



Left behind? The effects of digital gaps on e-learning in rural secondary schools and remote communities across Nigeria during the COVID19 pandemic

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ABSTRACT

The COVID19 pandemic has contributed to a digital economy by emphasising the importance of digital infrastructure while exposing the digital gaps between countries and communities. For example, during the period of COVID19, schools were closed with no option of online learning due to a deficit of infrastructure around educational technologies. Inequalities in digital access have impeded educational gains made towards achieving the Sustainable Development Goals (SDGs). Though significant studies have been carried out on digital learning, there is currently a dearth of knowledge on students' digital gaps and needs in remote communities in Nigeria. To this end, this research study explored the digital gaps and needs of rural secondary schools in remote communities and its implications on e-learning across 6 Nigerian states, namely Kwara, Ekiti, Ebonyi, Bayelsa, Adamawa, and Kano during the COVID19 era. The study adopted a concurrent embedded mixed method design approach to collect data from rural secondary schools from 6 Nigerian states. Findings from the study identified a lack of ICT strategies and policies in Nigeria, socioeconomic status, poor internet connectivity, electricity, and a high poverty level as the primary drivers of digital gaps in remote communities. Therefore, addressing the digital gaps among students in remote parts of Nigeria will be crucial to achieving the targets of SDGs, particularly SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all by 2030.

1. Introduction

Across the world, access to information and communication technologies (ICTs) and digital literacy, which is vital to knowledge empowerment, information generation, and utilisation, is unequally distributed both in terms of access to digital tools and infrastructure (Ifijeh et al., 2016). Despite the prominent role of ICTs in information generation, processing and use in the 21st century, it can be argued that widespread usage and adoption is still growing in several developing economies (UNDESA, 2018). Within the sub-Saharan context, for example, Ferri et al. (2020) highlight poor internet connectivity, poor infrastructural facilities, lack of operational capabilities and low teacher quality. These barriers have limited the applicability and integration of ICT into key human capital development processes, such as learning and teaching within school environments. This is consistent with Buabeng-Andoh (2012) findings, who argued that the lack of sustainable investments in ICT infrastructure perpetuates digital exclusion despite technological advancements. Clearly, the global economy continues to

thrive on digital innovation, and, this to a large extent, has led to advancement in sustainable development. Invariably, for countries whose citizens cannot effectively and efficiently deploy ICTs to access, process, share, exchange, utilise or transmit knowledge or quality information, attaining sustainable development will remain a mirage (Ifijeh et al., 2016).

Globally, Africa is home to the largest population of individuals without internet connectivity (88%), with Asia having the highest number of people with access to the internet (Google & International Finance Corporation, 2020). Nigeria, one of Africa's largest economies, has only about 111.6 million internet users, about 46% of its estimated population of 206.1 million people still lack access to internet connectivity (Adeleke, 2021; Pontianus & Oruonye, 2021). Nevertheless, the digital divide faced globally is not representative of just those who have and do not have access to the internet (International Telecommunications Union, 2019). This gap also includes several other discrepancies, such as internet connectivity speed, digital facilities and technological knowledge available in remote areas (Bahia & Suardi, 2019). We, therefore, argue that the complexity around the digital divide is problematic. How-

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Table 1
Socio-demographics of Respondents

Socio-demographics of Respondents	
Average age of respondents	17.5 ± 1.5 years
Age of respondents	<= 14 years (2.9%)15-19 years (89.9%)>= 20 (7.2%)
Sex	Females (52.9%)Male (47.1%)
Class	SS3 (67.7%)SS2 (24.2%)SS1 (8.1%)
Religion	Christians (62.3%)Muslims (37.7%)
State	Adamawa (27.5%)Bayelsa (29.0%)Ebonyi (14.5%)Kano (29.0%)

Table 2
Socio-demographic variables

Demographics		Frequency	Percentage (%)
Sex (n=68)	Male	32	47.1
	Female	36	52.9
Religion (n=69)	ChristianMuslim	4326	62.337.7
Ethnicity (n=69)	IgboHausaBayelsaFulani	1211719	17.430.424.627.5
Class (n= 62)	Jss3	5	8.1
	SS2SS3	1542	24.267.7
States (n=69)	KanoAdamawaBayelsaEbonyi	20192010	29.027.529.014.5

Table 3
Identifying the digital needs of rural secondary school students

Reasons for not learning via the Govt. digital learning intervention	Freq(%)
During the lockdown, did you know about the radio and television programme provided by the Govt. Yes	27(45.8)
No	32(54.2)
Did you learn via the radio and television programme provided by the Govt.?	
Yes	19(28.4)
No	48(71.6)
What were the reasons why you could not participate in the virtual learning provided (Cost)	
Yes	40(74.1)
No	14(25.9)
What were the reasons why you could not participate in the virtual learning provided (preference for face-to-face teaching)	
Yes	27(61.4)
No	17(38.6)

ever, despite the extensive studies on the digital divide and its impact, most developing countries are still looking for long-term solutions to address it (Afolayan, 2008; Katz, 2020; Scheerder et al., 2017). More so, due to disparities in technology access between urban and rural areas, countries struggle to leverage emerging advancements in Information Technology (IT) for greater economic and social benefits, and increased global competitiveness (Ohemeng & Ofozu-Adarkwa, 2014).

