that institutions meet up with IT infrastructure and internet connectivity requirements before accreditation and commissioning".* b. *IT infrastructure development across colleges of education nationwide.* c. *Access and availability of bandwidth.* d. *Need for improvement in digital literacy levels.*

3.3.3 Findings from Interview and Engagement Session with Ministry of Education

Table 26: Feedback from Interview and Engagement Session with Ministry of Education

SN	Discussion & Question Area	Response/Feedback
1.	Initiatives and Policies put in place during the COVID-era to ensure sustainable teaching and learning in tertiary institutions.	*a. Development and implementation of a coordinated COVID-19 response strategy for the education sector.* *b. Conducted a nationwide study on 'LEARNING IN A PANDEMIC: Nigeria's response to teaching and learning during the COVID-19 pandemic' in collaboration with The Education Partnership (TEP).*
2.	Frameworks being developed or currently implemented to ensure that the curriculum of tertiary institutions are aligned to meet up with new teaching solutions for students.	*"There is an advocacy for the development of a stand-alone policy on open and distance learning (ODL)".*
3.	Collaborations with key players in the Telecommunications industry to achieve and implement SN 2 above successfully.	*"Not sure but there may be eventually".*
4.	Recommendations to improve overall teaching and learning experience in tertiary institutions post-COVID.	*"More lecturers should be taken online to limit overcrowding and congestion. Lecturers/Notes could be digitized. Open and Distance Learning; e-learning should be adopted and fully embraced by all tertiary institutions".*

3.3.4 Findings from Interview and Engagement Session with TETFund

Table 27: Feedback from Interview and Engagement Session with TETFund

SN	Discussion & Question Area	Response/Feedback
1.	Initiatives and Policies put in place during the COVID-era to ensure sustainable teaching and learning in tertiary institutions.	*"From 2016 till date, TETFund has annually provided ICT Support intervention to different tertiary institutions. This intervention covers: (a) Development of e-learning platform and* (b) *e-Learning Support Training"*
2.	Frameworks being developed or currently implemented to ensure that the curriculum of tertiary institutions are aligned to meet up with new teaching solutions for students.	*"For beneficiary institutions, we ensure that their e-learning platform supports best practices and international standards for e-learning system such as support for REST API for integration support, very secure and complies with the Nigerian Data Protection Regulations as issued by NITDA*".
3.	Collaborations with key players in the Telecommunications industry to achieve and implement SN 2 above successfully.	"T*here is collaboration with Nigerian tertiary institutions, NUC, NBTE, NCCE and Ministry of Education".*
4.	Recommendations to improve overall teaching and learning experience in tertiary institutions post-COVID.	"*Visionary leadership on the part of the tertiary institutions is very paramount for transition to e-learning. The right policies, enablers and incentives have to be put in place to encourage e-learning in our tertiary institutions*"

3.3.5 Collated Responses/Feedback from Interview and Engagement Sessions with Administrators in Nigerian Tertiary Institutions.

The following section summarizes the feedback and responses obtained from Administrators (Heads of Departments, Deans of Faculties, Heads of MIS/ICT unit, Directors of Centres of Distance Learning).

a. **Impact of ICT and Telecommunications in Teaching, Learning and Research Activities in Tertiary Institutions**:
    1. ICT and Telecommunications has enhanced learning and research in most federal universities that have campus wide network with subsidized internet for student and staff.
    2. Institutions in remote rural areas with poor network coverage struggle with internet access and adoption of ICT for teaching, learning and research.

b. **Effects of COVID-19 in the Academic ecosystem in Nigerian Tertiary Institutions**:
    1. Realization of importance of use ICT in education.
    2. Increase in allocation and spending on ICT tools within tertiary institutions.
    3. Paradigm shift in knowledge delivery through adoption & use of e-learning.
    4. Embrace of ICT tools for teaching, learning and research.
    5. Increase in digital skill necessitated by transition to blended learning.

c. **Availability and Accessibility of ICT infrastructure for Teaching, Learning and Research in Nigerian Tertiary Institutions since 2015**:
    1. Availability of adequate infrastructure has been a major challenge for access and use of ICT infrastructure for teaching, learning and research.
    2. Access to stable electricity is a major problem in many tertiary institutions. The erratic power supply results in high operating costs (power generators, diesel etc.) of running ICT infrastructure.
    3. Access to steady, reliable and fast internet affects the user experience and time spent online for teaching, learning and research activities.

d. **Rate of Adoption of Use of ICT for Teaching and Learning in Nigerian Tertiary Institutions:**
    1. Increase in adoption of ICT for teaching and learning; this increase was catalysed by COVID-19. The rate of adoption in private tertiary institutions is greater than those of public tertiary institutions.
    2. Top adopters of ICT for teaching and learning in the following order: private universities, federal universities, state universities, polytechnics and colleges of education.

e. **Benefits of ICT to Nigerian Tertiary Institutions due to COVID-19 Effects:**
    1. Delivery of lectures online synchronously and asynchronously in spite of COVID-19.
    2. IT Capacity development of lecturers and management staff.
    3. Increase in digital skills of lecturers and students for e-Learning purposes.

f. **Alignment of Curriculum to Meet up with new teaching solutions for Students:**

Use of ICT for teaching and learning has rendered a good part of the current curriculum obsolete; hence the need for revamp of the curriculum. NUC has commenced work in this regard. Regulators of polytechnics and colleges of education are also working on updating their curriculum to allow for e-Learning methods of teaching, learning and assessment.

g. **Presence of e-Learning and OER Policies in Nigerian Tertiary Institutions:**

Most universities and some polytechnics have e-learning strategy and policies in place; just a few of the sampled colleges of education have such policies. These policies were either revised or created following the COVID-19 pandemic.

h. **Enforcement of e-Learning Policies in Nigerian Tertiary Institutions:**

Enforcement of the developed policies is quite low due to the following reasons:

1. Lack of adequate infrastructure for e-Learning to drive compliance
2. Resistance to change on the part of lecturers and students.
3. Aspects of the curriculum that must be delivered through traditional learning means such as: engineering workshop sessions, practical classes, laboratory works, etc.
4. Absence of a reliable mechanism to track compliance and participation in e-learning activities.

i. **e-Learning and OER Toolkits Available in Nigerian Tertiary Institutions:**

Google Classroom is the most used OER toolkit used by Nigerian universities and polytechnics. Others include Moodle, Microsoft Teams, Edmodo. A few universities have developed customized e-Learning. A huge number of the colleges of education in Nigeria do not have e-Learning and OER toolkits, largely because of ICT infrastructural deficiencies in these institutions.

j. **Strengths and Weaknesses of the OER Toolkits being Used:**

The **strengths** of OER toolkits being used include:

1. Ease of use.
2. Support for accessibility from multiple devices (laptop, desktop, tablet, mobile phones).
3. Effective communication and content sharing between lecturers and students.
4. Support for feedback and comments.
5. Ability to record lectures for future replays.
6. Use file types: PowerPoint, Word, PDF, Excel, Images etc.
7. Ability to enable and/or disable videos for student attendance spot checks.

The **weaknesses** of the OER toolkits include:

1. Difficulty in customization to meet institutions' specific learning needs.
2. Tracking of student engagement is difficult due to the virtual nature of learning.
3. Assessment modules rely majorly on multi-choice questions; there is limited support for theory questions.
4. User account management complexities, especially with roles and permissions management.

k. **Challenges with Use of ICT for Teaching, Learning and Research:**

1. Unstable power supply.
2. Insufficient data for internet connectivity.
3. Slow internet speeds.
4. Resistance to change.

l. **Recommendations for Improving Teaching and Learning Experience in Tertiary Institutions Post-COVID:**

1. Provision of adequate ICT infrastructure to support blended learning.
2. Provision of stable power supply because electricity is a determinant for use of ICT tools.
3. Need to boost internet bandwidth and speeds within tertiary institutions.
4. Continuous capacity development for lecturers in use of ICT for teaching.
5. Creation of awareness within the academic community on the use of ICT in knowledge delivery.
6. Government, private sector and NGO interventions in provision of ICT tools to lecturers and students at subsidized rates.

