Integrity Journal of Education and Training
Volume 5(4), pages 61-72, October 2021
Article Number: C535B9E91
ISSN: 2636-5995
https://doi.org/10.31248/IJET2021.118
https://integrityresjournals.org/journal/IJET

Review

Online teaching and learning as alternative route for sustainable education during and post covid-19 era in Nigeria: challenges and prospects

Onah, Federick C., Ezebuiro, Felicia N., Ekenta, Lilian U., Onah, Ogechukwu and Okadi, Ashagwu Ojang*

Department of Agricultural Education, University of Nigeria, Nsukka, Enugu state, Nigeria.

*Corresponding author: Email: ashagwu.okadi@unn.edu.ng; Tel: +234 7066980933.

Received 26th July, 2021; Accepted 18th August, 2021

ABSTRACT: The outbreak of epidemics, pandemics and other natural calamities has become an integral component of humanity. These have produced varying effects and tended to re-write the history and the lifestyle, culture, custom and tradition of communities and nations. The COVID-19 pandemic has produced the biggest disruption of education systems in human history. The global academic calendar has been thrown into a state of disarray by the Coronavirus outbreak. Most schools from basic to universities had to shut down their doors and students returned home to their parents and together self-quarantined. Many schools, colleges, and universities discontinued face-to-face teaching and learning due to school closures thus threatening the sustainability of the education system. This paper reviewed the challenges and prospects of online teaching and learning as alternative route for sustainable education during and post covid-19 era in Nigeria. The concepts of online teaching and learning (OTL), sustainable education, the role of OTL in promoting sustainable education, challenges and prospects of OTL were discussed. It was concluded that online teaching and learning is imperative if the dream of achieving sustainable education especially during emergencies is to be achieved. It recommended among others that intensive training programmes on ICT should be provided for teachers, encourage teachers to view learning as a lifelong process against one-shot terminal learning, encourage students to use different educational apps and the ministries of education, science and technology, and communication and digital economy should take steps and install ICT and online learning infrastructure in schools.

Keywords: Covid-19, distance learning, information and communication technology, online teaching and learning, sustainable education.

INTRODUCTION

The outbreak of epidemics, pandemics and other natural calamities such as floods, cyclones, earthquakes, hurricanes, and so on, has become an integral component of human existence. The history of man is replete with these outbreaks some of which have tended to re-write the history and altered the lifestyle, culture, custom and tradition of communities and nations across the globe. The COVID-19 pandemic which is currently ravaging the entire globe has produced the biggest disruption of education systems in human history. This tragedy has also shaken up the education sector, with the fear still resonating across the education sector globally. As of April 2020, UNESCO reported that approximately 1.723 billion learners have been cut off from education due to school closures as a means to contain the spread of the pandemic, with about 191 countries implementing nationwide closures and 5 implementing local closures (UNESCO, 2020a). Over 94 per cent of the world's population of students has been affected by the closure of schools, institutions and other training facilities (The World Health Organization [WHO], 2020b; Pokhrel and Chhetri, 2021).

In Nigeria, major outbreaks of epidemics and pandemics have resulted in temporary paralysis of one sector of the

economy or the other in parts or entire country in recent times. As of May 23rd 2021, the covid-19 has affected about 166,000 people in Nigeria (TVC News, May 23rd 2021), while there was a total shutdown of economic and social activities from April 2020 to about November 2020 when gradual ease of lockdown began. Presently, people live in an atmosphere of fear as daily routines have been completely or partially altered – social distancing, wearing of the face and nose masks, regular hand washing, use of sanitisers, economic and social activities at half capacities among others. This threatens sustainable development in not only the education sector but also social, economic and political spheres.

Concept of Covid-19 and its Influence on Education

As a non-expert in epidemiology and medical science, it will be beyond the scope of this paper to delve into the origin and biology of the covid-19 virus. However, it will just be very proper to cast a cursory look at the pandemic and its effects on human activities, especially the education sector. This will enable us to propound hypotheses that will help fashion appropriate exit mechanisms from the lockdown and closure in the education sector and be better prepared for future outbreaks of epidemics, pandemics and other natural disasters.

In December 2019, the outbreak of the coronavirus disease christened Covid-19 was reported in Wuhan, China. COVID-19 is a respiratory illness with a clinical spectrum of mild to moderate disease (80%), severe disease (15%), and critical illness (5%) with an overall case fatality rate of 0.5 to 2.8% with much higher rates (3.7 to 14.8%) in octogenarians (European Centre for Disease Prevention and Control, 2020). It was declared a public health emergency of international concern by the World Health Organization on 30 January and a pandemic on 11 March 2020 (Mahase, 2020; Meng, et al., 2020; Sohrabi et al., 2020; WHO, 2020a; Wind et al., 2020; International Committee on Taxonomy of Viruses, 2020; Balkhair, 2020; Doung et al., 2020; Gardner, et al., 2020; Viner et al., 2020).

Government response to the outbreak

In the absence of any vaccine to secure the people against infection, the government encouraged the adoption of non-pharmaceutical measures to contain the virus. Nations across the world urged their citizens to adopt precautionary strategies such as regular hand washing, wearing of the face and nose masks, use of hand sanitisers, physical distancing, avoidance of mass gathering and crowded areas. The total lockdown was introduced later in a bid to curb the further spread of the virus and reduce the rate of infection. According to Sintema (2020), lockdown and stay at home strategies have been put in place as a means of flattening the curve and control the transmission of the disease.

At the global level, the United Nations Educational, Scientific and Cultural Organization (UNESCO), reported that over 100 countries implemented nationwide closures, impacting over half of the world's student population (UNESCO, 2020a). In Nigeria, Onyema et al. (2020) reported that the federal government ordered a total closedown of all schools, a decision that was largely applauded by stakeholders. Regulatory bodies in the education sector such as the National University Commission (NUC), and the National Commission for Colleges of Education (NCCE), also directed all universities and institutions under their supervision to shut down.