Evidence from previous studies and literature on measuring internet access, mobile internet usage or technology adoption in sub-Saharan Africa (SSA) (Buabeng-Andoh, 2012; Calandro & Wang, 2012; Hart & Laher, 2015) attributes unequal access to and differentiated usage of internet and digital technologies for information, communication and professional development purposes to key individual characteristics and household factors. As Frankfurter et al. (2020) posit, key determinants include but are not limited to socioeconomic and demographic variables like education and income levels and gender, age, and geographical location. Consequently, as digital penetration continues to grow widely globally and enables digital literacies for citizens of developed countries, affordability, accessibility, and digital technologies remain an unprecedented challenge in African economies (IMF, 2020). Undoubtedly, the complex causative impact of cost and convenience on access and usage are key adoption factors perpetuating the rural-urban digital divide (Reddick et al., 2020). This digital poverty and social marginality is the reality of millions of children from poorer socioeconomic backgrounds in Nigeria who have limited access to internet connectivity or lack essential digital technologies such as laptops and smartphones (Adeleke, 2021). Unarguably, if internet access and digital tools are readily available, easily accessible and affordable to a maximal extent, there would be increased digital adoption and proficiency with digital technology and online communications for more individuals and house-

holds. Furthermore, exploring digital gaps most significantly in a pandemic context has gained the interest of field experts and development practitioners (Ramalingam & Prabhu, 2020; World Bank, 2020).

At the onset of the COVID19 pandemic, and as a response to massive school closures globally, the continuity of teaching and learning within formal educational systems became significantly dependent on the ability to engage in online learning activities or an access to educational materials digitally (Dhawan, 2020). The emergent trend in electronic teaching and learning presents new opportunities as well as grave implications. As traditional classroom teaching transitions to online learning delivery, bridging existing digital gaps between students and teachers and those who are not connected became imminent and pertinent (Dayagbil et al., 2021; UNESCO, 2020). In Nigeria, over 39,440,016 learners in elementary and secondary schools and makeshift learning centres in internally displaced persons (IDP) camps could not access learning opportunities in mainstream settings. The immediate urgency to close schools to contain the spread of COVID19 did not match up with the expected pro-active mobilisation of support for educational access through digital means. Although school closures at first led to a perceived proliferation of online learning, it is arguable that the efforts made by the federal and state governments across Nigeria to ensure that learning continues for every child did not fulfil the set objectives (Adegoke et al., 2020). According to UNICEF (2020, p. 1), the proportion of students unable to benefit from "digital and broadcast remote learning policies is the highest in SSA: at least 48 per cent in West and Central Africa and 49 per cent in Eastern and Southern Africa." McBurnie, Adam and Kaye (2020) argued that the disparities in technology-supported learning across several West African countries are widespread amidst marginalised students who have little access to online learning tools. OECD (2020) also posited that as many countries

continue to leverage digital pedagogical tools for online learning interactions between students and their teachers, attention needs to shift to marginalised students as they require additional support in accessing learning opportunities. According to The Education Partnership (TEP) centre in a 2020 study on learning during the pandemic, of the estimated 34 million Nigerian students missing out on learning opportunities during the COVID19 pandemic, about 70% do not have access to essential digital devices. Additionally, not all teachers have the technical capacity to facilitate e-learning with competence varying across rural and urban locations.

To ensure equitable technology-supported educational provision during current and future humanitarian emergencies and educational crises, there needs to be an in-depth understanding of the digital inequalities at the individual, household, or communal levels. As a response to this logical necessity, this study is set to explore the digital gaps and needs of secondary schools in remote communities across 6 Nigerian states using the New Psychological model within a digital divide and inclusion framework (Abah, 2019).

Therefore, this research paper is guided by the following research questions:

- 1 What are the causes of digital gaps in rural secondary schools and remote communities across 6 Nigerian states?
- 2 What are the digital needs of students in rural secondary schools and remote communities across 6 Nigerian states?
- 3 What is the effect of digital gaps on e-learning in rural secondary schools and remote communities across 6 Nigerian states during the COVID19 pandemic?

This paper is divided into seven sections. Section one above describes the background of the study and research questions. Sections two and three address the review of the literature on digital learning with special reference to Nigeria and the theoretical framework adopted for this study. Section four discusses the methodology employed in this study, sections five and six cover the results, discussion and implications, and section seven presents the limitations and conclusion.

2. Literature Review

2.1. Digital learning during COVID19 era

No doubt, the COVID19 pandemic brought about a new era within education sectors across the world by highlighting the importance of e-learning (Azubuike, Adegboye & Quadri, 2020). E-Learning is focused on delivering instructional design principles that are well-designed and learner-centred while providing interactive learning environments to anyone, any place, and at any time (Eze, Chinedu-Eze, & Bello, 2018; Hedge & Hayward, 2004), e-learning refers to information and telecommunications technologies and digital resources for teaching and learning activities. In most developed countries, e-learning has been adopted to provide learning for individuals living in hard-to-reach communities because of time, distance, and cost (Hedge & Hayward, 2004). This e-learning strategy has provided high-quality content delivery for every individual's needs (Obuekwe & Eze, 2017) while aiding retention among teachers and learners due to its immediate feedback mechanism. All over the world, e-learning continues to be an innovative way to bridge the digital divide, learning loss and advancement of development (Obuekwe & Eze, 2017). More so, it is believed that e-learning solutions and strategies are often less expensive to deliver, self-paced, provides consistent content, faster access with features that work anywhere and anytime (Obuekwe & Eze, 2017). However, in Nigeria, the level of e-learning adoption is still in its infancy, majorly due to poor commitment to its full implementation across all levels of education (Akinrinola, Adebayo, Onakpoya, & Nwaozuru, 2020). Although when fully implemented in Nigeria, e-learning will change the concept of a digital divide to digital opportunities (Nwegbu et al., 2011).

