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COVID-19 Pandemic and Lockdown on Education: Proposing an 'e-Pedagogy on the Go' System as an Alternative e-Teaching and Learning Platform During and in the Post-Pandemic Era

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Abstract

One of the most significant changes in the ecology of information and communication is the internet. It not only enables contact and engagement in real time across time zones, but also successful social growth and crisis management, including the promotion of distance learning, especially during the COVID-19 epidemic and the associated compartmentalisation of education systems. This disruption to education poses a threat to learning in Nigeria, and the consequences of continued closure of schools and academic programmes could have detrimental consequences for students, parents and the country. Students can be encouraged to explore their own interests and actively learn during lockdowns by using internet-enabled ICT as a resource. However, this has not been the case in the Nigerian education system. This work aims to provide a simple, cost-effective and alternative pedagogical system for use during and after the epidemic, especially for open schools and institutions. This study provides an e-learning/e-teaching system based on the use of a computer and android smartphone apps to mitigate the adverse effects of the prolonged lockdown on the Nigerian education system, or what is referred to in this study as 'edu-lockdemic'. The proposed system was developed as a framework based on a comprehensive review of existing literature and is designed to enable heads of institutions monitor school and academic teaching and learning activities in a virtual learning area known as "CT-learning area". Policy recommendations are made in the conclusion.

Keywords: alternative pedagogy, COVID-19, e-learning, ICT, internet, online pedagogy, pandemic, Nigeria.

1. Introduction

On 30 January 2020, the Director-General of the World Health Organisation (WHO) declared COVID-19 2019 a matter of public health of global concern. The Federal Ministry of Health reported the first verified case of COVID-19 in Lagos State, Nigeria on 27 February 2020. "The multi-sector coronavirus preparedness team, led by the Nigeria Centre for Disease Control [NCDC], has immediately activated its National Emergency Operations Centre [NEOC]," the health minister said in the same letter. Nigeria has seen more than 12,233 cases nationwide in less than four months. The figures are updated daily by the NCDC ([Anumudu, Ibrahim, 2020](#)).

Recently, a number of government directives have been issued to combat sanctions and structural changes across the country to stop the spread of COVID-19. They range from the closure

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of international airports to the closure of all schools across the country and the lockdown declared in several key states – Lagos, Abuja, Kano and Ogun - for several weeks. The Federal Ministry of Education issued a circular on 19 March 2020, authorising the closure of all schools for one month from Monday 23 March 2020, to prevent the spread of COVID-19, which affects nearly 46 million students and children across the country (Ejeh et al., 2020; Obiakor, Adeniran, 2020).

While the COVID-19 epidemic has led to a partial or complete “lockdown” in many countries, academic activities can continue because of the lockdown. Many studies (e.g., Ho et al., 2021; Ifijeh, Yusuf, 2020; Zawacki-Richter, 2021) have shown the importance of using electronic media in distance learning programmes. However, the use of electronic media in distance education programmes is not only focused on digital technologies, but also includes physical administration. According to Dreesen et al. (Dreesen et al., 2020) and UNESCO (UNESCO, 2020), learning and access to essential school services will be disrupted for a record number of students and pupils in Nigeria during the shutdown, with school lockdowns affecting approximately 46 million students and pupils nationwide, including more than 91 % of primary and secondary school students (Adarkwah, 2021; Dreesen et al., 2020).

As a result of the outbreak, Nigerian education was disrupted in a short period of time and students’ access to schools across the country was restricted. The epidemic COVID-19 poses significant problems for the government, students and parents as it exposes and potentially exacerbates existing deficiencies in the education system (Obiakor, Adeniran, 2020). As the country grapples with these problems, a crucial question arises: is the Nigerian education system designed to adapt quickly to changing circumstances? Given the current global circumstances, the country’s ability to ensure continuous learning will depend primarily on its ability to quickly harness existing technologies, create appropriate infrastructure and mobilise partners to develop alternative education programmes (Owolabi et al., 2013).

Education is the conscious transmission of the knowledge, values and skills acquired by society from one generation to the next through institutions. Consequently, an adequate education system is necessary for the advancement of individuals in society and the economy. The impact of repeated lockdown of schools and academic programmes on student learning can have detrimental consequences for students, parents and the nation in Nigeria. This report analyses the immediate and long-term effects on the Nigerian education system, proposes an online media technology system as a means of e-learning/e-teaching, and makes recommendations on how the government could mitigate the disruption. In addition, this study looks to the future by suggesting how the tragic crisis can be used as an opportunity to address a number of supply-side education issues in the run-up to the COVID-19 pandemic in Nigeria (Owolabi et al., 2013).