Effect of Covid-19 on the education sector

The impact of the closures and stay at home orders on teaching and learning has been enormous. The global academic calendar has been thrown into a state of disarray by the Coronavirus outbreak. Most schools from basic to universities were ordered to shut down their doors and students returned home to their parents and together self-quarantined (UNESCO, 2020a). Many schools, colleges, universities and other institutions of learning discontinued face-to-face teaching and learning due to school closures. Government ministries, industries, educational institutions and other sectors of economic life were shut down, with widespread disruptions of academic activities, and skills acquisition in skills training centres (Wikipedia, 2020).

The lockdown in the education sector produced negative impacts. It limits learning facilities, increases funding/debt issues, increased dropouts/loss of interest, limited education opportunities, job losses, prolonged study, learning disruption and research constraints among others, with the education sector generally impinged. According to UNESCO (2020b), school closures carry high social, educational and economic costs and the disruptions they cause touch people across communities, but their impact is particularly severe for disadvantaged persons and their families, the majority of whom are found in sub-Saharan Africa and other developing nations of the world, that do not have necessary infrastructure facilities to embark on online learning and other forms of technology-enhanced learning. Unplanned school closures can cause severe problems for students, educators, parents and society at large. Hallgarten (2020) enumerated the effects of large scale outbreaks of disease pandemic on education to include: school closures, diversion of resources and teachers, lack of at-home educational materials, reduction in the availability of education services, restriction of movements, reduced financial resources, reduction in access to education services, lack of reliable information on the progress of disease and school reopening, fear of school return and

emotional stress caused by the outbreak among others. This threatens sustainable teaching and learning in most nations, thus questioning the sustainability of the education systems globally.

SUSTAINABLE EDUCATION CONCEPTUALIZED

There seems to be no universal consensus on what constitutes sustainable education. This is because what is considered sustainable in one circumstance may not be sustainable in another. Generally, sustainable education is conceived as representing a shift in education focus that fosters and incorporates the theory and practice of sustainability. In this respect, sustainable education is seen as a transformative approach that values, sustain and realizes human potentials to attain sustainable economic, social and environmental goals. Sustainable education thus has a deep rooting in educational policy, thinking, content and practice.

Sustainable education means that the basic components of the education system such as educational policy and practices will need to be sustaining and quality-oriented, enhance the competencies and motivations of teachers, teacher educators, students, administrators and other stakeholders, and enrich the socio-environmental ecosystem of the educational institutions to deliver the desired goals and sustainable outcomes. In defining sustainable education, Claxton (2002) description of a resilient education system and resilient learner easily comes to mind. For the education system to be sustainable, it should be capable of helping the individual learner to develop certain learning skills or competencies alongside the formal curriculum. These competencies he defined as the four 'Rs':

1. Resilience: being ready, willing and able to lock on to learning.
2. Resourcefulness: being ready, willing and able to learn in different ways.
3. Reflection: being ready, willing and able to become more strategic about learning.
4. Relationships: being ready, willing and able to learn alone and with others.

Resilient learners are more apt to take on learning challenges of which the product is unsure, to continue with learning despite temporary confusion or dissatisfaction, and to recover from setbacks and failures. Sustainable education is a transformative paradigm that values, sustain and realizes the human potential concerning the need to attain and sustain social, economic and ecological wellbeing, recognizing that they must be part of the same dynamic (Sterling, 2001).

Sustainable education is that which provides an opportunity for every learner to acquire the knowledge, skills, attitudes and values necessary to shape a sustainable future. Sustainable education will require the adoption of participatory teaching and learning methods that motivate and empower learners to change their behaviour and take responsibility for the learning process. This is likely to promote competencies like critical thinking, imagining future scenarios and collaboratively making decisions.

In the context of the prevailing covid-19 scenario, sustainable education will be conceived in terms of the ability of a country's education system to ensure seamless teaching and learning at all times and under any circumstance. Such a system will ensure that teaching and learning continue under disrupted classroom situations, and interaction between teachers and learners and among learners proceed beyond the four walls of the classroom. Sustainable education in this regard can therefore only be possible through pedagogical modifications that will integrate elements of online learning in the country's education curriculum.

This will ensure sustainable, undisrupted teaching and learning especially at the secondary and tertiary levels of the education system, and forestall the eminent gaps in the labour market, as well as protect and save students, faculty members, academic staff, communities, societies, and the nation as a whole from unnecessary exposure to the risk of infection, not only from a covid-19 pandemic but from all situations that require reduction of face to face contact among the population.

CONCEPT OF ONLINE TEACHING-LEARNING

Online teaching and learning (OTL) is a concept that is closely linked to distance learning and has gradually gained ground in both developed and developing countries over the years. This concept has been associated with distance learning, and synonymously described as online learning, open learning, web-based learning, computer-mediated learning, blended learning, m-learning, among others. Notwithstanding the nomenclature, one common feature of online teaching and learning is the ability to use a computer connected to a network, which offers the possibility to learn from anywhere, anytime, at any pace, through any means. Blackboard Support defined online teaching and learning as an approach that employs internet technologies to communicate and collaborate in a given educational setup (Chaka and Nkhobo, 2019; Darby, 2020; Designing Digitally, 2019; Gannon, 2020; International Baccalaureate Organization [IBO], 2020; Palvia et al., 2018).

Online learning is learning experiences in synchronous or asynchronous environments using different devices (e.g., mobile phones, laptops, tablets, etc.) with internet access, and has the potential of making the teaching-learning process more student-centred, innovative, and more flexible. It is a pedagogical approach that ensures that teaching and learning proceeds without a face–to–face contact between teachers and learners. This is

facilitated through the deployment of information and communication technology (ICT) tools in the teaching and learning process. For distance learning institutions, online learning is a sin qua non for all matters related to teaching and learning. For regular residential institutions, it can be utilized alongside a face-to-face learning mode as part of a blended learning setup. In either case, online learning should be intentionally integrated into the overall institutional curriculum and pedagogy.