3.4 Initiatives & Intervention by NCC on Teaching, Learning and Research

Between 2015 and 2020, the Nigerian Communications Commission (NCC) has implemented several initiatives aimed at promoting the quality of tertiary education through the regulation of the Nigerian telecommunication industry; the provision of efficient telecommunication services is vital for e-learning to thrive in Nigeria. The following sections highlights key tertiary education supporting initiatives championed by NCC.

Figure 27: Interventions and Initiatives for Advancement of Tertiary Education

3.4.1 Facilitation of Broadband Penetration

Access to broadband is an important enabler for digital education as well as reduction of digital divide. Broadband penetration in Nigeria rose from 6% in 2015 to 45.02% in 2020. As at July 2022, broadband penetration in Nigeria stood at 44.49% and total internet subscribers were 152 million. The slight decline from 2020 to 2022 was due to vandalism of telecommunication infrastructure.

Techeconomy (2022) noted that "*The Nigerian Communications Commission (NCC) said over 50,000 cases of major destruction to telecom infrastructure and facilities have been reported across the country in the past five years, raising an*

alarm over the implication of these incidents to the quality of telecommunications services." The figure below shows broadband penetration trend in Nigeria.

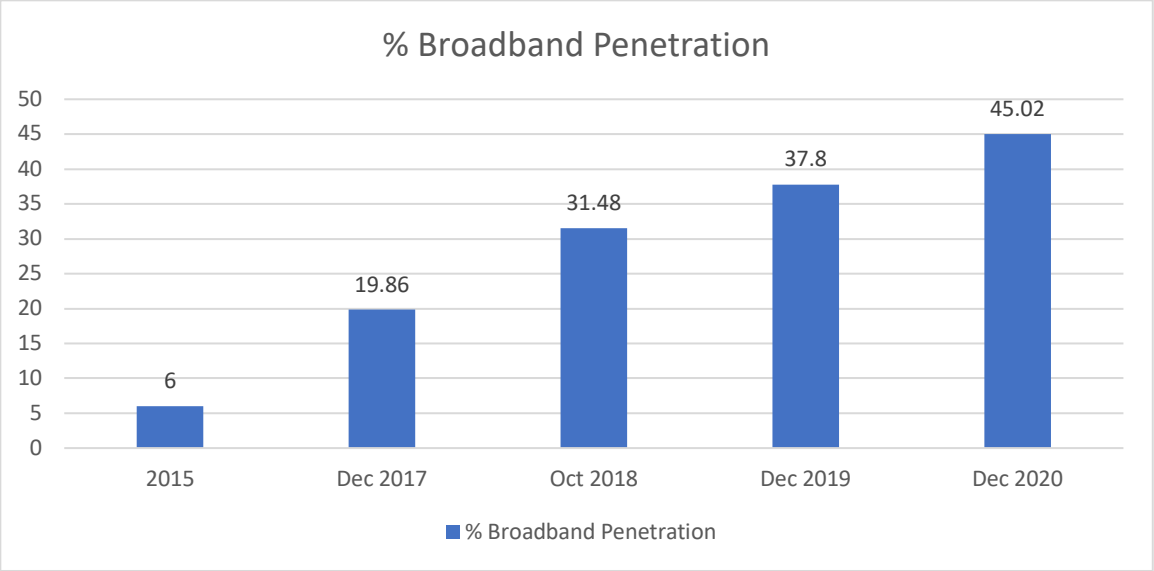

Figure 28: Percentage Broadband Penetration 2015 – 2020.
Data Source: NCC

In 2016, a World Bank study concluded that: "*a 10-percentage point increase in fixed broadband penetration would increase GDP growth by 1.21% in developed economies and 1.38% in developing ones".*

3.4.2 Advanced Digital Awareness Programme for Tertiary Institutions (ADAPTI)

ADAPTI is one of the most effective school support programmes for Nigerian tertiary institutions and was introduced by the NCC in 2008. The programme is aimed at bridging the digital gaps that exists in academia; NCC achieves this by providing ICT equipment (such as tablets, computers, printers, scanners etc to tertiary institutions), e-learning applications and capacity building for academics and students across the country. These tools enhance the utilization of ICT in teaching, research and learning. Since its inception, the over 300 tertiary institutions have been beneficiaries of the program.

In July 2022, the President/CEO of Digital Bridge Institute (DBI), Prof. Mohammed Ajiya, revealed that "*over 100,000 participants have been empowered through NCC's ADAPTI programme*".

3.4.3 Wireless Cloud

This is another initiative by NCC to support teaching, learning and research in Nigerian tertiary institutions by supporting campus-wide wireless access to the internet. Under this programme, NCC provides backbones infrastructure (such as

masts, antenna, network devices and one-year supply of bandwidth with maintenance) for wireless internet access. This programme has been implemented across several institutions across the six (6) geopolitical zone and FCT.

The deployment of wireless cloud has facilitated teaching, learning and research in Nigerian tertiary institutions; it also paved the way for the establishment of the Nigerian Research and Education Network (NgREN) by NUC.

3.4.4 Digital Bridge Institute (DBI)

DBI was established by NCC in May 2004 with a vision for the institute to be a Centre of Excellence for ICT innovation and capacity building. It is the training arm of NCC. The establishment of DBI has helped reduce the digital divide by improving digital capacity of tertiary institution workforce in Nigeria.

In July 2022, Mr. Chukwuemeka Nzeih, Manager – Professional Programmes (Learning and Development Group) at DBI, revealed that over 80,000 staff of tertiary institutions have been trained on digital literacy for productivity in teaching, learning and research.

3.4.5 Promotion of Innovation in the EdTech Space

During the COVID-19 lockdown, NCC organized a virtual hackathon for development of innovative and cutting-edge solutions to address socio-economic challenges caused by the pandemic. The hackathon featured five (5) categories: Community, Education, Health, Productivity and Transport.

Under the education sector, 86 solution proposal majorly on e-Learning were submitted to the Commission for review and consideration; an indication of the NCC's inspired innovation in the Nigerian EdTech space.

3.4.6 Funding of Research and Development

Asides the provision of telecommunication infrastructure and facilitation of capacity building for academic, NCC also awards telecommunications-based research innovation grants to researchers in Nigerian tertiary institutions. The aim of the research grant program is to develop commercially viable prototypes that can solve socio-economic challenges in the society.

Between year 2015 and 2020, NCC awarded 31 research grants valued at about N300million to 21 Nigerian tertiary institutions for telecommunications-based research innovations. As at 2022, the Commission has awarded over N500million in grants to researchers in Nigerian universities.

3.5 Africa Centre of Excellence (ACE) Intervention by World Bank Group

Africa Centre of Excellence is an initiative by the World Bank Group to support tertiary education in Africa.

World Bank (2020) noted that: "*Since 2014, the Africa Higher Education Centres of Excellence (ACE) Program has become synonymous with delivering quality and relevant post-graduate education that meets the demand for skills in priority fields. Between 2014 and 2020, it supported over 14,000 Masters and PhD students in agriculture, health, and other sciences. The program continues to expand across Sub-Saharan Africa, focusing on improving teaching and learning, expanding access, and ensuring sustainability*."