The term "digital divide" emerged in the 21st century because of emergent innovations in ICTs. It has become the universally accepted term explaining unequal access to and usage of ICT (Rallet & Rochelandet, 2007). As further described by OECD (2000, p.10), the digital divide exists as a "gap between individuals, households, businesses and geographical areas at different socioeconomic levels with regard" to their opportunities to access the internet or digital tools and use such for a variety of purposes. This inequality manifests as social and physical barriers, from never having seen a computer to the absence of electricity infrastructure and the cost of internet connectivity (Esteban-Navarro et al., 2020). Drori (2010), in a review of literature on globalisation and technology divides, observed that globally, the digital divide follows the lines of gender, wealth, education, race, minority designation, whereas, between countries, it follows the lines of national wealth, literacy, and democracy. Recent studies on the digital divide and its resultant effects in Nigeria highlights infrastructural inadequacies, lack of computer skills, poor internet access, disparities in internet usage, unreliable electricity as leading determinants (Akanbi & Akanbi, 2012; Tayo, Thompson, & Thompson 2015). These findings are also consistent with Adeleke (2021) community-level survey of the experiences of individuals across Nigeria with varying income and internet access levels and how this reflects as determinants of the digital divide. As Wong et al. (2010) posit from the South Asian perspective, digital exclusion is the new form of social exclusion, affecting people with lower income, individuals living in geographically remote areas with poor access to inadequate infrastructure coverage. This means that as the 21st century continues to unfold, having access to and using the new technologies implies being an integral part of the society, and people with limited access get outpaced by those with access (Wong et al., 2010).

2.2. Consequences of digital gaps on learning during COVID19

In the wake of the COVID19 pandemic, over 181 countries implemented a nationwide school closure as a preventive strategy to curtail the spread of the virus (United Nations Educational, Scientific and Cultural Organisation (UNESCO), 2020). The ripple effect of this measure resulted in over 1.5 billion students being out of school (UNESCO, 2020). In cushioning the effect of this strategy on learning, governments of various countries and international agencies recommended the adoption of e-learning worldwide (UNESCO, 2020). Although the measure to prevent learning disruption through the adoption of e-learning was an applaudable strategy, it recorded poor outcomes in a certain context. Massive school closures in Africa exposed the unequal access to digital technologies and the flaws in the administrative processes necessary for governments to effectively deliver online learning for their students (McBurnie, Adam & Kaye, 2020; Lynch, Singhal & Francis 2020).

In Nigeria, the education system was severely affected because teaching and learning could not be carried out via an e-learning platform, especially for students attending public schools (Azubuike, Adegboye & Quadri, 2020). In 2020, the Digital Global Overview Report submitted that about 60% of people from Nigeria do not have access to the internet. Also, a report by United Nations Educational, Scientific and Cultural Organisation. UNESCO (2020) found that about 89% of students in SSA do not have access to computers, while 82% lack access to the internet. It has been observed that access to internet connection being pivoted towards households with higher socioeconomic status. As typically expected in rural areas across Nigeria, difficulties with online learning opportunities remain prevalent due to infrastructural inadequacies and a lack of technical capabilities. As (Ubi & Ofre, 2021) reported, students in rural areas suffered significant neglect as government e-learning interventions were out of reach because of poor internet access coverage and a lack of radio and television devices. This was further bolstered by Adarkwah (2021) and Azubuike, Adegboye, and Quadri (2020), who reported that in Africa, students with parents who are affluent in the society had better access to online learning experiences than their counterparts from poor households.

Furthermore, education for many years continues to be a haven for children as it provides hope for a brighter future in addition to safety and protection. A prolonged lack of access leads to an increase in the number of vulnerable and unprotected children, with an upshoot in the likelihood of children who will be exposed to the risks of child labour, forced marriage, and trafficking (Aborode et al., 2020). A similar study in South Africa reported a long period of learning loss because of the lockdown (Mahaye, 2020). This further reinforces the findings by Kekić and Miladinović (2013) that reported the negative implications of any pandemic on a country's learning process for an extended period. Additionally, they found that this eventually leads to a chain reaction that disrupts the educational system's curriculum and increases out-of-school children.

2.3. Challenges of e-learning in Nigeria

Education in Nigeria continues to suffer various setbacks due to poor budgetary allocation, corruption, and unpreparedness (Adebayo & Adebayo, 2017; Adeoye et al., 2020). An in-depth look at the budgetary allocation of Nigeria to its education sector in the last 10 years shows an unfavourable decline from the 15-20% recommended by UNESCO. Against this backdrop, the inability of many public schools in Nigeria to adopt e-learning cannot be overemphasised. This can be attributed to the funding inadequacies that belittles significant progress within the education sector (UNESCO, 2020).

Another fundamental challenge that hinders the widespread adoption of e-learning is an unstable power supply (Adeoye et al., 2020). A study by Blimpo and Cosgrove-Davies (2019) on electricity access in Nigeria estimated that most individuals living in rural and remote areas are not guaranteed a maximum of two hours of power supply daily. Additionally, most rural areas in Nigeria are not even connected to the National Grid (Adeoye et al., 2020). Many students in rural communities are constantly faced with total blackout or a limited supply of electricity. Hence most digital tools such as mobile devices and computers have not been powered (Abdullahi et al., 2020). Realistically, most e-learning platforms require ample internet data, and purchasing data bundles is on the high side (Budiman, 2020). This poses difficulty for both students and teachers in Nigeria, where more than half of her citizens live below \$1 per day (Abdullahi et al., 2020).