Drivers of online teaching and learning (OTL) in Nigeria

Apart from covid-19 which is currently trending, one other factor which has long threatened the sustainability of the education system in Nigeria is a generational change in the characterization of learners in response to the introduction and utilization of technologies in various spheres of human life. This is been precipitated by the advent of globalization, digitalization, the greening culture and increased internationalization which have transformed the world into a global village. Any country that fails to restructure its education system to respond to the challenges posed by these variables will likely be left behind as the wind of change blows through the sector.

The concept of generational change is used loosely in this presentation to refer to peoples' approach to technology and their introduction and utilization in education delivery over time. Gibbons (2007) and Palfrey and Gasser (2008) present generational characterization and learner behaviours as shown in Table 1.

From the characterization above, it is obvious that people belonging to different generations have different levels of exposure to technology, especially information and communications technology (ICT) (digital technology). These generations require different pedagogical approaches as deploying delivery approaches utilized for the silent generation in communicating with the net generation may prove futile and retrogressive. The Net Generation is cut on the ICT, and for any sustainable interaction to take place with this generation requires that the teacher adopts strategies that appeal to them most. Any education system that does not consider these progressive changes like the learners and the workplace runs the risk of remaining largely unsustainable.

Synchronous and asynchronous online learning environments

The synchronous learning environment is structured such that students attend live lectures, there are real-time interactions between educators and learners, and there is a possibility of instant feedback. Synchronous learning can provide a lot of opportunities for social interaction (Cojocariu et al., 2014). Amidst this deadly covid-19 spread, synchronous online platforms are needed where;

1. video conferencing with at least 40 to 50 students is possible.
2. discussions with students can be done to keep classes organic.
3. internet connections are good.
4. lectures are accessible on mobile phones and not just laptops.
5. possibility of watching already recorded lectures.
6. instant feedback from students can be achieved and assignments can be taken (Basilaia and Kvavadze, 2020).

Asynchronous learning environments are not structured for real-time interactions. In such a learning environment, learning content is not available in the form of live lectures or classes; it is available at different learning systems and forums. Instant feedback and immediate response are not possible under such an environment (Littlefield, 2018).

Major online tools for sustainable teaching and learning

Some of the online platforms commonly in use include unified communication and collaboration platforms such as Microsoft Teams, Google Classroom, Canvas and Blackboard, among others which allow the teachers to create educational courses, training and skill development programmes (Petrie, 2020). Others include virtual classroom platforms like videoconferencing (Google Hangouts Meet, Zoom, Slack, Cisco, and WebEx) and customizable cloud-based learning management platforms such as Elias, Moodle, BigBlueButton and Skype among others. These modes allow for interaction and chat, video conferencing, and file storage that keeps classes organized and easy to work. They usually support the sharing of a variety of content like Word, PDF, Excel files, audio, videos and many more. These also allow the tracking of student learning and assessment by using quizzes and the rubric-based assessment of submitted assignments.

Other online modes include Gmail, Google Forms, Calendars, G-Drive, Google Hangouts, Google Jam board and Drawings, Google Classroom, and Open Board Software (Basilaia and Kvavadze, 2020). The flipped classroom is a simple strategy for providing learning resources such as articles, pre-recorded videos and YouTube links before the class. The online classroom time is then used to deepen understanding through discussion with faculty and peers (Doucet et al., 2020). This is a very effective way of encouraging skills such as problem-solving, critical thinking and self-directed learning.

One interesting feature of some of these modes is that they allow for synchronous, real-time interaction between the teacher and the learners, as well as among learners. In addition, they provide simple, easy to use guidelines for the user to facilitate preparation, uploading and presentation of lessons without much hindrance. Basic knowledge

Table 1. Generational characterization and learner behaviours.

The silent generation 1946 (75 + years old) Digital Aliens	- Raised without modern technology - More enmeshed in the profession if they have not retired - Technology is foreign to them and often had to learn a whole new language and skills late in their careers - Defined themselves by their career and family often took a back seat to work
Baby Boomers 1946 – 1964 (75 – 56 years old) Digital Immigrants	- Formed the first technological generation with computers on the horizon - Have a single job throughout their working career, are fiercely loyal to their job, work to live and avoid making waves - Learned technology after their schooling and prefer face–to–face, process-oriented meetings - Like routines - They are auditory and visual learners - When they get a new gadget, their first step is to read the manual
Generation X 1965 – 1980 (55 – 40 years old) Digital Natives	- Were first to be computer literate - Hold multiple jobs with some working for upwards of seven different companies - Because of their mobility, they tend to challenge authorities rather than simply follow company directives - Work is not the most important part of their lives and they value their time - They are result-oriented and since they grow up with technology, they prefer electronic communication - They are spontaneous in their actions - Have little tolerance for time-intensive activities and feel strongly that meetings are a waste of time. They will prefer their boss to give them a job and stand back and let them do their work - Are tactical learners - When they get a new gadget, they just start hooking up wires and pressing buttons - To this generation, manuals are for old folks - They may prefer to communicate technologically - They will want to see your website before they have their initial session - If you don't have one, they may feel that you cannot possibly connect at their level - They will ask you immediately for your e-mail address and if encouraged at all will send e-mail messages between class sessions
The Net Generation 1980 (40 years and below) Digital Natives	- Cut their teeth on the computer, video games and the internet - They have been entangled with technology from birth - The average that they started using the computer is 3, and most sent their first email before they enter kindergarten - They live on instant messaging and communicate with friends more on IM than any other way - They multi-task constantly with the average teen talking to three people at once on IM plus doing several other tasks at the same time - They get bored easily and change jobs and careers often - Are tactile learners - When they get a new gadget, they just start hooking up wires and pressing buttons - To this generation, manuals are for old folks - They may prefer to communicate technologically - They will want to see your website before they have their initial session - If you don't have one, they may feel that you cannot possibly connect at their level - They will ask you immediately for your e-mail address and if encouraged at all will send e-mail messages between class sessions

Gibbons (2007) and Palfrey and Gasser (2008) in Yalams (2017).

of ICT, an android phone/laptop/tablet, with an internet connection is thus the only qualifications for successful utilization (Table 2).