Moreover, education is a panacea for liberating people from enslavement and universities serve as the nation’s “brain box” as they play a key role in helping countries move from poor to developed status (Oyeniran et al., 2020). The study presented a system that allows professors and students to participate in academic activities during graduation, while the institute management can monitor the ongoing academic activities using open-source computer and robotic applications.

The COVID-19 pandemic has begun to affect the education system, particularly basic education, and especially for pupils, students and parents of public schools. On the other hand, pupils, trainees and students can use effective resources such as information and communication technology (ICT) to explore things that interest them and actively learn during the lockdown. It is important to maximise the impact of online media, such as e-learning/e-teaching systems that promote continuous learning (Ibrahim et al., 2017; Nguyen, 2021). Therefore, this paper presents the ICT learning system as a technology-based teaching tool for schools, universities and colleges across the country to be explored during the COVID-19 insurance process. The proposed system was developed to reduce the adverse effects of educational disruption caused by the 1990 disease outbreak.

The proposed online media-based system would include computer and Android mobile applications that will be cost-effective and easy to use. In addition, this system is expected to enable teachers and lecturers to easily share and interact with syllabi and e-lecture notes for students and pupils in e-classrooms known as ICT learning areas, as well as provide schools and classroom administration with the ability to monitor academic activities.

The Nigerian education system is unable to adapt to the challenge COVID-19 and the country will continue to struggle in this area for the foreseeable future. However, compared to public schools, public school students face a disproportionate socio-economic burden. While several public schools have started distance education programmes and are taking advantage of the many

opportunities for online learning in the international community, the government has not yet announced formal plans to provide distance education, especially for public schools, due to lack of funds and inadequate planning. This means that these students in public schools currently have no formal learning plans and may not know what they are learning at all (Ibrahim et al., 2017; Onyema et al., 2020). By developing and proposing a cost-effective ICT learning system, this study offers a way to end the disruption to education caused by the pandemic.

COVID-19 Pandemic and Internet Access in Nigeria: according to the Nigerian National Centre for Disease Control (NCDC), as of 24 November 2021, there were 3,479,682 tested samples of COVID-19, 213,677 confirmed cases, 3,906 active cases, 206,797 discharged cases and 2,974 deaths. Since the first batch of COVID-19 vaccines was delivered in Nigeria on 2 March 2021, at least 9,483,387 doses of vaccine have been administered so far, equivalent to about 2.4 % of Nigeria's 200 million population if each person requires two doses (Reuters COVID-19 Tracker, 2021 November 24). "As COVID-19 emerged around the world, many countries (including Nigeria) closed public facilities such as schools, workplaces and international borders to contain the spread of the virus" (Reuters COVID-19 Tracker, 2021 November 24). So, by November 2021, no less than 6 million Nigerians have been vaccinated (NTA Network News at 9, 2021 November 23). Figure 1 shows a diagram of how school closure measures were implemented during the pandemic in Nigeria. At the beginning of 2021, the lockdown was still ongoing. The lockdown of schools and universities was officially lifted on 12 October 2020 after a long lockdown of about six months (Dessy et al., 2021 July 15).



Fig. 1. T A chart showing measures school lockdown measures implemented during the pandemic in Nigeria (Source: Reuters COVID-19 Tracker, 2021 November 24)

About 60 % of Nigerians are offline, according to the Digital World Outlook report cited in Smith (Smith, 2020). Statistics on mobile phones, which can also be used for e-learning/e-teaching, are more optimistic. According to the report, about 169.2 million Nigerians (83 %) have access to mobile phone connections; however, only half of them, or about 84.5 million, live in urban areas. The population that has access tends to be socio-economically better off and live in cities. Most of them are private school students who already have a head start over their peers in public schools. The integration of ICT-enhanced learning will be limited for children from low-income families who have limited access to the Internet and computers. Most of them live in rural areas where indigenous languages predominate over English (Kalas, 2010; Garanina, 2020).

Access to vulnerable populations in Nigeria requires the use of various educational media, from television and radio to mobile SMS platforms, which are more accessible to the poor. With more than 80 % of the adult population having access to radio and mobile phones, most of the children left behind will be able to access instruction delivered through these mediums. But while online platforms enable face-to-face learning, other media for service delivery require a centralised system as well as coordination between the three levels of government and the private sector (owners of the media system). Here, the role of the Ministry of Education will be critical beyond developing traditional policies and regulations. Education officers can help deploy and use these tools in the states, while the federal government coordinates state efforts by filling capacity and funding gaps. The government could benefit from the experience of Sierra Leone, where the Ebola crisis led to the closure of schools for almost nine months (Harrism, 2009; Smith, 2020). To reach the most vulnerable and marginalised children, the government of Sierra Leone has used radio and television to “teach lessons”. Whatever strategy the government chooses, it must ensure that it is cost-effective (at least available at home) and easy to use (children and their parents have some prior knowledge or can easily learn to use it).