Even in exceedingly rare cases where students have access to free or inexpensive data, poor internet connectivity is a major cause of concern (Frankfurter et al., 2020). Also, considering the income level of an average worker in Nigeria, the cost of purchasing most digital devices such as computers and mobile phones is high impeding access to digital learning (Chair & De Lannoy, 2018). Although parents and caregivers are believed to help school children with their learning during the lockdown, most parents in rural areas have no formal education or background in online learning to support students in remote communities (Abdullahi et al., 2020; Akinrinmade, Ammani & Zuilkowski, 2021). There will continue to be heightened risks of increased social inequalities if digital technology remains inaccessible (ILO, 2017). In summation, these identified challenges to e-learning in Nigeria compromises accessibility to ICT infrastructure for educational purposes and widen digital inequalities.

3. Theoretical Framework

3.1. New Psychological Model of e-adoption within the context of the digital divide

Thatcher and Ndabeni (2011) developed a more comprehensive model of e-adoption in the context of the Digital Divide, based on the framework of existing technology-adoption models. This model is referred to as the New Psychological Model (NPM). The primary starting point of this model focuses on the awareness about the existence of technology and its positive impact on socioeconomic advancement

(Thatcher & Ndabeni, 2011). The perception of one's socioeconomic environment is either influenced by its negative or positive impact factors (Thatcher & Ndabeni, 2011). While positive-impact factors include favourable perceptions towards technological infrastructure, employment levels, and education and training systems. Negative-impact factors on the other hand, comprise negative perceptions of poverty, corruption, bribery, and access to basic resources (Thatcher & Ndabeni, 2011).

Highly negative-impact perceptions of the socioeconomic environment force people to meet basic needs (e.g. water, food, and shelter) with a positive-impact perception. Also, giving room for a cognitive space that makes people explore the new technological territory (Thatcher & Ndabeni, 2011). Furthermore, Abah (2019), who uses the NPM in his study on digital inclusion among mathematics education in Nigeria, finds that social pressure on students to use technology may result from close relationships such as family, friends, and supervisors and other social networking processes. Additionally, there is a mutual relationship between this social pressure and the socio-economic environment and the availability of a specific type of technology within a particular social construct (Thatcher & Ndabeni, 2011).

In understanding the digital needs of rural communities for e-learning, this model provides insight for us to better understand the causes of digital gaps in rural secondary schools and remote communities in Nigeria. We argue that it is imperative to understand that everyone's needs depend on their socioeconomic environment, which is majorly influenced by their perception that either this technology has a positive or negative impact on their well-being (Abah, 2019; Thatcher & Ndabeni, 2011). This means that in introducing any new technology, it is necessary to have an in-depth knowledge of how this technology will influence learning, especially during the COVID19 pandemic (Thatcher & Ndabeni, 2011). No community will adopt any digital learning technology perceived to have a negative impact factor, such as poverty and difficulty in accessing the technology. This will force people to concentrate on meeting basic psychological needs, e.g. water, food and shelter. For our research study, we engage the NPM by giving attention to the need to understand the aspects of quantity, extent and quality of the usage, and if it brings out the socioeconomic upliftment's effect on learners (Thatcher & Ndabeni, 2011). Furthermore, using the NPM as a theoretical lens for this study, we explore the relationship between socioeconomic outcomes and digital gaps as well as the needs of students in remote rural secondary schools across Nigeria during the COVID19 pandemic.

4. Research Methodology

4.1. Study design

The study adopted a concurrent embedded mixed-method design. This is a type of study design where quantitative and qualitative data are analysed simultaneously because the quantitative data alone would not be sufficient to answer the research question (Creswell & Plano Clark, 2011). The intent is for the qualitative data to provide additional information based on the premise that the quantitative data will not be sufficient to answer the different research questions requiring answers (Creswell et al., 2003). Hence, the quantitative and qualitative data was used to answer different research questions within the study (Hanson et al., 2005). Using a mixed-methods design enables the pragmatic understanding of the research phenomena from multiple realities rather than eliciting responses from a singular perspective.

4.2. Study site

This study was conducted in Government-owned secondary schools in 24 rural communities in Kwara, Ebonyi, Ekiti, Kano, Adamawa and Bayelsa states.

The purposive selection of states, communities and schools was informed by data from the Nigerian National Broad-Band Plan 2020-2025, which ranks states according to levels of internet connectivity. Data obtained on the state of digital exclusion in Nigeria shows that internet fibre reach per population in the states and communities of this study was below 50%.

4.3. Data

The data for this study was obtained from a survey funded by the Foreign Commonwealth Development Organization and conducted by the Aid for Rural Education Access initiative between January 2021 and February 2021. The survey sampled 90 respondents from 24 communities in the Kwara, Ebonyi, Ekiti, Kano, Adamawa and Bayelsa. The study used both closed and open-ended questions to elicit information on the causes of digital gaps in rural secondary schools, the digital needs of students in these schools, the effect of digital gaps on e-learning processes in these rural secondary schools during the COVID19 pandemic and strategies to promote digital inclusion. Informed consent was obtained from students. Before the interviews at the communities and school levels, we organised an information session for school administrators and key community leaders. Parents provided written and verbal consent for children below the age of 18. Other respondents above the age of 18 signed off consent forms.

4.4. Sample size determination

4.4.1. Qualitative data

A total of 20 eligible respondents who consent to voluntarily participate in the research study were interviewed for the study as saturation was attained with these numbers, i.e., where no new themes emerged (Creswell et al., 2003). In recruiting those respondents, the focus was on identifying respondents whose lived experiences of the digital divide was consistent, reliable, uniform and objective in line with our research inquiry.