Advantages of online teaching and learning

According to Pokhrel and Chhetri (2021), OTL has yielded positive results in most cases despite the challenges it posed to both teachers and learners. Online teaching and learning have played a crucial role during this covid-19 pandemic, helping schools and universities facilitate student learning during the global lockdown (Subedi et al., 2020), particularly among education institutions in some European and Asian countries. Teaching and learning through the online modes have become an answer for the unparalleled global disruption caused by the covid-19 pandemic in countries with technology that support such modes. It specific advantages lie in the following:

Table 2. Types and function of OTL platforms and resources.

Types of OTL platforms and resources	Functions
Zoom	Online application facilitating video and audio conferencing, webinars, live chats, screen-sharing, and other collaborative functions
Canvas	LMS supports online learning and teaching and allows for posting grades, information, and assignments online.
Blackboard (Collaborate)	Online tool offering integrated LMS and conferencing solutions
Panopto	Online lecture capture tool that enables recording of audios, videos, slides, and screen capture
Microsoft Teams	The online team owned by Microsoft integrate collaboration, communication and file offerings for virtual teams
Webex/WebEx	Online tool offering messaging, file sharing, white-boarding, video meetings, calling and more
Kaltura	Online video recording, uploading, sharing, publishing, and streaming platform
Microsoft Office	Online tool owned by Microsoft offering integrated virtual Office documents, spreadsheets and presentations, and a suite of other office applications
Google Hangouts/Meets	Online video conferencing tool that is part of Google Suite
One Drive	Cloud storage application that is part of Office
Google Drive	Cloud storage application owned by Google
Respondus	Online assessment proctoring service or system for LMS (in the form of respondus monitor or respondus lock down browser)
Box	Cloud storage tool
VoiceThread	Online platform with voice, video and text commenting capabilities
Proctorio	Online test, assessment. or examination proctoring tool
Skype	Online video calling and text messaging/chatting tool that is part of Office 365
Google Suite	Cloud-based collaboration and productivity tools (e.g., Gmail, Docs, Meet, Calendar, etc.) owned by Google
Jabber	Integrated online communications service for instant messaging, voice and video calling, conferencing, desktop sharing, etc., owned by Cisco
Moodle	Moodle (Modular Object-Oriented Dynamic Learning Environment) is a free, open-source LMS
Camtasia	Screen recording and video editing tool
Examity	Online tool offering examination and proctoring solutions
LinkedInLearning	An online educational platform that helps users discover and develop creative skills and technology skills via course videos
MyMedia	Online file manager
Piazza	An online platform enabling to engage in students' discussion forums or collaborative interactions under an instructor's guidance
Slack	Workplace chat or messaging tool
Virtual desktop	A remote desktop that users can access anytime, anywhere, from any device
Wiki	Online application allowing collaborative writing and editing of texts or documents
Adobe Creative Cloud	A suite of desktop and mobile services and apps for online creatives
BlueJeans	A platform for live video calls, video conferencing, online meetings, and screen sharing
Clickers	Response-system based instructional technologies that are capable of collecting and analysing student responses during instruction
WhatsApp	Instant messaging application
YouTube	video sharing platform
Zoom	Free online video conferencing tool
Google Hangouts	Free online video conference tool
Microsoft Teams	Free online video conferencing tool
RingCentral	Free online video conferencing tool
LogMeIn	Free online video conferencing tool
Google Drive	Free online storage & file sharing tool
Dropbox	Free online storage & file sharing tool
Box	Free online storage & file sharing tool
OneDrive	Free online storage & file sharing tool

Adapted with modifications from Soccolich (2020).

1. Accessibility - online mode of learning is easily accessible because of its wide reach. It can be accessed by rural dwellers as well as those living in remote areas where there is network coverage. It is thus ideal for disrupted classroom conditions where face-to-face contact between teachers and learners is impossible (Murgatrotd, 2020). It can be accessed at any time and at the learner's convenience by subscribing to any of the online platforms (Almohammadi et al., 2017).
2. Affordability – OTL is considered to be a relatively cheaper mode of education in terms of the lower cost of transportation, accommodation, and the overall cost of institution-based learning. The demand for basic school facilities and other on-site learning resources is reduced.
3. Flexibility - Flexibility is another interesting aspect of online learning; learners can schedule or plan their time for completion of courses available online. Online learning is flexible in terms of time and location (Murgatrotd, 2020).
4. Promotes blended learning pedagogy - Combining face-to-face lectures with technology gives rise to blended learning and flipped classrooms; this type of learning environment can increase the learning potential of the students as one reinforces the other.
5. Promote life-long learning - Students can learn anytime and anywhere, thereby developing new skills in the process leading to life-long learning. Lifelong learning as against one-shot/terminal learning is the real ingredient required for enhancing the sustainability of the education sector and promoting the employability of graduates. Lifelong learning reduces the rate of knowledge obsolesce.
6. Promotes undisrupted learning in times of crisis and emergencies – online learning mode is ideal during crisis periods which result in the shutdown of educational institutions and training centres. At the peak of the covid-19 outbreak, Europe and most other countries of the west that were worst hit by the virus experienced less disruption in their academic calendar because they already had facilities on the ground for online learning. China which is the epicentre of the covid-19 pandemic did not experience much disruption in their academic calendar compared to those experienced by the developing countries of Africa which recorded far fewer cases of the virus.
7. Catering for a wide audience and their needs – online learning caters for the special needs of the audience as each learner has the opportunity to learn at his pace. The courses and contents are widely available, while the materials remain available long after the interaction and students are at liberty to consult them at their leisure.
8. Provides immediate feedback–online learning provides an opportunity for immediate feedback, especially the synchronous environment where real- time interaction is made possible. It can share and offer teaching-learning materials in diverse formats such as slideshows, audios, videos, PDFs, e-mails, word documents and so on.
9. It is the most suitable way for self-learning. It provides a wide range of materials for the learners that covers almost all topics and doubts (Bajaj and Sharma, 2018). It provides clear, easy, gradual instructions for better understanding of the learners, thus promote individualized learning.