Unequal access to ICT-enhanced learning may have a negative impact on further exacerbating disparities in learning outcomes due to social and economic conditions and the gap between urban and rural areas. As school lockdowns are “currently indefinite”, pupils, trainees and students may be left behind, especially pupils with “learning difficulties and those living in fragile and conflict-affected regions have even worse prospects” (Obiakor, Adeniran, 2020: 3). This poses a major challenge to inequality in education in relation to the technological system with the accompanying “income-based digital divide”. How can Nigeria “harness” the technology currently in use to support “marginalised” students during the widespread and protracted lockdown or ‘lockdemic’? If this challenging question is not answered, the lockdown demy could worsen “the gap in the quality of education and unintended socio-economic equality” (Smith, 2020).

The Role of ICT in Teaching and Learning: Information and communication technology (ICT) is a type of electronic technology that enables people to shop and retrieve data (Al-Rahmi, 2020; Nkechinyere, 2020). ICT plays such an important role in our daily lives that it is almost impossible to spend a day without using some forms of ICT such as mobile phones, smartphones, laptops and the internet. Technology has made “teaching and learning” in education easier, more accessible and more productive. It helps teachers and administrators track student academic progress. It also allows students to learn in a fun and accessible way. Technological research and educational materials are more accessible, regardless of time and place. To enhance teaching and learning, teachers and students now have access to Massive Open Online Courses (MOOCs). Students have become digital natives through the digital revolution. Today, young people want to learn via mobile devices and through social media. As technology is an integral part of their lives, it has become the most convenient way for students to learn. With technology, there are fewer limits to learning and today’s generation of students seem to be quite comfortable with digital skills. Technology not only facilitates student-centred learning, but it also encourages student curiosity, teaching and innovation in learning (Onyema et al., 2020: 124; Garanina, 2020).

Previous studies have shown that the use of ICT in teaching and learning increases student engagement and improves learning outcomes. For example, Francis and Shannon (Francis, Shannon, 2013), Dawson et al. (Dawson et al., 2010), Harandi (Harandi, 2015) and Agbetuyi and Oluwatayo (Agbetuyi and Oluwatayo, 2012) have described ICT as a critical resource as its absence can lead to lack of knowledge and poor decision-making. According to Diane and Steven (Diane, Steven, 2007: 165), there is an evolving relationship between education and technology, and that evolving pedagogical systems “take advantage of newly designed or emerging technologies.”

As Oliveira, Behnagh, Ni, Mohsinah, Burgess and Guo (Oliveira et al., 2019) noted, emerging technological artefacts such as computer simulations, virtual labs, mobile devices, robots, games, painting and digital photography enhance learners’ experiences. Bao (Bao, 2020) and Yakubu and Dasuki (Yakubu, Dasuki, 2019) argue that “emerging technologies have spawned the exponential development of software and AI-powered cloud-based technology aimed at adapting learning methods and designing curricula to match each learner’s ability to progress at their own pace.” Hemant (Hemant, 2018), on the other hand, asserts that technology plays a critical role in making teaching and learning activities more meaningful and is one of the most effective tools for advancing knowledge and skills. As the need for home-based teaching and learning increases due to the COVID-19 pandemic, technology will play a key role in the present and future of teaching

and learning in Nigerian schools and educational institutions. Teachers should also adopt more flexible pedagogical approaches that support students (Onyema et al., 2020).

Nearly 1.5 million Nigerian students and 27 Nigerian federal universities were connected to the internet in 2015 by the Ministry of Communications and Digital Economy in collaboration with the Ministry of Education and the World Bank's STEP-B project (Samson, 2015). This is a milestone in the Nigerian education system as it demonstrates efforts to introduce students to information and communication technologies and the internet. More than 1,500 (1,522) secondary schools have been equipped, resulting in an estimated 1,458,880 million students being introduced to ICT, according to the ministry. It was also revealed that the National Information Technology Development Agency (NITDA) has launched the Third Enterprise Access Project (TIAP), which provides desktop computers, printers and wireless network facilities to selected educational institutions across the country (Samson, 2015).