The World Bank Group revealed that ACE projects are expected to perform the following tasks:

a. Build institutional capacity to provide quality post-graduate education with relevance to the labour market
b. Build institutional capacity to conduct high quality applied research, relevant to addressing a key development challenge/priority;
c. Develop and enhance partnerships with other academic institutions (national, regional and international) to pursue academic excellence
d. Develop and enhance partnerships with industry and the private sector to generate greater impact;
e. Improve governance and management of the institution and set up a role model for other higher education institutions; and
f. Deliver outreach, and create an impact, to society by delivering excellent teaching and producing high quality applied research.

The ACE program was launched in 2013 and Nigeria was among seven (7) West and Central African countries that benefited from the pilot grant of $165million (i.e. ACE I) In 2019, the World Bank Group further provisioned $143million to scale up higher education quality in these countries. One notable characteristics of the ACE program is its extensive support and use of e-Learning for its educational programmes. The table below shows the number of ACE centres in Nigeria.

Table 28: World Bank Sponsored ACE Centres in Nigeria

SN	ACE Program	Number of Centres in Nigeria
1.	ACE I	8
2.	ACE Impact	17

3.6 Assessment of Available LMS in Nigerian Tertiary Institutions

Nigerian tertiary institutions have access to several learning management systems (LMS) for e-Learning purposes; most of the LMS subscribed to or deployed by these institutions are from foreign software service providers. The top five (5) LMS used by Nigerian tertiary institutions are:

a. Google Classroom
b. Blackboard LMS
c. Moodle LMS
d. Microsoft Teams
e. Canvas LMS

3.6.1 Over of popular LMS used by Nigerian Tertiary Institutions

a. **"*Google Classroom*** *is a free blended learning platform developed by Google for educational institutions that aims to simplify creating, distributing, and grading assignments. The primary purpose of Google Classroom is to streamline the process of sharing files between teachers and students*". [Source: Google Inc].
b. *"**Blackboard LMS** is a web-based virtual learning environment and learning management system developed by Blackboard Inc. The software features course management, customizable open architecture, and scalable design that allows integration with student information systems and authentication protocols".* [Source: Blackboard Inc.]
c. *"**Moodle** is a free and open-source learning management system written in PHP and distributed under the GNU General Public License. Moodle is used for blended learning, distance education, flipped classroom and other online learning schemes in schools, universities, workplaces and other sectors*". [Source: https://moodle.org/].
d. *"**Microsoft Teams** is a proprietary business communication platform developed by Microsoft, as part of the Microsoft 365 family of products. Teams primarily competes with the similar service Slack, offering workspace chat and videoconferencing, file storage, and application integration."* [Source: Microsoft Corporation].
e. *"**Canvas LMS** is a web-based learning management system, or LMS. It is used by learning institutions, educators, and students to access and manage online course learning materials and communicate about skill development and learning achievement".* [Source: https://community.canvaslms.com/t5/Canvas-Basics-Guide/What-is-Canvas/ta-p/45].

3.6.2 Comparative Analysis of LMS used by Nigerian Tertiary Institutions

Table 29: Comparative Analysis of Common LMS used by Nigerian Tertiary Institutions

SN	OER Tool	**Google Classroom**	**Moodle LMS**	**Microsoft Teams**	**Canvas LMS**	**Blackboard LMS**
1.	**Date of 1st Stable Release**	August 2014	August 2002	March 2017	2008	October 2014
2.	**Indigenous**	No	No	No	No	Yes
3.	**Developer**	Google Inc	Martin Dougiamas Moodle Community	Microsoft	Instructure	Blackboard
4.	**License Type & Model**	Free, Paid	Free, Paid	Free, Paid	Free, Paid	Free, Paid
5.	**Source Type**	Closed Source	Open Source	Closed Source	Open Source	Open Source
6.	**Deployment Model**	Cloud: Software as a Service (SAAS)	Cloud: Software as a Service (SAAS) & On-premise Deployment	Cloud: Software as a Service (SAAS)	Cloud: Software as a Service (SAAS) & On-premise Deployment	Cloud: Software as a Service (SAAS) & On-premise Deployment
7.	**Has Mobile App**	Yes (Android, IOS)	Yes (Android, IOS)	Yes (Android, IOS)	Yes (Android, IOS)	Yes (Android, IOS)
8.	**Registered Users**	150 million	200 million	270 million	Over 30 million	150 million
9.	**Technology Stack**	Java, C++, Python for backend; Angular JS for Frontend	PHP	Microsoft.NET Framework for backend; Angular JS, React and Nodejs for front end	Ruby on Rails	Java
10.	**Supported Operating System**	Cross platform compatibility Windows, Linux, IOS, Android	Cross platform compatibility: Windows, Linux, IOS, Android	Cross platform compatibility: Windows, Linux, IOS, Android	Cross platform compatibility: Windows, Linux, IOS, Android	Cross platform compatibility: Windows, Linux, IOS, Android
11.	**Browsers Supported**	All major browsers	All major browsers	All major browsers	All major browsers	All major browsers
12.	**Compatible Database System**	Bigtable	MySQL, PostgreSQL, SQL Server, Oracle	SQL Server	PostgreSQL	SQL Server, Oracle
13.	**Minimum System Requirement**	Any Computer or mobile phone with internet access	5GB of Hard Disk; 2GB of RAM; minimum. Processor; 1 GHz (min), 2 GHz dual core or more	4.0 GB RAM; 3.0 GB of available disk space; Minimum 1.1 GHz or faster, two cores	2GB of RAM; 2GHz processor; 1GB of free hard disk space	2 GB of RAM (2 GB or higher optimal); 1 GB of free disk space; Sound card & speakers.
14.	**Integration Options**	Support for 3rd party widgets and plugins	Support for 3rd party widgets and plugins	Support for Microsoft Office suites and other 3rd party widgets	Support for 3rd party widgets and plugins	Support for 3rd party widgets and plugins

15.	**Scalability**	Scalable	Scalable for Cloud deployment; Scalability for on-premise deployment depends on the deployment environment being used	Scalable	Scalable for Cloud deployment; Scalability for on-premise deployment depends on the deployment environment being used	Scalable
16.	**Security**	Relies on Google security framework	Cloud deployment relies on open security architecture; On-premise deployment depends on strength of the deployment environment being used	Relies on Microsoft security framework	Cloud deployment relies on open security architecture; On-premise deployment depends on strength of the deployment environment being used	Cloud deployment relies on open security architecture; On-premise deployment depends on strength of the deployment environment being used
17.	**Vulnerability**	Phishing & Malware; Account Takeover; Data Loss; Student privacy	Cross Site Scripting (XSS); Directory traversal attack; SQL injection; Account lockout bypass; CSRF; Command Execution; DOS Attack	DOS; Command Execution; XSS	Server-side Request Forgery; XSS	Cross Site Scripting (XSS), CSRF; No-encryption of database backups; Admin Impersonation; Limited roles and permissions check for authenticated users
18.	**Patches and Updates**	Controlled and released by Google Inc as part of its support services	Controlled and released by Moodle Community; Developers can implement updates and patches as desired because of its open source nature	Controlled and released by Microsoft Corporation Inc as part of its support services	Controlled and released by Instructure; Developers can implement updates and patches as desired because of its open source nature	Controlled & released by Blackboard Inc; Developers can implement updates and patches as desired because of its open source nature
19.	**Limitations**	Student privacy issues; Grading System; Custom logic cannot be implemented; Cost	Limited support for very large institutions; Social networking; Exchange of contents	Too many similar plugins/tools; Lack of intuitive UI notification; Limited support for Custom logic	Usability issues around assignments management; Technical issues with audio recording	Not very user friendly; Limited support for default data; cost

3.6.3 Ideal LMS Features and Innovations to support Blended Learning in Nigeria

Considering the limitations of the current LMS solutions available to Nigerian tertiary institutions and the nature of the current Nigerian tertiary education curriculum, the following features are essential innovations required to support blended learning that suites the Nigerian tertiary education system.

a. Integration of robust qualitative assessment feature.
b. Use of new and emerging technologies such as artificial intelligence (AI), augmented reality (AR), virtual reality (VR), etc.
c. Integration of virtual 3D laboratories and workshops to support simulation of practical component of course topics.
d. Robust gamification of course contents and quizzes for improved learning experience.
e. Integration of toolkits to support Microlearning and adaptive learning.
f. Use of Bigdata reporting and analytics.