Challenges of online teaching and learning

Online learning is wrought with enormous challenges and criticisms but according to Carey (2020), the major headache for educationists and policymakers at this critical period should not be on the potentials of online teaching-learning methods to provide quality education, but should rather focus on how academic institutions will be able to deploy online learning in the magnitude that is required now, for online learning has emerged as a victor amidst the covid-19 crisis. Specific challenges include:

1. Weakness of online teaching and learning infrastructure – there is a lack of online teaching and learning infrastructure in most Nigerian schools and homes. When the federal ministry of education advised schools and institutions to adopt online learning during the lockdown, only a few private schools could afford to comply while a large majority of public institutions of learning could not because facilities and infrastructure for online teaching and learning were not in place. Even when some schools attempted to deliver instructions using platforms such as email, WhatsApp, and zoom, most students could not afford to cope because students do not have the means to access the materials such as a laptop/tablet or a good phone. The majority of students do not have access to smartphones or TV at home. A non-disruptive interactive teaching environment would mean accessibility to computer and internet connection, where the student joins the team meeting without any disruptions.
2. Skills challenge - the limited exposure of teachers to online teaching skills. Most teachers often have inadequate or inappropriate skills and experiences with using digital technologies and are often provided with inadequate training. According to Ungar and Baruch (2016), the most significant hindering factors for the implementation of ICT related pedagogy among teacher educators are lack of time and insufficient knowledge and skills. Teacher training institutions find it challenging to design ICT-rich lessons and provide adequate feedback to support teachers (Tondeur et al., 2016). Not only the teachers but the students are also facing challenges due to their deficiency of proper

learning attitude, lack of suitable materials for learning, more involvement in classroom learning, incapability of self-discipline, and the inadequate learning environment at some of their homes during self-isolation (Brazendale et al., 2017).

3. Non-conducive environment for learning at home. There are challenges around physical workspaces conducive to different ways of learning. There are distractions in most homes as students have the responsibility of attending to their ailing parents/grandparents/family members and take them to hospitals. When they are back at home, it becomes difficult for them to keep abreast with the lessons because they are already exhausted and tired.
4. Lack of parental guidance, especially for young learners - this is especially a challenge for parents who are working.
5. Reduced contact and interaction with teachers – online teaching and learning reduce the level of interaction between teachers and learners in a real-time situation, especially when asynchronous OTL modes are adopted. This makes it difficult for the teacher to monitor the progress of learners, and according to Sintema 2020), produce negative impact on learners' academic performance in both year-end and internal examinations due to reduced contact hours for learners and lack of consultation with teachers when facing difficulties in learning/understanding.
6. Negative social, economic and psychological influence of isolation on students - School time is often fun for the children and also raises social skills and awareness among the children. Isolating students from a normal school schedule has some economic, social and psychological repercussions on the life of the students.
7. Poor Internet connectivity: Most rural communities are not connected to any communication network, thus have no internet coverage. Even where there are internet facilities, the cost of the data package is comparatively high against average income earners, and continuous access to the internet is a costly business for the farming community. To compound this challenge is the fact that there is no or less income for a huge population due to the closure of businesses and offices during periods of lockdown.
8. Technical challenges - Users can face many technical difficulties that hinder and slow down the teaching-learning process (Favale et al., 2020)

Dhawan (2020) presents a synopsis of the challenges to the use of online tools for effective teaching and learning to include learner's low capability and confidence level; poor time management on the part of both teachers and the students; distractions, frustration, anxiety and confusion arising from parents and family members, poor connections and inability to seek immediate clarifications especially with asynchronous tools; lack of personal/ physical attention; unequal distribution of ICT infrastructure; digital illiteracy; digital divide; technology cost and obsolescence.

Strategies for promoting online learning for sustainable teaching and learning during and post-Covid 19 pandemic

1. Re-profiling of the mindsets and attitudes of teachers **-** For successful introduction and adoption of online teaching-learning in Nigeria, there will be the need for re-profiling of teachers and teacher education programmes. This will ensure that teachers acquire favourable mindsets, attitudes and capability to accept and utilize online-based pedagogical approaches as pedagogical innovations and make conscious efforts to acquire needed skills. There is a need for a paradigm shift and a re-orientation of teachers on the perception of their roles and position in the teaching-learning process. Such re-profiling will require that the teacher transforms from current profile to expected profile as shown in Table 3.
2. Development of ICT infrastructure in institutions of learning – the success of online learning depends largely on the level of development of ICT infrastructure not only in schools, colleges, universities and other training institutions but also in rural and urban communities. Infrastructure such as electricity, communication networks, internet facilities, and ICT centres need to be adequately developed to facilitate teachers and students access to online resources.
3. Proper assessment of staff and students' readiness - staff and student readiness for online teaching and learning need to be adequately gauged and needed support provided accordingly. Their level of ICT skills and their attitude towards online learning needs to be properly assessed and needed support provided to raise their skills level and readiness. Learners with a conservative attitude may find it difficult to adapt and adjust, whereas the learners with a progressive mindset quickly adapt to a new learning environment. The use of suitable and relevant pedagogy for online education largely depends on the expertise and exposure to information and communications technology (ICT) for both educators and learners.
4. Designing online tools to meet the personal characteristics and special needs of the learners such as age groups and the physically challenged: These according to Doucet et al. (2020) and Basilaia and Kvavadze (2020) require different approaches to online learning. Understanding the special needs of learners will enable the packaging of online resources to suit special needs and abilities. The difficulty, length and quality of teaching material should match the student's online-learning behavioural characteristics

Table 3. Teachers' transformation.