With the outbreak of COVID-19 (which has devastated and crippled various sectors of the world with devastating and seemingly long-lasting consequences), many African countries, including Nigeria, were forced to close schools and higher institutions as part of containment measures against the spread of the virus. This left educational institutions with no choice but to look forward to the use of ICT for teaching and communicating with students (Onyema et al., 2020; Garanina, 2020). However, this has mainly highlighted the gap between the educational institutions in Nigeria and the countries with much better ICT infrastructure and the educational institutions within the country with better infrastructure and implementation than others such that the majority as well as the students within the university itself who are challenged by the financial situation to resist the power of the internet or network in relation to urban or rural developments. Despite the struggle to apply and use ICT in education, most schools and colleges lack the primary capacity to implement a meaningful e-learning/e-teaching system. Few private universities are able to have a recognisable e-learning/e-teaching system and probably only the National Open University of Nigeria (NOUN) is able to effectively handle distance education and learning (Muhamadbhai, 2020).

To understand why it is necessary to provide scientific support in overcoming the blockage of the education system, or what is referred to in this paper as the 'edu-lockdemic', we need to visualise the challenges facing the adoption of ICT in the Nigerian education system.

Limitations of ICT-Enhanced Alternative Pedagogy in Nigeria: The effective use of ICT in Nigerian schools and institutions of higher learning is facing several problems. One of them is the unfortunate lack of well-trained ICT teachers (Adeoye et al., 2013) and the unwillingness of some people to adapt to technological advancement in the education system (Oluwole, 2015). The few ICT facilities in some of these schools are not well managed and not effectively utilised due to lack of ICT trained staff and teachers in Nigerian schools and higher institutions. Another obstacle to the growth and use of ICT in Nigerian education is lack of funding. Due to lack of funding, the most important and survival needs of institutions are often put on hold (Idowu, Esere, 2013). Another major problem faced by most ICT users in Nigeria is inadequate power supply and frequent power outages.

Finally, there is the question of political will. The existing policy is somewhat outdated and discourages the use of ICT in Nigerian education (Martens et al., 2020; Usman, 2016). Despite Samson's claims (Samson, 2015), recent studies show that the integration of computers in the school system is low (Egielewa et al, 2021; Eze et al, 2018; Ibrahim et al, 2017; Olayemi et al, 2021; Peimani et al, 2021). These are just some of the challenges Nigerian schools and tertiary institutions face when it comes to using ICT to advance education in the country.

Educational institutions are taking advantage of benefits such as the ability to create small, simple and quick content, a social factor that provides immediate communication and feedback, which encourages the creation and improvement of digital content, and the development of communication skills that are critical in the process (Jiang et al., 2021). Some organizations try to create a safe study environment by choosing to build their own internal networks, others choose an inclusive approach and use existing media that are already publicly available and try to move the study process into the public space and create study communities there. Students in the digital environment benefit from communication with peers and lecturers who can enable students to reach a higher level of understanding. Online discussions allow students to improve their reading and writing skills. Using the Internet in education requires focusing on students' interests and

needs and improving communication with students not only because of the physical presence in the classroom (Oyeniran et al., 2020).

Theoretical Underpinning: understanding and predicting the factors associated with e-learning/e-teaching or ICT-enabled learning are critical to the success of the Nigerian education system as well as the education systems of many countries in the Global South during the current subsequent lockdowns because, apparently, COVID-19 pandemic may not be eradicated soon. The basic objectives of communication-cognitive theories are to interpret and predict behaviour. The Technology Acceptance Model (TAM) is one of the most useful theories. According to Agarwal and Prasad (Agarwal, Prasad, 1999) and Davis (Davis, 1989), TAM is a powerful tool developed to measure user acceptance of new technologies. TAM was developed by Davis (Davis, 1989, 1993). The model has proven its worth through a variety of applications and extensions over the years, including web-based information systems such as online banking, electronic tax return systems and e-learning/e-teaching (Yi, Hwang, 2003). Since e-learning/e-teaching is still relatively new, especially in the Nigerian and many other developing countries' context (especially in Africa), it is useful to examine it using the TAM model.