3.7 Assessment of Available OER used by Nigerian Tertiary Institutions

Open Educational Resources (OER) are educational & research materials that are free and publicly accessible for the purpose of supporting teaching, learning, and research activities. OERs typically include: textbooks, course materials, full courses, modules, streaming videos, audio, articles, tests, software, and any other tools, materials, or techniques that supports knowledge sharing; these resources span multiple disciplines such as core sciences, social science, humanities, business, essentials, engineering, etc. OERs support free use and distribution.

As at June 2022, no fewer than 153 Nigerian universities had subscribed to the National OER repository commissioned by NUC and Commonwealth of Learning (COL). This OER is called the Nigerian University System Open Educational Resources (**NUSOER**) and houses over 2 million resources. [Source: NUC].

Other common OERs used by Nigerian tertiary institutions include: **OpenStax, OER Commons and MIT Open Courseware** which feature free and flexible textbooks and resources and allow for integration with different LMS platforms. The integration of LMS with OER extends the resource capability and utilization potential of an LMS. Currently, over 50 Nigerian tertiary institutions have subscribed to OpenStax OER platform. [Source: https://openstax.org/adopters].

3.7.1 Promoting Adaptation and Adoption of OER in Nigeria

The following actions can promote the adaptation and adoption of OER in Nigerian tertiary institutions.

a. Create better awareness on Nigeria's OER policy.
b. Provision of ICT assets and facilities to facilitate access to OER.
c. Drive implementation of the OER policy in Nigerian tertiary institutions.
d. Encourage usage of OER within academic community.
e. Institute a reward structure.
f. Encourage indigenous resource publications and uploads to the NUSOER.
g. Libraries should advise faculties on the importance of OER as well champion integration of OER to their collections.

3.8 Impacts & Roles of Telecoms Industry in Supporting e-Learning

3.8.1 Impacts of the Telecommunications Industry in Supporting e-Learning

a. Provision of robust telecommunication infrastructure during and after the COVID-19 pandemic to promote broadband penetration. Teledensity rose from 97.45% in January 2020 to 100.56% in October 2022; similarly, broadband penetration rose from 38.49% in January 2020 to 45.09% in September 2022. [Data Source: NCC online available at: https://www.ncc.gov.ng/statistics-reports/industry-overview#view-graphs-tables-6.
b. Advocacy and awareness on protection of telecommunication infrastructure by consumers, Civil Defence Corps, security & law enforcement agencies, traditional rulers, etc. This initiative assured good quality of service needed for e-learning.
c. Consumer education & protection activities improved cybersecurity awareness amongst subscribers nationwide. An example is the sensitization of students and lecturers on "Safer Internet Space" usually observed annually during the Africa Safer Internet Day (ASID).
d. NCC supported Right of Passage (RoP) for all telecommunications members for easy movement during the COVID-19 lockdown. This eliminated operational and movement hassles for telecommunication service providers.
e. Education (e-Learning) was one of the themes in the NCC sponsored COVID-19 research grant for innovators in 2020. The Commission awarded N9million to 3 innovators that emerged as winners during the virtual hackathon exercise. KlasConnect, a learning management software emerged as one of the winners.
f. Intervention programmes such as Digital Awareness Program for Tertiary Institution (ADAPTI), Digital Awareness Programme (DAP), Tertiary Institution Knowledge Centre (TIKC) has helped in bridging the digital gap in academia.

3.8.2 Roles of the Telecommunications Industry in Supporting e-Learning

The roles of the telecommunications industry in supporting and sustaining e-learning in Nigeria are enumerated as follows:

a. Improve access to technology and telecommunication services.
b. Effective Regulation of the telecommunication industry (consumer protection, consumer education, fair pricing, etc.).
c. Development and Sustainability of Telecommunication infrastructure.
d. Strengthen and sustain linkages with Academia.

4. Technology-Enhanced Tertiary Education Landscape in Nigeria

4.1 SWOT Analysis of e-Learning in Nigerian Tertiary Institutions

Table 30: SWOT Analysis of e-Learning in Nigerian Tertiary Institutions

Strengths	a. Ongoing review of tertiary education curriculum to allow for e-Learning e.g. CCMAS. b. Policy formulation to support blended learning by tertiary education regulators and tertiary institutions and Government. E.g. Nigerian Open Education policy for higher education. c. Increase in broadband penetration to ease access to e-learning platforms. d. Availability of various e-Learning solutions. e. Increasing advocacy for adoption of e-learning solutions. f. Increase in awareness on benefits of blended learning. g. Access and use of OER resources and LMS solutions.
Weaknesses	a. Inadequate ICT infrastructure in most Nigerian public tertiary institutions. b. Erratic power supply c. Low to average digital skill level of lecturers and students required for effective e-Learning d. Slow internet speeds and bandwidth issues e. Current tertiary education curriculum has little or zero support for e-Learning f. Low patronage of indigenous e-learning software solutions by tertiary institutions.
Opportunities	a. Innovation-driven competition for EdTech solution providers in developing cutting-edge solutions using new and emerging technologies b. Implementation of blended learning model in Nigerian tertiary institutions. c. Full implementation of the Nigeria research and education network across Nigerian tertiary institutions. d. Subsidized cost of tertiary education. e. Flexibility and increase in options for tertiary education degree programmes (e.g. online masters, online PhD, foreign-linkage degree programmes, etc). f. Increase in revenue through improved admission potential into tertiary institutions for various degree-awarding programmes.
Threats	a. Vandalism of telecommunications infrastructure b. Resistance to change c. Shortage of microchips which has increased cost of basic ICT tools for learning such as computers, tablets, etc. d. Laxity and slow transition to blended learning by many tertiary institutions due to easing of COVID-19 safety protocols.

4.2 Determinants for Use of ICT for Teaching, Learning & Research

Electricity, ICT tools, broadband internet and digital literacy are determinants for use of ICT for teaching, learning and research in Nigerian tertiary institutions. The figure below highlights these determinants.

Figure 29: Determinants for Use of ICT for Teaching, Learning and Research

4.3 Conceptual Framework for Transition and Sustainability of e-Learning

The transition to and sustenance of blended learning in Nigerian tertiary institutions is essential to ensure quality education which promotes the actualization of SDG 4: *"Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all"*.

All stakeholders in tertiary education ecosystem have important roles to play in the transition and sustainability journey. COVID-19 buttressed the need for a robust transition and sustainability framework for adoption of blended learning in tertiary institutions. Resiliency in the framework design is critical to guarantee longevity and reliability of blended learning.

The determinants for use of ICT in teaching, learning and research as well as key enablers for e-learning should be put in place to overcome the barriers and ensure that remarkable results are to be achieved.