Current profile	Expected profile
A teacher who knows all	A teacher who is actively seeking to know how to know – learning to learn
Talking teacher	Listening teacher
A teacher who is a drum tank of knowledge and information	A teacher who is a co-seeker of knowledge, awareness and insight
A teacher who tells the answer	A teacher who provides multiple ways of solving a problem
Teacher who dictates	A teacher who encourages the search for solution/knowledge
A teacher who promotes solo learning	A teacher who build up team spirit

and academic readiness.

5. Minimize technical difficulties and hitches – this can be achieved through prerecording video lectures, testing the content, and always keeping Plan B ready so that the teaching-learning process cannot be hampered. Online courses should be made dynamic, interesting, and interactive. It is also proper to adopt a mix of both synchronous and asynchronous learning environments so that learners can easily switch and continue interaction with the materials when real-time interaction is disrupted. For the accomplishment of large-scale online education, it is very essential to generate advanced contingency plans to overcome technical problems like traffic overload in the online educational platforms.
6. Proper monitoring of students' activities on online platforms - Teachers should set time limits and reminders for students to make them alert and attentive. Efforts should be made to humanize the learning process to the best extent possible. Personal attention should be provided to students so that they can easily adapt to this learning environment. Social media and various group forums can be used to communicate with students. A mix of online modes should be adopted in order to enable students to practice and hone their skills.
7. Design online resources to facilitate interactions – according to Partlow and Gibbs (2003), online programs should be designed in such a way that they are creative, interactive, relevant, student-centred, and group-based. Educators must spend a lot of time in making effective strategies for giving online instructions. Effective online instructions facilitate feedback from learners, make learners ask questions, and broaden the learner horizon for the course content (Keeton, 2004).
8. Need for pedagogical reorientation - Institutions must focus on pedagogical issues and emphasize collaborative learning, project and problem-based learning through online instructions (Kim and Bonk, 2006). Teachers must be encouraged to unlearn obsolete practices and relearn innovative pedagogies to ensure that teaching and learning stay relevant to societal needs.
9. Training for staff and students - Bao (2020) and Filius et al. (2019) expressed the need to provide adequate training for staff and students. This is necessary because going entirely online requires significant planning and teachers must be adequately prepared for this task. Yang and Li (2018) emphasizes the need for institutions of learning to take the students and instructors through online teaching and training in order to build their capacity.
10. Curriculum modification – for the integration of online delivery techniques in the education sector to be effective, the curriculum must be modified to include online pedagogical platforms in the methodology and delivery system at various levels of the education system.
11. Provide mechanisms for timely feedback: prompt knowledge of the result of online experience will spur the learners for greater engagement. Timely feedback should be shared by the educators with their students to motivate them.

Prospects of online learning in promoting sustainable education

Online teaching and learning have enormous potentials in enhancing the sustainability of the education system in both developed and developing countries. Its prospects however increase with the level of development of ICT infrastructure, and related variables such as ICT literacy levels of teachers, learners, parents and other stakeholders in the education sector. Since OTL is capable of guaranteeing seamless teaching and learning under disrupted classroom situations where face-to-face contact between teachers and learners is practically impossible as is the case with the global shutdown of economic and social activities during the covid-19 outbreak, it is thus likely to promote the quality of knowledge and skills acquired by graduates.

With the rapid changes in the world of work due to the impact of globalization, increased internationalization and the greening of work processes, OTL has the prospects of enhancing the employability of graduates by ensuring that knowledge and skills are acquired using prevalent methods and processes in the world of work. Further, the possibility of learners to interact with teachers, fellow learners, and resources from other parts of the world breaks the traditional boundaries or limits imposed on the

learners by the four walls of the classroom. Since sustainable education is that which provides an opportunity for every learner to acquire the knowledge, skills, attitudes and values necessary to shape a sustainable future, online learning has the prospects of providing participatory teaching and learning modes that motivate and empower learners to change their behaviour and take responsibility for the learning process, thus promote competencies like critical thinking, imagining future scenarios and making decisions in a collaborative way.

CONCLUSION

With continued havoc been wrecked by the covid-19 pandemic, and the recent resurgence of a new strain of the virus considered more virulent, online teaching-learning is becoming no more an option, but rather a necessity. The possibility of a return to full-time face to face instruction may seem to be mere wishful thinking. All institutions of learning and educators at all levels are therefore challenged to key into the opportunity provided by technology and embrace online teaching-learning to sermonize learners at any time, in any part of the world not minding the level of institutional closure or lockdown. Institutions must scramble different options of online pedagogical approaches.

The traditional face–to–face lecture method of teaching has become a habit for most teachers such that they may be tempted to resist any innovation. But in the midst of the present Covid-19 crises, there is no other option than to adjust to the dynamic situation and accepting the change. The long-term benefits for learners, parents, teachers/educators, school administrators/proprietors, and the education sector as a whole could spring surprises for stakeholders. The message we need to bear in mind is the need to embrace e-learning technology before another disaster strikes, and the children may not have the opportunity to acquire formal education while the gap between the haves and have not will continue to grow. While recognizing the fact that going entirely online requires significant planning and investments from all sectors, it will be very appropriate that we start doing something than doing nothing at all.