As part of our duty to keep the participants' information confidential, confidentiality agreements were presented at the beginning of the data collection process. As Crow et al. (2006) note, discussing the subject of confidentiality at the onset of data collection aids in acquiring informed consent and helps build trust with the respondents.

4.4.2. Quantitative data

A purposive sampling technique (Patton, 1990) was adopted to select a total of 70 participants from 24 rural communities in 6 states selected for this study.

4.5. Method for data collection

4.5.1. Qualitative data collection

An in-depth interview guide was used to obtain qualitative data. All interviews were conducted in the English language. All the respondents show they can read efficiently, write clearly, listen precisely, and speak fluently in this language, rather than their local language. The interviews were semi-structured following the research questions and included open-ended questions as well as "probe" questions. The in-depth interview guide was used to elicit information on the effect of digital gaps on e-learning in rural secondary schools during the COVID19 pandemic.

4.5.2. Quantitative data collection

A validated, semi-structured self-administered questionnaire was used for data collection. The questionnaire was designed to obtain information on;

- 1 What are the causes of digital gaps in rural secondary schools and remote communities across 6 Nigerian states?
- 2 What are the digital needs of students in rural secondary schools and remote communities across 6 Nigerian states?
- 3 What is the effect of digital gaps on e-learning in rural secondary schools and remote communities across 6 Nigerian states during the COVID19 pandemic?

4.6. Inclusion and exclusion criteria

4.6.1. Inclusion criteria

The following group of participants were recruited for the study:

- Male and female secondary students who were between the ages of 14 and above
- Students attending a rural Government school
- Students who consented to participate in the study

4.6.2. Exclusion criteria

The following group of students were excluded from the study:

- Students who did not consent to participate in the study
- Students that could not speak the English language

4.7. Data analysis

Questionnaires were sorted, collated, serially numbered, and imputed into the computer. Descriptive analysis was done using the Statistical Package for Social Sciences (SPSS) 26 software version. Data was cleaned, and descriptive statistics such as frequency means and standard deviation were carried out to respond to the identified research questions.

Qualitative data was first transcribed verbatim, followed by a preliminary familiarisation of data to get the general sense of the data and reflect on its meaning. Two researchers did this to ascertain intercoder reliability. Following this, the two researchers developed the codes and codebook. Thereafter, a more detailed analysis was performed, and data was organised under different headings that depict a different segment of the discussion. The analysis aimed to look for trends and patterns that reappear within the interview. For data analysis, the thematic analysis approach (Braun & Clarke, 2006) was employed for the study. A list of themes was generated, revised, and compiled into categories labelled as key findings. These key findings were analysed to determine the inter-connectedness of issues and conditions that may have given rise to the categories. As such, there was high levels of agreement about these issues and significant consistency in how the issues were discussed among the interviewees.

Additionally, the study's rigour was ensured by noting the audit trail on all decisions made during the study. Furthermore, intercoder reliability was done by involving two or more independent coders using the same coding scheme and then allowing the extent to which they agree on the coding to influence the analysis. Questions on reflexivity, which included reflection on assumptions and preconceptions, were considered and stated. Finally, there was a triangulation of both qualitative and quantitative data by analysing data independently and comparing these data to understand how results from both methods inform each other to increase the validity of the study.

5. Results

5.1. Socio-demographics of participants

The study showed that the average age of respondents was 17.5 ± 1.5 years, with the minimum age being 14 years and the maximum age being 21 years. Majority (89.9%) were within the age group of 15 to 19 years, with a little over half of the respondents being females (52.9%). More than half of the respondents were in Senior Secondary level 3 (SS3) (67.7%) and Christians (62.3%), with a little above one-quarter of the participants being Hausa (30.4%).

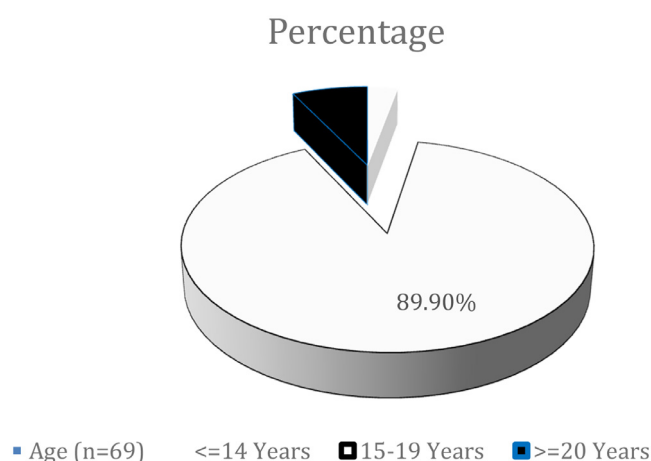


Fig. 1. Age of participants

5.2. Assessing the level of digital gaps in rural secondary schools

Fig. 2 below shows the level of digital gaps in rural secondary schools. A higher proportion (63.1%) of students reported not having access to digital learning tools prior to the pandemic. Majority (61.1%) did not have access to a phone, 84.1% did not have access to a laptop, and 75.4% did not have access to the internet. More than half (53.8%) of the students did not have access to a radio, and 66.7% did not have access to a television. Slightly over half (50.8%) of the participants reported that they had their learning disrupted during the school closure. As shown in the Fig. above, the majority (82.5%) of students that learnt during the pandemic did not have access to any school online management learning system, while 70.7% of the students stated that they did not have access to any radio or television programme provided by the government. Together, the results confirm the causative impact of the lack of digital technologies at either home, community, or school levels during the COVID19 pandemic. This reality suggests that the government responses to digital access and delivery of e-learning opportunities during emergencies must account for the availability of mobile learning tools and infrastructural provision at community levels.