Frydyneberg (2022) enumerated nine (9) domains that determine the quality of e-Learning from the viewpoint of the educator. These domains are:

a. **Institutional Commitment**: Leadership support and financial commitment.
b. **Technology**: ICT infrastructure, broadband connectivity, etc.
c. **Student Services**: Onboarding support for students.
d. **Instructional Design and Course Development**: this involves learning goals and content presentation; interactions; assessment and measurement; instructional media and tools; and learner services and support.
e. **Instruction and Instructors:** e-Learning program management activities
f. **Finance:** financial health of e-learning program for sustainability
g. **Regulatory and Legal Compliance:** setting of standards, accreditation, etc.
h. **Evaluation:** review of effectiveness, outcomes and cost-benefit analysis.

A multi-stakeholder framework for transition and sustainability of e-learning in Nigerian tertiary institutions was designed with considerations of the following:

a. Findings from field survey exercise
b. SWOT analysis of e-learning in Nigerian tertiary institutions
c. Review of relevant documentations and reports pertinent to the research study
d. Benchmarking of existing frameworks and strategies such as:
    1. United Nations e-learning methodologies and good practices (https://www.fao.org/3/i2516e/i2516e.pdf)
    2. Malaysia's e-learning strategy – "Education as an industry (2020 – 2025)" (https://www.mida.gov.my/mida-news/evolution-of-e-learning-in-the-malaysian-higher-education-institutions/)
    3. India's e-learning strategy (https://www.meity.gov.in/content/e-learning
    4. World Bank's model framework for its ACE intervention program.
    5. eLearning Strategy and Policy for National Open University of Nigeria (NOUN).

The figure below shows the conceptual framework for transition and sustainability of blended learning in Nigerian tertiary institutions.

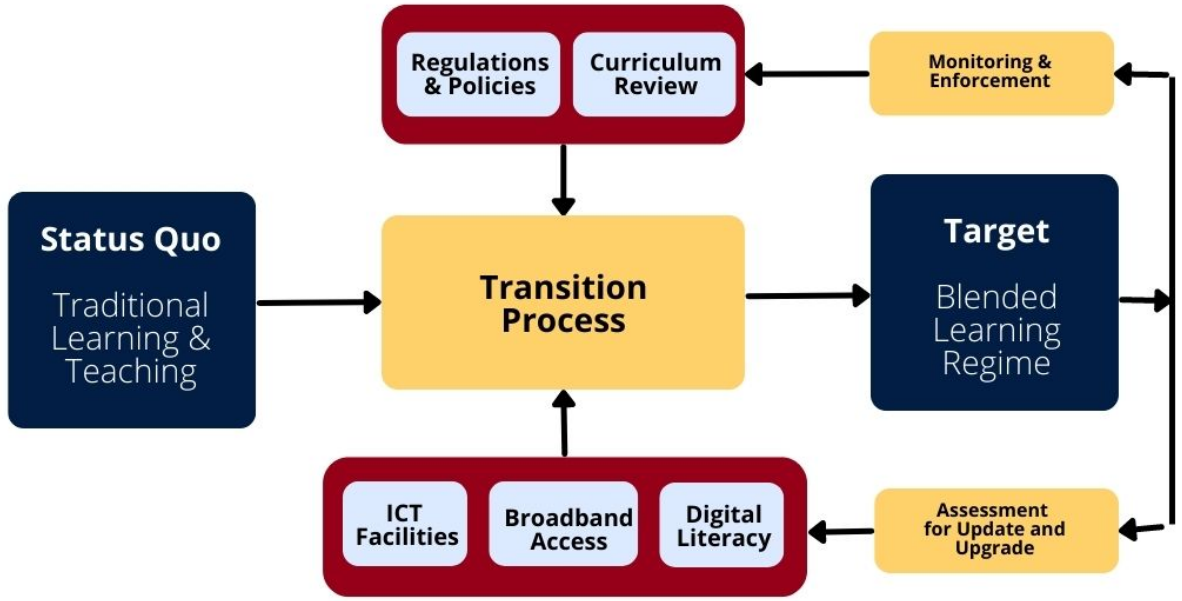

Figure 30: Conceptual Framework for Transition to & Sustainability of Blended Learning

Transition component of the conceptual framework relies on the provision of key enablers such as:

a. Enabling regulations and policies to support e-learning.
b. Curriculum review to ensure conformance with e-learning standards.
c. ICT facilities to equip and empower lecturers and students for digital education. This includes but is not limited to OER solutions, computers, tablets, printers, scanners, projectors. Cybersecurity is also essential to provide a safe cyberspace for students and lecturers.
d. Broadband for internet access; interventions similar to the wireless cloud programme can be used for this purpose.
e. Digital literacy through capacity building.

The Sustainability component of the conceptual framework relies on two key activities:

a. Monitoring and enforcement to ensure compliance by tertiary institutions; and sanctioning of non-compliant institutions where necessary. This can be embedded within the accreditation checks conducted by regulators.
b. Assessment for updates and upgrades need to be done periodically to ensure adequacy of enablers such as: ICT facilities, broadband access and

digital literacy level. This is essential because new technologies are constantly emerging and raising the bar for e-learning globally.

The table below highlights the different stakeholders and their corresponding responsibilities in the conceptual framework.

Table 31: Framework Components, Actors and Activities for Transition and Sustainability of Blended Learning in Nigerian Tertiary Institutions

SN	Framework Component	Actors	Activities
1.	Regulation and Policies	a. **Tertiary Education Regulators**: Ministry of Education, NUC, NCCE, NBTE	Creation and enforcement of enabling policies that facilitates e-Learning.
2.	Curriculum Review	a. **Tertiary Education Regulator**s: Ministry of Education, NUC, NCCE, NBTE b. **Tertiary Institutions**: Universities, polytechnics and colleges of education	Collaborative review, update and implementation of new tertiary education curriculum that allows for seamless support of e-learning.
3.	ICT Facilities	a. **Government**: Federal, state and local governments as well as government MDAs such as TETFund, NITDA, USPF, FMoCDE b. **Telecommunications Industry Regulator**: NCC c. **NGOs** d. **International Development Organizations:** World Bank Group, AfDB, etc.	Provision of robust and adequate ICT facilities to support teaching, learning and research activities. Provision of adequate cybersecurity for ICT and telecoms facilities to ensure a safe cyberspace for students and lecturers.
4.	Broadband Access	a. **Telecommunications Industry Regulator**: NCC b. **Telecommunication Service Providers** c. **Government:** FMoCDE, Federal, State and Local Governments, ONSA	Facilitation and provision of broadband. Creation of enabling policies and initiatives that promotes broadband penetration. Protection of telecommunication infrastructure.
5.	Digital Literacy	a. **Government**: Federal, state and local governments as well as MDAs such as NITDA, USPF, DBI, FMoCDE, FMSTI b. **Telecommunications Industry Regulator**: NCC c. **NGOs**	Trainings and capacity building programmes aimed at improving digital literacy and competency in tertiary institutions. Cybersecurity Awareness.

4.4 Curriculum-Update Initiatives to Support e-Learning

The following curriculum-update initiatives will facilitate transition and adoption of e-learning in Nigerian tertiary institutions.

a. Collaborative review, update and implementation of new tertiary education curriculum that allows for seamless support of e-learning. (All tertiary education regulators are finalizing their updated curriculum in this regard).
b. Introduction of a new course type: "e-learning" in tertiary education curriculum - for courses that will only be delivered and assessed via e-learning methods. (The current course types in tertiary institutions are: theory, practical and fieldwork).
c. Segmentation of theory-based course contents to allow for blended learning (e.g. 60% physical learning and 40% e-learning).
d. Use of virtual labs, simulators, alternative-to-practical, augmented reality (AR), virtual reality (VR) for delivery of practical-based courses.