Recommendations

From the review, the following recommendations are made:

1. There should be intensive training programmes on ICT for teachers – there is a need to provide training for teachers on basic ICT knowledge because students cannot effectively utilize OTL tools unless teachers have the capability to deploy and use the same. There is a need for teachers to learn not only how to use new technologies but also how to deeply integrate them into their curriculum to meet the changing needs of their students as well as to train, plan, and stimulate online interactions. Educators and students should be provided with suitable training to enhance their knowledge and skills that are required for the maximum usage of technological devices, E-learning tools, educational apps and other online platforms.
2. Teachers should be encouraged to view learning as a lifelong process against one-shot terminal learning. According to UNESCO Report as cited in UNESCO (2020a), this will enable teachers to unlearn obsolete ideas and techniques, relearn emerging ones and take greater responsibility for the educational systems, institutions and educators to develop competencies in order to address the challenges of the 21st century.
3. Students should be encouraged to use different educational apps and should be provided with easy, effective and interesting study materials by the educators to draw their attention towards E-learning.
4. The ministries of education, science and technology, and communication and digital economy should take steps and install ICT and online learning infrastructure in schools. Internet facilities should be provided in schools to enable teachers to prepare and deliver online training resources.
5. Trained personnel should be provided by the ministries of education to mount the ICT centres in various schools. This will help enhance the utilitarian value of ICT centres and the rate of dilapidation of the facilities.
6. ICT proficiency should be an integral component of the requirements for hiring teachers at various levels of the school system, as well as make ICT training compulsory for all teachers who are already in the system as a necessary first step to the acquisition of skills for implementation of online instructional delivery.
7. Awareness should be created among parents and guardians on the need to encourage their wards to engage in online learning by creating a conducive environment at home, provide laptops computers or mobile phones and data bundles for their wards.
8. Curriculum planners should integrate online teaching-learning pedagogies in the curriculum of all subject areas.
9. A mixed variety of platforms should be adopted for online instructional delivery. For instance, Google (2020) recommended that the Google classroom platform can be integrated into the Google meet system for creating laboratory practices for STEM courses. Other suitable educational platforms can also be integrated into the Google meet system for lab practices.

CONFLICT OF INTEREST

Authors declare that they have no conflict of interest.

REFERENCES

Almohammadi, K., Hagras, H., Alghazzawi, D., & Aldabbagh, G. (2017). A survey of artificial intelligence techniques employed for adaptive educational systems within e-learning platforms. *Journal of Artificial Intelligence and Soft Computing Research*, *7*(1), 47-64.

Bajaj, R. V., & Sharma, V. (2018). Smart education with an artificial intelligence-based determination of learning styles. *Procedia Computer Science*, 132, 834-842.

Balkhair, A. A. (2020). COVID-19 Pandemic: A New Chapter in the History of Infectious Diseases *Oman Medical Journal*, 35(2), e123.

Bao, W. (2020). COVID -19 and online teaching in higher education: A case study of Peking University. *Human Behavior and Emerging Technologies*, *2*(2), 113-115.

Basilaia, G., & Kvavadze, D. (2020). Transition to online education in schools during a SARS CoV-2 coronavirus (COVID-19) pandemic in Georgia. *Pedagogical Research,* 5(4), em0060.

Brazendale, K., Beets, M. W., Weaver, R. G., Pate, R. R., Turner-McGrievy, G. M., Kaczynski, A. T., Chandler, J. L., Bohnert, A., & von Hippel, P. T. (2017). Understanding differences between summer vs. school obesogenic behaviors of children: the structured days hypothesis. *International Journal of Behavioral Nutrition and Physical Activity*, 14, Article number 100.

Carey, K. (2020). Is everybody ready for the big migration to online college? Actually, no. The New York Times. Retrieved from https://www.nytimes.com/2020/03/13/upshot/coronavirus-online-college-classes-unprepared.html.

Chaka, C., & Nkhobo, T. (2019). Online module login data as a proxy measure of student engagement: The case of myUnisa, MoyaMA, Flipgrid, and Gephi at an OdeL institution in South Africa. *International Journal of Educational Technology in Higher Education,* 16, Article number 38.

Claxton, G. 2002. *Building learning power: Helping young people become better learners.* Bristol: TLO.

Cojocariu, V. M., Lazar, I., Nedeff, V., & Lazar, G. (2014). SWOT anlysis of e-learning educational services from the perspective of their beneficiaries. *Procedia-Social and Behavioral Sciences*, 116, 1999-2003. https://www.designingdigitally.com/blog/common-online-learning-terms-definitions

Designing Digitally (2019). Common online learning terms and definitions.

Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crises. *Journal of Educational Technology,* 49(1), 5-22.

Doucet, A., Netolicky, D., Timmers, K., & Tuscano, F. J. (2020). *Thinking about pedagogy in an unfolding pandemic:* An Independent Report on Approaches to Distance Learning during COVID-19 School Closure. Work of Education International and UNESCO. Retrieved from https://learningportal.iiep.unesco.org/en/library/thinking-about-pedagogy-in-an-unfolding-pandemic-an-independent-report-on-approaches-to.

Doung, V., Luo, J., Pham, P., Yang, T., & Wang, T. (2020). The ivory tower lost: How college students respond differently than the general public to the COVID-19 pandemic. arXiv: 2004.09968v1.

European Centre for Disease Prevention and Control (2020*). Novel coronavirus disease 2019 (COVID-19) pandemic: increased transmission in the EU/EEA and the UK* sixth update – 12 March 2020. Stockholm: ECDC; 2020. Retrieved from https://www.ecdc.europa.eu/sites/default/files/documents/RR-A-sixth-update-Outbreak-of-novel-coronavirus-disease-2019-COVID-19.pdf.

Favale, T., Soro, F., Trevisan, M., Drago, I., & Mellia, M. (2020). Campus traffic and e-Learning during COVID-19 pandemic. *Computer Networks*, 176, 107290.

Filius, R. M., Kleijn, R. A. M., Uijl, S. G., Prins, F. J., Rijen, H. V. M., & Grobbee, D. E. (2019). Audio peer feedback to promote deep learning in online education.*Journal of Computer Assisted Learning*, *35*(5), 607-619.

Gannon, K. (2020). *Lessons from moving a face-to-face course online.* The Chronicle of Higher Education. Pp. 24-27.

Gardner, J. M., Willem, L., van der Wijngaart, W., Kamerlin, S. C. L., Brusselaers, N., & Kasson, P. (2020). Intervention strategies against COVID-19 and their estimated impact on Swedish healthcare capacity. medRxiv, 1-33.

Gibbons, S. (2007). Redefining the roles of information professionals in higher education to engage the next generation. *Paper presented at EDUCAUSE*, Australasia.