TAM consists of six constructs, namely “external variables, perceived usefulness [PU], perceived ease of use [PEoU], attitude [AT], behavioural intention [BI] and actual use [UB]” (Shyu, Huang, 2011: 493). User behaviour is determined by behavioural intention, which is influenced by attitude and perceived usefulness. Perception of usefulness and ease of use of a particular technology determines attitude (Adams et al., 1992). Depending on the technology, context and the users, external variables influence the perception of usefulness and ease of use. According to the model, “two behavioural beliefs, perceived usefulness and perceived ease of use, are fundamental factors in predicting user acceptance, and the effects of external variables on intention are mediated by these two beliefs” (Shyu, Huang, 2011: 493). PU is defined as a person's perception that using a new technology will enhance or improve their performance (Davis, 1989, 1993). Based on this definition, PU in this paper is the user's perception that e-teaching, i.e., delivering lessons using the proposed system (on the part of teachers) and e-learning/e-teaching, i.e., receiving lessons using the proposed system (on the part of students) will enable them to continue teaching and learning from home despite the imposed lockdown due to the COVID-19 pandemic.

Consolidating this belief leads to a positive attitude towards e-learning/e-teaching, which increases users' intention to use e-learning/e-teaching sites. PEoU is defined as a person's perception that using a new technology will be effortless (Davis, 1989, 1993). Based on this definition, PEoU in this paper represents the perception that e-learning/e-teaching or ICT-enabled teaching and learning sites are user-friendly. PEoU has been shown to have an effect on PU. “Moreover, both perceived usefulness and perceived ease of use are influenced by external variables and have a positive effect on attitude” (Shyu, Huang, 2011: 494). Although TAM is applicable to various technologies, it has been criticised for not providing enough information about individual views on new systems. Davis (Davis, 1989: 985) found that external variables enhance the ability of TAM to predict the acceptance of future technologies. In other words, “TAM constructions must be expanded by incorporating additional factors”. These additional factors depend on the target technology, the users and the context (Shyu, Huang, 2011).

2. Materials and methods

This study used secondary sources to obtain relevant data for the design of the Internet-enabled alternative pedagogical system. Relevant existing and previous literature was critically reviewed for four weeks. Thematic analysis was used to identify the main arguments and viewpoints related to the design of Internet-based systems through a thorough review of existing literature. The thematic analysis method was chosen to “capture the complexity of meaning within a textual dataset” and to “describe both implicit and explicit ideas” (Dimitriadis, Kamberelis, 2011). Key themes and concepts were coded to identify recurring key phrases and to organise the data. According to Saldana's coding, these are “repetitive patterns of action and consistency in human affairs” (Yerpude, Singhal, 2018).

Moreover, the inductive method is used in thematic analysis. This means that no a priori list of codes or themes is created before data analysis. The meaning of a sentence or paragraph is represented by codes. During the review of the literature, the texts were read several times, resulting in numerous changes to the codes. Because of its simplicity, open coding is a common coding technique in exploratory research (Saldana, 2009). Several hundred pages were reviewed

and coded with many open codes that were assigned to several categories. The term “category” refers to a collection of codes that have the same meaning as different arguments or viewpoints. According to Ryan and Bernard (Ryan, Bernard, 2011), it is crucial to assess recurring themes, similarities and expression of individual participants, as well as linguistic linkages, interpersonal interactions, social tensions and control difficulties when developing categories (Dovile, 2017). For example, the categories classify codes related to internet access, internet penetration, internet of things, information and communication technology use, internet data, Wi-Fi, broadband penetration rates, government policies on education, e-learning/e-teaching, alternative pedagogy, socio-economic factors affecting education, health, public diseases and social well-being, pandemics and social well-being, and COVID-19 and lockdown.

This final analysis and classification allow the study to determine which ideas have the most in common and why they are so highly regarded. From the reviews, six major themes were developed, namely: COVID-19 pandemic and internet access in Nigeria; the role of ICT in teaching and learning; limitations of ICT-enabled alternative pedagogy in Nigeria; theoretical underpinnings; operationalisation of internet-enabled alternative pedagogical system; and advantages and disadvantages of ICT-enabled alternative pedagogical systems.

Limitations of the Methodology: the disadvantage of thematic analysis based on a literature review is that it does not provide empirical results and therefore limits the generalisability of conclusions as they are based on subjective rather than objective data (Dimitriadis, Kamberelis, 2011; Saldana, 2009). Future research will require quantitative, qualitative and data-based evidence to draw more acceptable conclusions. When analysing data using a thematic analysis framework, there is a risk of interpretation as the codes are reviewed by a researcher and are influenced by their experience. Some of the thematic codes may have been generated incorrectly.

3. Discussion

This research has identified many new internet-based technological interfaces that are used in this type of situation, which more or less resembles a teleconference. Among the most popular are Zoom, Google Classroom, etc. Mobile smartphone applications such as WhatsApp and online blogging are also used to facilitate flexible and effective pedagogy. All these applications and gadgets are ICT. However, for effective teaching and learning in distance education due to the pandemic COVID-19 and the lockdown it has caused, an internet service needs to be made available. Finally, the aforementioned technologies are Internet-enabled.