4.5 Digital Economy Policy Initiatives to Support e-Learning

The role of the telecommunications industry in supporting e-learning cannot be overemphasized. Digital economy policy initiatives that would have long-term positive impacts for technology-enhanced tertiary education in Nigeria.

a. Prioritize provision of solid, service and soft infrastructure to Nigerian tertiary institutions in line with pillars 3, 4 and 6 of the current National Digital Economy Policy and Strategy (NDEPS) 2020 – 2030.
b. Promote digital literacy and skills for lecturers and students in Nigerian tertiary institutions through special capacity development programmes. this can be modelled as a continuous professional development programme and continuous learning programme for lecturers and students respectively. This aligns with pillar 2 of NDEPS 2020 – 2030.
c. Facilitate access to and use of new and emerging technologies for e-learning in tertiary institutions.
d. Subsidize cost of telecommunication services for tertiary institutions and surrounding environments to reduce barriers for e-learning.
e. Promote "Collocation" of telecommunication infrastructure to increase broadband penetration in locations with tertiary institutions.
f. Reduce (or eliminate) taxation and charges applicable in the provision of telecommunication services to tertiary institutions.

g. Drive transition from use of conventional power to use of renewal energy (e.g. solar, wind, biogas, etc) for powering key ICT infrastructure in tertiary institutions. This will enhance access to electricity to promote sustainable access to electricity.
h. Encourage and promote strategic domestic and international partnerships aimed at providing ICT tools for lecturers and students at subsidized rates.
i. Introduction of specialized annual programs (such as Competitions, Technology Fairs and Expos) that will strengthen the linkages between government, academia and industry in technology enhanced learning.
j. Introduction of a ranking and reward system to recognize compliant and innovative tertiary institutions in the e-learning space.
k. Introduce an ICT-based university preparatory programme for secondary schools aimed at ensuring ICT proficiency in e-learning among students.

5. Conclusion and Recommendations

5.1 Conclusion

There has been a paradigm shift in the teaching, learning and research methods used in Nigerian tertiary institutions. This transition was accelerated by the COVID-19 pandemic which exposed the limitations of traditional teaching methods. Digital education has become a new reality in the Nigerian education system. The integration of technology to learning will promote attainment of SDG 4: *"Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all"*.

ICT tools, digital literacy, broadband and access to electricity are key determinants for use of ICT for teaching and learning. The technology-enhanced learning landscape in Nigerian tertiary institutions is currently marred by poor infrastructure, slow internet bandwidth, high internet access costs, digital literacy issues among others.

The developed conceptual framework for transition and sustainability of e-learning features key enablers (ICT facilities, Broadband Access and Digital Literacy) as well as sustainability components (Regulation & Policies, Curriculum Review). Cybersecurity is also essential to provide a safe cyberspace for lecturers and students. The implementation of this framework will help address the current limitations of e-learning and assure a reliable blended-learning regime in Nigerian tertiary institutions.

5.2 Recommendations

The recommendations are grouped per key stakeholder category and are enumerated as follows:

1. **Government**
    a. Increase budget allocation and public spending on education especially for provision of robust infrastructure.
    b. Drive policy formulation, implementation and enforcement to promote and sustain blended learning at levels of education.
    c. Facilitate formulation of regulations to promote reduced taxation and charges for provision and access to telecommunication services in tertiary education locations.
    d. Sponsor R&D programmes for production of indigenous digital tools for e-learning purposes.
    e. Promote and drive awareness on importance and benefits of blended learning.

f. Drive implementation of the national cybersecurity policy.

2. Tertiary Education Regulators

a. Fast track the update and introduction of new tertiary education curriculum which aligns with e-learning.
b. Drive awareness on the National Policy on ICT in Education (2019) and OER Policy for Higher Education in Nigeria.
c. The accreditation requirements for approval of new tertiary institutions should include existence of robust ICT infrastructure capable of supporting e-learning.
d. Strengthen and enforce the accreditation checklist for existing Nigerian tertiary institutions to contain components that ensures ICT compliance and support for e-learning (i.e. infrastructure, personnel and actual usage).
e. Promote and drive awareness on importance and benefits of blended learning.

3. Tertiary Institutions

a. Institute, implement and enforce a campus-wide ICT policy that supports e-learning.
b. Increase ICT budget allocation and expenditure.
c. Facilitate capacity building of current staff and students for improved digital literacy and skills.
d. Proficiency in ICT should be one of the eligibility criteria for admission of new students into Nigerian tertiary institutions.
e. Proficiency in ICT should be one of the eligibility criteria for employment of new lecturers by Nigerian tertiary institutions.
f. Prioritize ICT infrastructure when applying for grants and interventions.
g. Institute a reward scheme for ICT-compliant departments and faculties to promote adoption.
h. Promote access to OER for students and lecturers.
i. Seek external funding from developmental banks to provide key infrastructure aimed at accelerating transition to blended learning.
j. Promote and drive awareness on importance and benefits of blended learning.
k. Promotion of campus-wide cybersecurity policies and a strict compliance regime.

4. Lecturers and Students

a. Embrace and adoption of e-learning as part of tertiary education.
b. Conscious personal development in digital literacy and skills.

5. Telecommunications Industry

a. Development and sustainability of telecommunication infrastructure especially in locations with tertiary institutions.
b. Strengthen and sustain linkages with Academia via improved collaborations.
c. Improve access to technology and telecommunication services via provision of ICT tools, interventions, special plans for academia and quick transition to new & emerging technologies.
d. Effective Regulation of the telecommunication industry (consumer protection, consumer education, fair pricing, etc.).
e. Promotion and constant improvement of cybersecurity of ICT and telecommunications infrastructure.

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Appendix

Appendix A: Sample Size Computation

Preamble:

The National Universities Commission (NUC) in January 2022, revealed that "***Nigeria currently has only 100,000 academic staff members teaching and supervising about 2.1 million students in universities across the country***".

(Source: https://tribuneonlineng.com/universities-in-nigeria-have-100000-lecturers-for-2-1-million-students-%E2%80%95-nuc/).

Calculations and Assumptions:

a. Use of the renown **Yamane's formula** for sample size computation

$$\boldsymbol{n = \frac{N}{1 + N(e)^2}}$$

Where:

n = minimum Sample Size

N = Total Population

e = Precision Level for defined Confidence level (95%)

b. Let the study population size for students be the sum of total student and lecturer population size in the "Nigerian University System (NUS)" which constitutes a larger proportion of the study population groups. This equals **2,200,000**.

c. Substituting into Yamane's formula as follows:

$$\boldsymbol{Minimum\ \ Sample\ Size, n = \frac{2,200,000}{1 + 2,200,000(0.01)^2} = 9,954}$$

d. The computed minimum sample size is 9,954 (This minimum sample size can be scaled upwards based on realities during the field survey exercise).

e. Use of 160 samples per institution with 70:30 student to lecturer ratio (i.e. 110 students and 50 lecturers per institution).