5.3. Identifying the digital needs of rural secondary schools

In identifying the digital needs of secondary school students in rural communities, we asked participants questions relating to why students could not participate in the digital learning intervention provided by the government. We also explored what significant factors impeded students learning and strategies to improve digital learning in their communities.

Results from the study found that More than Half (54.2%) of the participants were not aware of learning intervention provided by the government and for the few (45.8%) that were aware of the programme, the majority (71.6%) did not learn via the radio and television programmes with a little above half (51%) attributing lack of time as the reason, with a high percentage (74.1%) stating cost and preference for face-to-face learning (61.4%).

5.4. Factors impeding access to digital learning among students

The reported factors impeding digital learning among students were lack of technical know-how (78%), financial constraints (84.1%), preference for face-to-face learning (72.9%), electricity (85.3%), access to digital learning tools (73%), and cost (88.2%). Only a few (24.2%) students stated factors such as internet connectivity and lack of parental support (49%) as a factor impeding their digital learning. Our findings reveal how poor access to technology, limited support networks and contextual realities interfere with the experiences of rural students

in accessing e-learning opportunities during the pandemic. These rural students' experiences cast a new light on how observable or unobservable disparities in demographic and socioeconomic realities contribute to digital exclusion.

5.5. Strategies to promote digital inclusion in schools

From table 4 below, almost all (95.1%) of the students agreed that access to digital information improves their digital literacy skills. Furthermore, 97.1% of the students suggested the need for having ICT related subjects in schools. Majority (69.6%) of the students cannot afford the cost of using digital learning tools, while 87% of the students believe that there is a need for school-based ICT centres. All students mentioned the need for an ICT teacher, with (98.5%) opining the need for students training on ICT. A higher percentage of students (84.8%) and (93.8%) preferred the provision of mobile phones access to internet connectivity.

In summary, our key findings from the quantitative data reveal that the lack of digital technologies in rural communities to ensure continuous learning during the pandemic results from the poor socioeconomic status of students and their families. Furthermore, the experiences of rural students to access digital learning opportunities reflects inherent issues of equity and inclusion within Nigeria's education system.

5.6. Effect of digital gaps on e-learning during the COVID19 pandemic

The effect of digital gap refers to the lack of benefits of e-learning opportunities, especially during the pandemic. Most of the participants have reported the effect of e-learning in the areas of readiness to e-learning, insufficient knowledge and low level of awareness of digital learning tools. Sub-themes from the qualitative data include inadequate e-learning resources and unavailability of teachers to support students on the use of e-learning.

5.6.1. Inadequate e-learning resources

Students in this study identified the lack of access to education technologies and insufficient e-learning platforms disrupting their learning during the pandemic. In the words of the students:

"Even before the lockdown, I had no access to phone, internet. I don't know how to use Google classroom, Zoom or WhatsApp" - Female, South West.

"Although teachers have WhatsApp group to communicate with one another, they did not share this group with us. In fact, we did not have any online lesson, the purpose of not having this online lesson is because we are not in a private school. Schools like REOMICHs had online lessons our teachers were saying there was WhatsApp group. This WhatsApp group cannot help us because if it was that we had a website and all of us can go to that website. The website will show all the subjects that we have and we can learn from it. But having a Facebook or WhatsApp group cannot help us" - Male, SS3, North Central

"Because of the lockdown we had to just go home and when we resumed there were things we could not recollect, and they had to start all over again" - Female 17, North Central

5.6.2. Unavailability of teachers to support students on the use of e-learning

Data from students highlight the absence of skilled teachers to both deliver digital learning as well support students using the available e-learning platforms:

"Yes, because one of the challenges is the teachers are no longer teaching us, I am on my own. I am even confused whenever I carry my book I cannot be able to understand everything but with the help of the teachers I can understand it very well" - Female, SS3, South East

"Number 1, learning on my own was boring because if I was learning online, it will not be only me. And two again I might not be able to be