ICT learning is thus a combination of Android and computer apps for teaching and learning purposes. The Android apps and computer programmes suggested for the learning area are listed below.

1. *Zoom:* Zoom is a video communication platform that provides video calling and internet chat services through a peer-to-peer cloud-based distance learning and social networking software system.

2. *WhatsApp:* WhatsApp is a free mobile app that offers cross-platform messaging and VOIP services. Facebook is the owner of WhatsApp. Users can send text and voice messages, make voice and video calls, and share photos, documents, user location and other multimedia content through WhatsApp.

3. *Google Classroom:* this is a free web service developed by Google for schools to facilitate the creation, distribution and classification of paper assignments and the sharing of files between teachers and students.

4. *Blog:* A blog is an online “journal” or information site where content is displayed in reverse chronological order, with the most recent entry appearing first. It is a platform where the author shares his/her opinion on any topic.

The immediate consequences of the epidemic may be dire, but this crisis is a unique turning point, an opportunity to learn to redesign Nigeria’s education system and build its resilience. The need to integrate e-education into the curriculum is becoming more urgent. The current pandemic has shown the need to integrate more technology into the classroom. Technological solutions, such as adaptive learning technologies, can ensure personalised learning with minimal teacher involvement and have the potential to provide better learning experiences at low cost. However, the uptake of these technologies in Nigeria is slow and uneven. The post-pandemic period could be an opportunity to invest in technology in both the private/commercial and public school systems.

To develop this system on a large scale, it is important to strengthen education partnerships between the public and private sectors. Many relevant stakeholders, including the government, its ministries and departments such as the Ministry of Communications and Digital Economy, the National Telecommunications Commission, internet and telecommunication service providers, education experts and others, will need to work together to drive the necessary innovation. Conscious efforts must also be made to bridge the digital divide by ensuring that the cost of technology is low. In general, the introduction of innovative technology in the classroom can help improve learning outcomes across the board.

The COVID-19 crisis has been added to the list of policies aimed at addressing out-of-school populations, as forced school closures have led to a proliferation of different ways to reach children and youth when they are not in school. However, the prevailing policy response to the problem of most children and youth in Nigeria has focused only on getting them to school. Going forward, some of the interventions introduced during the crisis should be explored for out-of-school populations before the pandemic spread. This approach is similar to the “school meets learner” approach that was used to provide education to girls in the Northeast by offering education to children and youth in situations where they cannot go to school due to cultural and economic conditions. While the goal must remain to get all school-age children into school, finding ways to reach children and youth at home can be part of the process.

The epidemic has pointed to the need to integrate appropriate electronic media technology into learning and to close existing gaps in education. However, without a focused and concerted effort, the impact on education can be lasting and negative. The onus is now on us: do we allow this pandemic to further deepen the education crisis, or do we seize the opportunity to influence change that can meet the challenges of the pandemic now and beyond? The model proposed in this paper is an attempt to provide an answer to this question.

This proposed system, like other ICTs, is likely to have both positive and negative aspects. The following subsections elaborate on some of the likely significant advantages (pros) and disadvantages (cons). As noted by Oyeniran et al. (Oyeniran et al., 2020), there are some notable advantages to using the alternative pedagogical system in pandemics:

1. Continuous learning: as there is no barrier on the part of lecturers or students for the prescribed courses in ICT learning areas, this framework enables continuous learning. The cost of setting up individual distance learning platforms is eliminated: Since this framework provides open-source distance learning applications, no educational institution needs to develop its own distance learning application.

2. Effective feedback mechanism: This framework ensures that students receive adequate feedback and that they can interact with their fellow students as well as with the lecturers. This enables them to ask and answer questions that seem difficult or unclear to them. Since the ICT learning spaces are equipped with many different applications, each student can communicate with their professors and fellow students through any platform.

3. Reworked lessons: With multi-platform technology, any student who misses a session can catch up on lessons on other platforms, as course materials are available on other accredited ICT learning platforms and can be used by students at any time.

4. Moderate installation and accessibility costs: Since the ICT learning platform is open source and can be used by anyone free of charge, there are no implementation or maintenance costs. The network operator, on the other hand, charges a data subscription fee for internet access.

5. Learning a new method and curriculum: While all ICT learning platforms in the ICT learning sectors may not be new to some, they provide an opportunity for many others to learn about new learning platforms and content.