Appendix B: List of Sampled Tertiary Institutions

A. List of Sampled Federal Universities

SN	Institution Name	State	Geo-Political Zone
1.	University of Abuja	Abuja FCT	North Central
2.	Federal University of Technology, Minna	Niger	
3.	University of Jos	Plateau	
4.	Abubakar Tafawa Balewa University, Bauchi	Bauchi	North East
5.	University of Maiduguri	Borno	
6.	Federal University, Kashere, Gombe State	Gombe	
7.	Ahmadu Bello University, Zaria	Kaduna	North West
8.	Bayero University, Kano	Kano	
9.	Usmanu Danfodiyo University	Sokoto	
10.	University of Nigeria, Nsukka	Enugu	South East
11.	Federal University of Technology, Owerri	Imo	
12.	Nnamdi Azikiwe University, Awka	Anambra	
13.	University of Port Harcourt	Rivers	South-South
14.	University of Calabar	Cross River	
15.	Niger Delta University, Bayelsa	Bayelsa	
16.	Obafemi Awolowo University, Ife	Osun	South West
17.	University of Lagos	Lagos	
18.	University of Ibadan	Oyo	

B. List of Sampled State Universities

SN	Institution Name	State	Geo-Political Zone
1.	Kwara State University	Kwara	North Central
2.	Kogi State University	Niger	
3.	Nasarawa State University	Nasarawa	
4.	Taraba State University	Taraba	North East
5.	Adamawa State University	Adamawa	
6.	Kebbi State University of Science and Tech.	Kebbi	North West
7.	Umaru Musa Yar'Adua University	Katsina	
8.	Ebonyi State University	Ebonyi	South East
9.	Abia State University	Abia	
10.	Delta State University	Delta	South-South
11.	Akwa Ibom State University	Akwa Ibom	
12.	Ondo State University of Science Tech.	Ondo	South-West
13.	Ekiti State University	Ekiti	

C. List of Sampled Private Universities

SN	Institution Name	State	Geo-Political Zone
1.	Baze University	Abuja FCT	North Central
2.	Bingham University, Lokoja	Nasarawa	
3.	American University of Nigeria	Adamawa	North East
4.	Kwararafa University Wukari	Taraba	
5.	Northwest University Sokoto	Sokoto	North West
6.	Al-Qalam University	Katsina	
7.	Madonna University, Okija	Anambra	South East
8.	Godfrey Okoye University	Enugu	
9.	Igbenedion University, Okada	Edo	South-South
10.	Western Delta University	Delta	
11.	Covenant University, Ota	Ogun	South West
12.	Elizade University	Ondo	

D. List of Sampled Colleges of Education

SN	Institution Name	State	Geo-Political Zone
1.	Federal College of Education, Okene	Kogi	North Central
2.	College of Education (Technical), Lafiagi	Kwara	
3.	Federal College of Education Yola	Adamawa	North East
4.	Federal College of Education (Technical) Gombe	Gombe	
5.	Federal College of Education, Zaria	Kaduna	North West
6.	Shehu Shagari College of Education, Sokoto	Sokoto	
7.	Federal College of Education, Eha-Amufu	Enugu	South East
8.	Alvan Ikoku College of Education, Owerri	Imo	
9.	Federal College of Education (Technical), Asaba	Delta	South-South
10.	College of Education, Ekiadolor-Benin	Edo	
11.	Federal College of Education (Technical), Akoka	Lagos	South West
12.	Osun State College of Education, Ilesa	Oyo	

E. List of Sampled Polytechnics

SN	Institution Name	State	Geo-Political Zone
1.	Federal Polytechnic, Idah	Kogi	North Central
2.	Federal Polytechnic Bida	Niger	
3.	Federal Polytechnic Bauchi	Bauchi	North East
4.	Federal Polytechnic Mubi	Adawama	
5.	Binyaminu Usman Polytechnic, Jigawa	Jigawa	North West
6.	Waziri Umaru Federal Polytechnic, Birnin Kebbi	Kebbi	
7.	Federal Polytechnic, Kaura Namoda	Zamfara	
8.	Federal Polytechnic Nekede, Owerri	Imo	South East
9.	Federal Polytechnic Oko	Anambra	
10.	Auchi Polytechnic, Auchi	Edo	South-South
11.	Yaba College of Technology	Lagos	South West
12.	Federal Polytechnic Ilaro	Ogun	
13.	The Polytechnic Ibadan	Oyo	

F. Others (Specialized, Military, etc.)

SN	Institution Name	State	Geo-Political Zone
1.	Nigerian Army School of Military Engineers	Benue	North Central
2.	Nigerian Army University, Biu	Borno	North East
3.	Nigerian Airforce Institute of Technology	Kaduna	North West
4.	Federal Training Centre, Emene	Enugu	South East
5.	Petroleum Training Institution, Warri	Delta	South-South
6.	Federal University of Agriculture, Abeokuta	Ogun	South West

Appendix C: Survey Questionnaire

Aim and Objectives:

To gather data aimed at determining:

a. the impact of ICT in teaching and learning in Nigerian tertiary institutions
b. benefits of ICT in teaching and learning Post-COVID for both lecturers and pupils
c. challenges of ICT in teaching and learning Post-COVID for both lecturers and pupils
d. ways of improving the teaching, learning and research in tertiary institutions

Target Respondents: Students, Lecturers, Researcher

SECTION A: Background Information

1. What is the name of your Institution.
2. Type of Institution:

   (1) Federal University (2) State University (3) Private University
   (4) College of Education (5) Polytechnic
   (6) Others (Military, Training Centre's, Specialized)

3. State of Location: _____
4. Available Telecommunication Services:
   (1) Voice only (2) Data Only (3) Voice and Data
5. Available Major Networks (MNOs) – Select all that apply
   (1) MTN (2) Airtel (3) Globacom (4) 9Mobile
6. GPS Mapping - Longitude: _____ Latitude: _____

SECTION B: Socio-Economic and Education Attributes of Respondent

7. What is Category do you belong to?
   (1) Student (2) Lecturer/Researcher (3) Administrator
8. What is your Gender?
   (1) Male (2) Female
9. What is your Age bracket in years as at last birthday?
   (1) Below 18 (2) 18 -20 (3)21 – 25 (4)26 - 30 (5)31 - 35 (6)36 - 40
   (7) 41 - 45 (8) 46 -50 (9)51 – 55 (10)56 - 60 (11)61 - 65 (12) Above 65
10. What is your Marital Status?
    (1) Single (Never Married) (2) Married (Monogamous) (3) Married (Polygamous)
    (4) Informal/Loose Union (5) Divorced (6) Separated
11. What is your Faculty/Area of discipline?
    (1) Administration; Management and Management Technology
    (2) Agriculture, Forestry, Fisheries and Home Economics. (3) Arts.
    (4) Basic Medical and Health Science (5) Education (6) Engineering and Technology
    (7) Environmental Sciences (8) Law (9) Pharmaceutical Sciences
    (10) Medicine and Dentistry (11) Science (Natural, Applied, Physical, Biological)
    (12) Social Sciences (13) Veterinary Medicine
12. What is your current level of Study? (Student only)
    (1) 300 Level (2) 400 Level (3) 500 Level (4) above 500 Level
13. What is your highest qualification? (Lecturer only)
    (1) HND (2) Bachelors (3) PgD (4) Masters (5) PhD

14. What is your length of service in years?
    (1) Less than 5 (2) 6 – 10 (3) 11 – 15 (4) 16 – 20 (5) 21 – 25
    (6) 26 – 30 (7) Above 30

15. What is your monthly stipend range (Pocket Money) - Student only?
    (1) below N10,000 (2) N10,000 – N19,999 (3) N20,000 – N29,999
    (4) N30,000 – N39,999 (5) N40,000 – N49,999 (6) N50,000 – N59,999
    (7) N60,000 – N69,999 (7) N70,000 – N79,999 (8) N80,000 – N89,999
    (8) N90,000 – N99,999 (9) N100,000 and above

16. What is your Monthly Salary range - (Lecturer only)?
    (1) below N100,000 (2) N100,000 – N199,999 (3)N200,000 – N299,999
    (4) N300,000 – N399,999 (5) N400,000 – N499,999 (6) N500,000 – N599,999
    (7) N600,000 and above

SECTION C: Ownership of Basic ICT Assets, Access to ICT & Digital Literacy Level

	Question	**YES**	**NO**
17.	Do you have access to power supply from an electricity distribution company?		
18.	Do you have access to backup or alternative power supply?		
19.	Do you own a personal computer (Desktop or Laptop)?		
20.	Do you have access to a computer connected to the internet?		
21.	Do you own a smartphone or tablet?		
22.	Do you know how to use a computer?		
23.	Can you use the internet?		
24.	Do you access the internet with your phone?		
25.	Do you have an email address?		
26.	Do you currently (teach or learn) any of your courses online?		
27.	Does your school have a campus-wide internet network?		
28.	Does your institution have ICT labs and computer centres?		
29.	Has your institution enforced any e-Learning policy?		