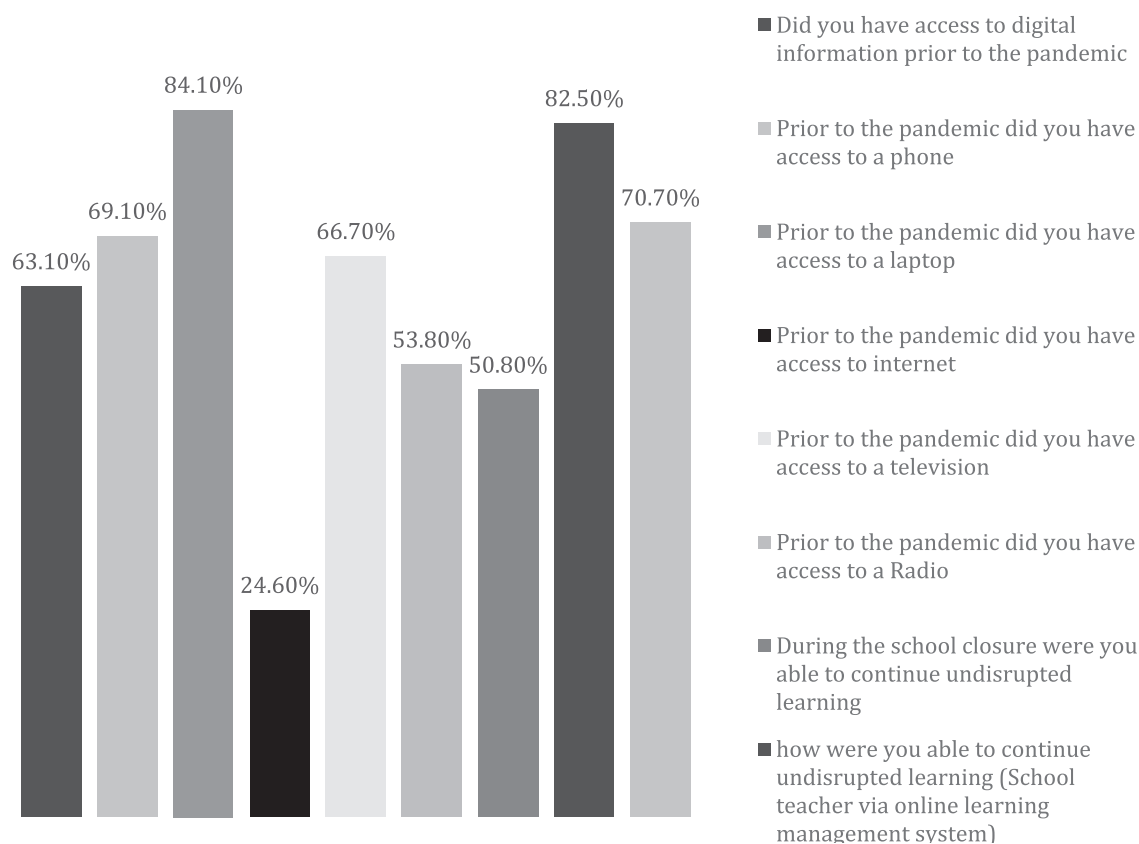


Fig. 2. Assessing the level of digital gaps in rural secondary schools

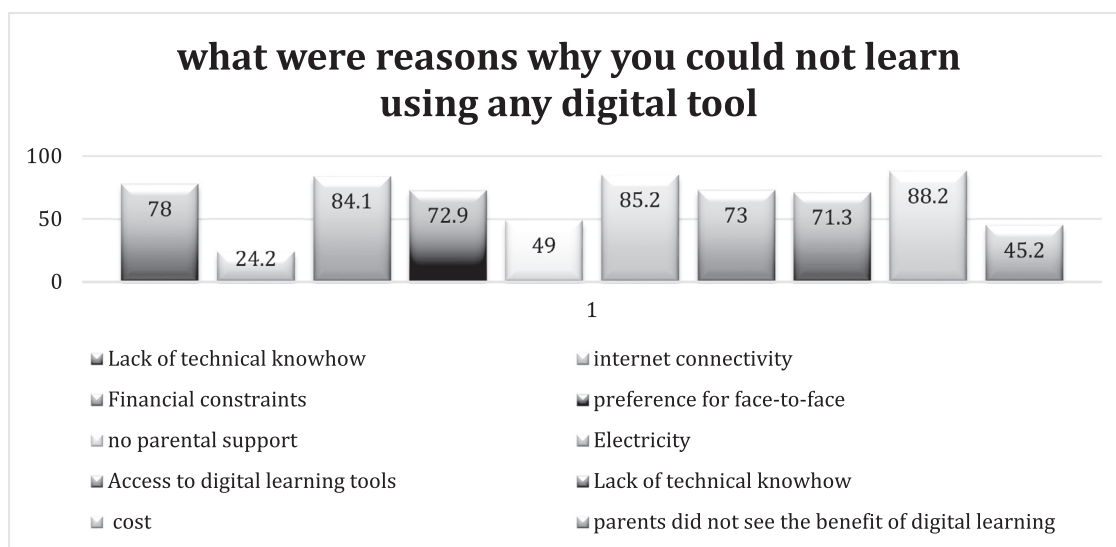


Fig. 3. Factors impeding access to digital learning among students

exposed to some pictures about the things I might be reading and this pictures and videos will be able to help me" - Male SS2, North Central

6. Discussions and Implications

This study presents findings detailing the various challenges experienced by secondary school students in rural Nigeria in accessing e-learning opportunities during the COVID19 pandemic. Our evidence shows that the government did not respond adequately to support the online learning aspirations of marginalised rural students across Nige-

ria. In all the rural schools and communities surveyed, the already existing 'digital divide' between rural and urban students became more pronounced at the onset and during the COVID19 pandemic. Despite claims that online learning confers advantages in the absence of traditional classroom teaching and learning, we recount that during an educational crisis such as the COVID19 pandemic, it can be an active driver of educational exclusion. Our findings on the implications of digital inequalities on the online learning experiences of rural students during the COVID19 pandemic is consistent with recent research on the impact of COVID19 on students' learning and access to educa-

Table 4
Strategies to promote digital inclusion in schools

Strategies to promote digital inclusion	Freq (%)
Do you think access to digital information can improve your digital literacy skills	
Yes	58(95.1)
No	3(4.9)
Do you have interest in taking an ICT related subjects if provided	
Yes	66(97.1)
No	2(2.9)
Can you afford the cost of using a digital tool for learning	54
Yes	21(30.4)
No	48(69.6)
Do you think your school can maintain a school-based ICT centre if provided	
Yes	60(87)
No	9(13)
How do you think the govt can promote digital inclusion in your school (provision of a computer)	
Yes	39(59.1)
No	27(40.9)
How do you think the govt can promote digital inclusion in your school (provision of phones)	
Yes	56(84.8)
No	10(15.2)
How do you think the govt can promote digital inclusion in your school (Training of students in ICT)	
Yes	66(98.5)
No	1(1.5)
How do you think the govt can promote digital inclusion in your school (Recruitment and training of qualified teachers)	
Yes	66(100)
No	0
How do you think the govt can promote digital inclusion in your school (Access to internet connectivity)	
Yes	61(93.8)
No	4(6.2)

tional opportunities (Belay, 2020; Dube, 2020; Esteban-Navarro et al., 2020; Akinrinmade, Ammani & Zuilkowski, 2021; Azubuike, Adegboye, & Quadri, 2020).