Below are some of the critical challenges in using the alternative pedagogical system during the pandemic (Gruzina et al., 2020; Oyeniran et al., 2020):

1. Affordability of learning tools (smartphone): not all students have or can afford smartphones, as some parents are still struggling to fund their children’s education and may not be able to provide them with smartphones at any point during their studies.

2. Unpredictable network problems: Another problem is that network problems can occur in different parts of the country at different times of the day.

3. Internet access (data subscription): The data discount tariff you subscribe to is quite questionable and this could be a major drawback as lecturers and students have to subscribe to it regularly to keep classes online.

4. Power supply instability: The first drawback to address is the current situation in Nigeria where power supply is epileptic. This poses a serious threat to the smooth running of the system and many lecturers and students will be forced to spend a considerable amount of money on generators and fuel.

5. Inadequate technical knowledge: Since not all lecturers or students are familiar with certain platforms, some people will need training, guidance or support to use them effectively.

6. Environmental distractions: A number of environmental distractions recognised by society can affect this system. Addictions, housework and family influences are just a few examples.

7. An unexpected shutdown of an ICT learning platform hinders learning: This is the last disadvantage to be discussed. Some technologies and applications have been bought by new people with new conditions or they have been discontinued altogether.

8. Duplicate curriculum on different learning platforms: Since different learning platforms offer comparable services, the materials and curriculum observations will be available on all platforms, so the materials will be repeated on the platforms.

4. Results

Operationalisation of the Internet-based Alternative Pedagogical System: The proposed Internet-based alternative pedagogical system is divided into three main dimensions or regions as shown in Figure 2, namely teaching areas, learning areas and e-learning areas. The teaching areas are where the instructor (teacher, lecturer or trainer) delivers his/her instruction to the learners (pupils, students or trainees), while the learning areas are where the learners live and receive instruction from the instructor. Between these two places is the e-learning area, which is essentially an internet-enabled technological interface through which both parties (trainer and learner) are connected. The exchange of lesson messages is an important part of this communication activity. The lessons that the teacher, lecturer or trainer communicates to the pupils, students or trainees are called pedagogical messages in this context.

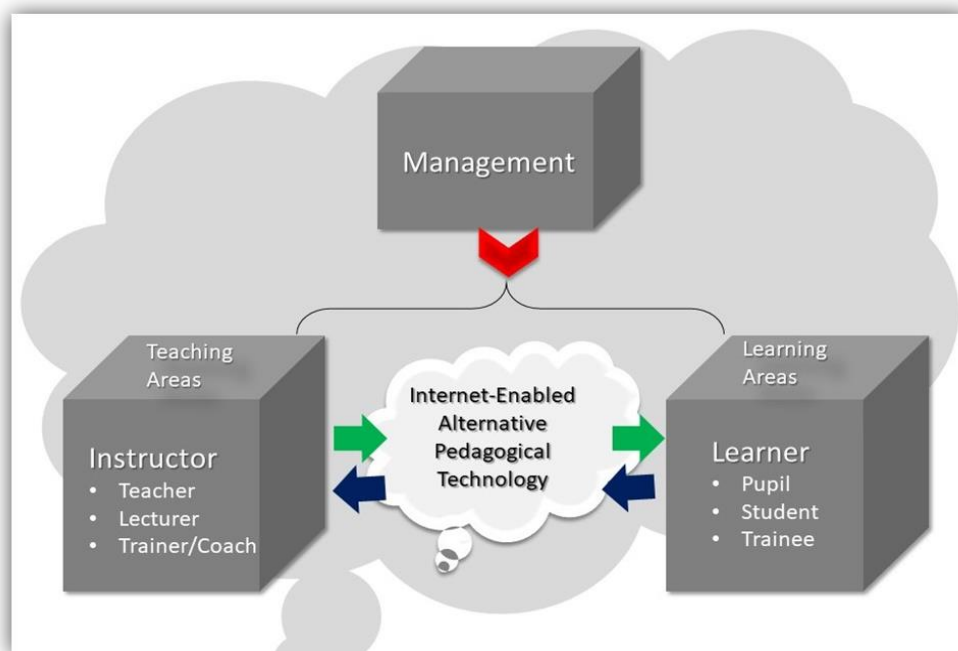


Fig. 2. An illustration of the internet-enabled ICT-pedagogical system. (Source: Authors).