Hallgarten, J. (2020). *Evidence on efforts to mitigate the negative educational impact of past disease outbreaks*. K4D Helpdesk Report 793. Reading, UK: Education Development Trust.

International Baccalaureate Organization (2020). *Online learning, teaching and education continuity planning for schools*. Retrieved from https://www.ibo.org/globalassets/news-assets/coronavirus/online-learning-continuity-planning-en.pdf

International Committee on Taxonomy of Viruses (2020). The species severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. *Nature microbiology*, *5*(4), 536-544.

Keeton, M. T. (2004). Best online instructional practices: Report of phase I of an ongoing study. *Journal of Asynchronous Learning Networks*, 8(2), 75-100.

Kim, K. J., & Bonk, C. J. (2006). The future of online teaching and learning in higher education. *Educause quarterly*, 29(4), 22-30.

Littlefield, J. (2018). The difference between synchronous and asynchronous distance learning. Retrieved from https://www.thoughtco.com/synchronous-distance-learning-asynchronous-distance-learning-1097959.

Mahase, E. (2020). China coronavirus: WHO declares international emergency as death toll exceeds 200. *British Medical Journal (Online)*, *368*.

Meng, L., Hua, F., & Bian, Z. (2020). Coronavirus disease 2019 (COVID-19): Emerging and future challenges for dental and oral medicine. *Journal of Dental Research*, 99(5), 481-487.

Murgatrotd, S. (2020). *COVID-19 and Online learning.* Alberta, Canada.

Onyema, E. M., Eucheria, N. C., Obafemi, F. A., Sen, S., Atonye, F. G., Sharma, A., & Alsayed, A. O. (2020). Impact of Coronavirus pandemic on education. *Journal of Education and Practice*, 11(13), 108-121.

Palfrey, J. G., & Gasser, U. (2008). *Born digital: Understanding the first generation of digital natives.* New York; Basic Books.

Palvia, S., Aeron, P., Gupta, P., Mahapatra, D., Parida, R., Rosner, R., & Sindhi, S. (2018). Online education: Worldwide status, challenges, trends, and implications. *Journal of Global Information Technology Management*, 21(4), 233-241.

Partlow, K. M., & Gibbs, W. J. (2003). Indicators of constructivist principles in internet based courses. *Journal of Computing in Higher Education*, 14(2), 68-97.

Petrie, C. (2020). *Spotlight: Quality education for all during COVID-19*. United Nations. Retrieved from https://hundred.org/en/collections/quality-education-for-all-during-coronavirus.

Pokhrel, S., & Chhetri, R. (2021). A literature review on impact of COVID-19 pandemic on teaching and learning. *Higher Education for the Future,* 8(1) 133-141.

Sintema, E. J. (2020). Effect of COVID-19 on the performance of grade 12 students: Implications for STEM education. *EURASIA Journal of Mathematics, Science and Technology Education*, 16(7), em1851.

Sohrabi, C., Alsafi, Z., O'neill, N., Khan, M., Kerwan, A., Al-Jabir, A., Iosifidis, C., & Agha, R. (2020). World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). *International Journal of Surgery*, *76*, 71-76.

Sterling, S. (2001). *Sustainable education – Re-visioning learning and change.* Schumacher Society Briefing No. 6. Dartington: Green Books.

Subedi, S., Nayaju, S., Subedi, S., Shah, S. K., & Shah, J. M. (2020). Impact of E-learning during COVID-19 pandemic among nursing students and teachers of Nepal. *International Journal of Science and Healthcare Research*, 5(3), 68-76.

Tondeur, J., van Braak, J., Siddiq, F., & Scherer, R. (2016). Time for a new approach to prepare future teachers for educational technology use: Its meaning and measurement. *Computers & Education*, 94, 134-150.

UNESCO (2020a). COVID-19 *educational disruption and response.* Retrieved April 21, 2020 from https://en.unesco.org/news/covid-19-educational-disruption-and-response.

UNESCO (2020b). UNESCO: 290 million students stay home due to coronavirus. Retrieved April 21, 2020 from https://learningenglish.voanews.com/a/unesco-290-million-students-stayhome-dueto-coronavirus/5317148.html.

Ungar, O. A., & Baruch, A. F. (2016). Perceptions of teacher educators regarding ICT implementation. *Interdisciplinary Journal of e-Skills and Lifelong Learning*, 12, 279-296.

Viner, R. M., Russell, S. J., Croker, H., Packer, J., Ward, J., Stansfield, C., Mytton, O., Bonell, C., & Booy, R. (2020). School closure and management practices during coronavirus outbreaks including COVID-19: A rapid systematic review. *The Lancet Child & Adolescent Health*, 4(5), 397-404.

Wikipedia (2020). Impact of the 2019–20 coronavirus pandemic on education. Retrieved April 21, 2020 from https://en.wikipedia.org/wiki/Impact_of_the_2019–20_coronavirus_pandemic_on_education

Wind, T. R., Rijkeboer, M., Andersson, G., & Riper, H. (2020). The COVID-19 pandemic: The 'black swan'for mental health care and a turning point for e-health. *Internet Interventions*, 20, 100317.

World Health Organization (2020a). Rolling updates on coronavirus disease (COVID-19). Retrieved from https://www.globalpandemicnetwork.org/covid-19/international-business-and-global-virtual-teams/rolling-updates-on-coronavirus-disease-covid-19/

World Health Organization (2020b). Coronavirus *disease 2019 (COVID-19) Situation Report –80.* Retrieved from https://apps.who.int/iris/handle/10665/331778

Yalams, S. M. (2017). Refocusing TVET instructional delivery in Nigerian schools in the digital era. UNESCO-UNEVOC UNIT: Centre for Technical, Vocational Education, Training & Research.

Yang, F., & Li, F. W. (2018). Study on student performance estimation, student progress analysis, and student potential prediction based on data mining. *Computers and Education*, 123, 97-108.