SECTION D: Timeline of Ownership of ICT Assets, Access to ICT & Digital Literacy

	Question	**Never**	**Before COVID**	**During COVID**	**After COVID**
30.	From what time have you owned a personal computer?				
31.	From what time have you owned a Smartphone?				
32.	From what time have you had access to a computer connected to the internet?				
33.	When did you known/learn how to use the internet?				
34.	When did you start personal e-Learning activities online?				
35.	When did you start taking (teach, learn) academic courses online?				
36.	When was the campus-wide internet network launched?				
37.	When were the ICT labs and computer centres launched?				
38.	When did your institution enforce its e-Learning policy?				

39. Did Teaching, Learning and Research come to a complete halt in your institution during the COVID era due to the various COVID restrictions?
    (1) YES (2) NO (3) I DON'T KNOW

40. Who are the major facilitators in the provision of ICT infrastructure to your institution in the last 3 to 5 years
    (1) School Administration (2) TetFund (3) NCC/USPF (4) State Government
    (5) NGOs (6) Alumni Network (7) Donations from Philanthropists
    (8) Others (9) I don't Know

SECTION E: Access and Use of ICT for Teaching, Learning and Research

How often do you use the following ICT tools?

SN	ICT Tool	Frequently (3)	Sometimes (2)	Never (1)
41.	Desktop Computer, Laptop			
42.	Projectors			
43.	Interactive Whiteboards			
44.	Learning Management System (LMS)			
45.	Internet			
46.	Meeting & Video Conferencing Tools (e.g. Zoom, Teams, Google Meet etc.)			

47. What data bandwidth in GB do you approximately consume monthly?
    (0) None (1) Less than 5 (2) 6 - 10 (3) 11 - 15
    (4) 16 - 20 (5) 21 - 25 (6) 26 - 30 (7) above 30

48. How much do you spend for your monthly internet subscription?
    (1) Zero (2) below 5,000 (3)N5,000 – N9,999
    (4) N10,000 – N14,999 (5) N15,000 – N19,999 (6) N20,000 – N24,999
    (7) N25,000 and above

49. What period did you spend the most time online for academic related activities?
    (1) Never (2) Before COVID (3) During COVID (4) Post-COVID

50. Which of these OER or LMS does your institution use?
    (0) None (1) Google Classroom (2) Microsoft Team Suite
    (3) Moodle (4) Canvas LMS (5) EdModo
    (6) Blackboard Learn (7) Talent LMS (8) Others (off the Shelf)
    (9) Others (Custom built) (10) Other (indigenous) (11) Others (foreign)

51. How effective has your institutions e-Learning/LMS solution being for teaching, learning and research?
    (5) Highly Effective (4) Effective (3) Undecided (3) Ineffective
    (1) Highly Ineffective (0) Not Applicable

52. How effective has your institutions e-Learning/LMS policy being for adoption of teaching, learning and research?
    (5) Highly Effective (4) Effective (3) Undecided (3) Ineffective
    (1) Highly Ineffective (0) Not Applicable

53. What are the limitations of your institution's LMS/OER or e-Learning tool? (select top three)
    (0) Not user friendly (1) Not Flexible or Customizable (2) Not Robust enough
    (3) course Management related Issues (4) Assessment related issues
    (5) Student activity tracking related issues
    (6) Issues with integration and interoperability (7) Security related issues
    (8) Others

54. What are your biggest barriers/challenges to use and adoption of e-Learning? – (select top three)
    (0) None (1) Lack of e-Learning Knowledge (2) Power Supply Issues
    (3) Slow Internet Bandwidth (4) Internet subscription Cost
    (5) Lack of Technical and Managerial Support
    (6) Lack of Computing Device (7) Resistance to Change
    (8) Lack of publicly accessible ICT centres/labs (9) Security related issues
    (10) Privacy related issues
    (11) Issues with integration and interoperability (12) Others

How do you agree or disagree with following statements within your institution?

SN	Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
55.	Digital literacy has improved among the student's population since COVID era					
56.	Digital literacy has improved among the lecturer's population since COVID era					
57.	Use of the internet for academic activities such as searching for academic research materials and publications of research works have increased since the COVID era					
58.	Use of the internet for other non-academic activities such as social media, payment, commerce, News, entertainment has increased since the COVID era					
59.	Use of ICT tools has improved teaching and learning experience					

60. What aspects of your school's curriculum need to be aligned to meet up with new teaching & learning solutions for lecturers and students post-COVID?

Appendix D: Interview Questions

Section A: Tertiary Institutions

Interviewees: Management staff overseeing academics such as Deputy Vice-Chancellor (Academics), Deans of Faculties, Deans of Study, Heads of Departments, Head of Management Information System (MIS) or ICT unit.

1. How has ICT and telecommunications impacted teaching, learning and research activities in your institution since 2015?
2. What were the effects of COVID-19 in the academic ecosystem of your institution?
3. How would you rate the availability and accessibility of ICT infrastructure for teaching, learning and research in your institution since 2015?
4. What is the rate of adoption of use of ICT for teaching and learning in the institution?
5. How has use of ICT benefited your institution with respect to COVID-19 effects?
6. In what ways can the curriculum of your institution be aligned to meet up with new teaching solutions for students?
7. Are there any policies in place to drive the use and adoption of e-Learning and OER resources in your institution?
8. Are there any e-Learning enforcement policies and framework in the school?
9. What e-Learning and OER toolkits are available in your institution?
10. What are the strengths and weaknesses of the OER toolkits being used?
11. What are the challenges with use of ICT for teaching, learning and research?
12. What can be done to improve the overall teaching and learning experience in your school post-COVID?

Section B: Regulatory Agencies for Tertiary Institutions

Interviewees: Federal Ministry of Education**,** Nigerian Universities Commission**,** National Board of Technical Education (NBTE)**,** National Commission for Colleges of Education (NCCE).

1. What initiatives and policies were put in place during the COVID era to ensure sustainability of teaching and learning in tertiary institutions?
2. Are there any frameworks being developed or currently implemented to ensure that the curriculums of tertiary institutions are aligned to meet up with new teaching solutions for students?
3. Are there any collaborations with key players in the Telecommunications industry to achieve and implement SN 2 successfully?
4. What can be done to improve the overall teaching and learning experience in tertiary institutions post-COVID?

Sections C: Telecommunication Industry Regulator, ICT and Tertiary Education Development Agencies, Non-Governmental Organizations (NGOs)

Interviewees: Nigerian Communications Commission (NCC), National Information Technology Development Agency (NITDA), Civil Society Organizations, Donor Agencies.

1. What initiatives and policies were put in place during the COVID era to ensure sustainability of teaching and learning in tertiary institutions?
2. What Interventions have been provided for tertiary institutions since 2015?
3. Was any special intervention provided during the COVID era?
4. What has been the impacts of these interventions in teaching, learning and research activities in tertiary institution?
5. What aspects of the initiatives and intervention framework can be improved upon?
6. What is the sustainability plan for these interventions and initiatives?
7. What can be done to improve the overall teaching and learning experience in tertiary institutions post-COVID?

Contact Us

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