The Internet-enabled ICT learning system was designed based on the two critical constructs of the TAM: PU and PEOU. The perceived usefulness (PU) of the system is expected to contribute to its adoption by all Nigerian schools and institutions and indeed other developing countries in the Global South, especially Africa, the Middle East, Latin America and Asia. Its prospective benefits are expected to accrue to both private (commercial) and public schools and institutions. However, as the scheme was intended to be used within the school or university during lockdowns in the post-pandemic era, or in the neo-post-pandemic era, teachers in private schools and colleges appear to be the most affected by job losses and leaves of absence, as the management of

commercial (private) schools and colleges are unable to continue paying teachers while they are at home, unlike teachers and lecturers in public schools and institutions who have received their monthly salaries despite the closure.

In addition, the perceived ease of use of the system can be used to determine its PU (PEoU). The simplicity of the system gives an indication of its ease of use. Essentially, the system consists of two virtual pedagogical areas – the teaching area (TA) and the learning area (LA) – which are connected via the Internet and are enabled by internet-enabled teleconferencing technology using a computer (e.g., a smartphone, a laptop, a PC, an iPad, a tablet, etc.) and free open-source software (FOSS) (e.g., Zoom or Google Classroom). The FOSS, installed on a computer with an internet connection or a mobile device, facilitates pedagogical communication between lecturers and students from any location (teaching area and learning area). TA and LA can be located where the participants are, e.g., at home or in a shop.

Multimedia mobile instant messaging programmes such as WhatsApp and Messenger can be used to complement FOSS, as they allow media-intensive communication with photos, video, audio and voice over the internet. For example, the lecturer could instantly share an important e-handout with learners while explaining points on Zoom or Google Classroom. All he has to do is upload the e-copy of the handout on his WhatsApp or Messenger app and share it with the learners. It is assumed that the instructor and learner have exchanged mobile phone numbers, especially if they want to use WhatsApp. Alternatively, the instructor can post the content of the handout on his blog, especially if it is not for immediate use during the online class session. So, the benefit of the system lies in its ease of use and this ease of use shows that it can be used in all categories of schools and institutions. The school, university or institution management can attend the pedagogical sessions as a non-participating observer by assigning a representative to monitor the activity. The presence of management thus serves mainly administrative purposes.

The arrows (refer back to in [Figure 2](#) above) indicate the direction of the flow of pedagogical messages (lessons and learners' responses), which proceed in a two-way protocol – a dialogical process in which each part of the two parties can send and receive pedagogical messages simultaneously, as in real life.

5. Conclusion

Even though several countries have been “locked down” because of the COVID-19 problem, academic activity can be maintained. Many studies have shown the value of using online media in distance education programmes; yet distance education programmes depend not only on the use of computer technology but also on physical administrative activities. Therefore, this article presents a framework in which lecturers and students can participate in academic activities using FOSS, Android and computer apps.

Apart from data subscription fees with the respective data network providers, the use of these apps does not incur any additional costs for lecturers, professors, teachers or students. Under the framework, instructors, teachers and lecturers will submit syllabi and lecture notes to the ICT learning areas, and students will have access to the ICT learning areas to participate in the various courses scheduled by lecturers or directed by school or institutional administrators. The ICT learning areas essentially function as a meeting place or lecture hall for students, trainees, professors and lecturers. Students can complete and ‘submi’ assignments in the ICT learning areas, while instructors, teachers and lecturers can supervise students using various technical functions integrated into the areas.

While this is helpful information, the school’s contingency plan is inadequate as it does not guarantee that learning can continue despite the problem. This closure of the school, occasioned by COVID-19, may have been the catalyst for identifying certain critical inadequacies across the sector. Given the rising number of infectious diseases worldwide and the conflict in the Northeast, the COVID-19 pandemic is certainly not the latest crisis to threaten the continuity of education in Nigeria. Therefore, the government must develop a comprehensive contingency plan that includes not only measures to keep schools safe, but also ways to ensure that students and teachers continue to learn and receive support in times of crisis. The government should also provide significant support for essential social services and other services directly or indirectly related to learning at home, such as electricity costs and internet/Wi-Fi.

Limitations of the Study: The study used secondary sources to generate data on the basis of which the proposed internet-based alternative pedagogical system was conceived and designed.

Thus, no empirical data (results/evidence) was generated from the study. Therefore, caution should be exercised when deciding to adopt the proposed system, as the system may or may not be suitable for certain contexts. However, as the system was developed after a thorough review of the literature and concepts related to the main research problems, it is expected that the simplicity of the system may encourage policy makers to commission the development of prototypes and testing in smaller, specific Nigerian contexts before recommending wider use and application at national and continental levels. Future research should use mixed methods, including quantitative, qualitative and data-driven methods, to generate empirical data to guide the development of such alternative teaching and learning systems that are internet-enabled and can be used in future pandemics and/or lockdowns.

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