We revealed specific contextual factors that exacerbate the digital gaps for students in rural communities: lack of digital awareness, financial constraints, poor internet connection, an absence of parental support, unstable power supply, lack of access to digital learning tools, and inability to afford usage costs. Rural students' online learning experiences also depend on their school types and teachers' capacity to deliver online learning, as both are crucial to quality learning achievement during emergencies (Akinrinmade, Ammani & Zuilkowski, 2021; Azubuike, Adegboye & Quadri, 2020; TEP Centre, 2020). Our findings show that students in rural schools experienced both digital and education exclusion during the COVID19 pandemic due to various technological limitations, infrastructural inadequacies at home or schools' levels, and lack of digital capabilities. The statistical analysis of the critical factors highlighted that while the significance of remote learning opportunities to students' learning outcomes is well understood, geographical limitations, socioeconomic costs, household dynamics, and lack of access to digital infrastructure to leverage online learning options remain a considerable challenge. Furthermore, the statistically significant relationship between low level of readiness to e-learning adoption in rural communities with perceived benefit of digital learning, insufficient knowledge and low level of awareness of digital learning tools show the degree of marginalisation that continues to deepen social and educational inequalities. At the same time, evidence from the qualitative data reflects teachers' low capacity to deliver digital learning and support students engaging in e-learning platforms. Therefore, this study further contributes to the knowledge base of the state of technology access and usage for learning and teaching in Nigeria, specifically during the COVID-19 pandemic.

The adoption of digital technologies as a significant element of remote learning strategies during humanitarian emergencies such as the COVID19 pandemic would require bold commitments from the government. This will ensure that schools, children and/or teachers in rural communities are not left out and can access school-based digital support and interventions (TEP Centre, 2020). From our findings, we argue that schools must endeavour to incorporate digital awareness into

learning activities for vulnerable children from remote communities to know what technological tools are available, affordable, and accessible for them. Within the context of Nigeria, we found that addressing infrastructural inadequacies is central to maximising the potential of remote learning for rural students (Amorighoye, 2020).

As a form of policy, the government can provide amenities such as internet-enabled community e-learning centres and equip them with computers that can ease physical access to technological tools and aid the acquisition of digital literacy skills (Aborode et al., 2020). As our results demonstrate, internet access and connectivity in Nigeran rural communities is a necessary accessory for social equality and must be prioritised as a developmental necessity. Not only will the availability of internet services at community levels help improve students' attitudes toward learning, but it will also facilitate access to educational opportunities for community children, including older learners. Similarly, in their study, Lawrence and Fakuade (2021) found that a digital revolution can only happen in Nigeria when the education system provides equal opportunities to all learners accessing e-learning platforms. Therefore, we propose the need for more public-private partnerships to enable pathways to affordable internet access and usage for learning through the provision of low broadband services, zero-rated airtime support and subsidised internet packages. These partnerships can be mobilised and coordinated through the Ministry of Communications and Digital Economy, National Information Technology Development Agency, National Communications Commission, major internet service providers and mobile network operators. Our findings significantly show that the role of family members, community leaders and stakeholder groups in fostering access to quality e-learning opportunities cannot be overemphasised. The crucial roles of parental involvement in students continued learning via e-learning platforms during a pandemic have been identified by other studies (Akinrinmade, Ammani & Zuilkowski, 2021; Azubuike, Adegboye, & Quadri, 2020; Lawrence & Fakuade, 2021). To promote inclusive access to digital learning opportunities, the government can develop initiatives with local non-profits, community schools and faith-based organisations. These local stakeholders can help facilitate the delivery of digital skills training and provision of school-based ICT hubs to expand the reach of and access to national digital equity initiatives. Moreover, in rural communities with limited technology access and internet con-

nectivity issues, government at various levels and schools can leverage home learning kits, including printed study guides, reading lists and lesson notes.

7. Limitations and Conclusion

It is important for us to state the limitations of our study as it is often required of all studies. While this study was conducted during a difficult time around the world, the study site could have been more comprehensive in the sense of covering more rural communities challenged with access to e-learning during the pandemic. Furthermore, the participants in this study are in 6 Nigerian states out of a total of 36 states. Therefore, generalisation from the research findings will not be advisable because students' experiences in rural schools in other states may be different from the students who participated in this study. However, the use of a concurrent mixed method approach has provided a deeper insight and nuanced understanding of the digital divide that affects students learning during a pandemic in rural parts of Nigeria. Our findings have further contributed to the knowledge base of educational inequalities present among marginalised or vulnerable groups in SSA, particularly in Nigeria.

To close, this research study presents both quantitative and qualitative evidence on how the most vulnerable students in rural communities are disproportionately excluded from e-learning during the COVID19 pandemic in Nigeria. Inferring from our results, we recommend that the Nigerian government mobilise research, policy and practice on addressing critical technology adoption and usage challenges to enable a substantial increase in online learning possibilities and opportunities for disadvantaged students during future emergencies. Government-led agencies such as the National Information Technology Development Agency (NITDA) must embark on a more comprehensive digital gap and needs assessment survey across the country as part of its Strategic Roadmap and Action Plan. We also recommend that subsequent efforts to address the perceived usefulness, ease of use and adoption of digital technologies for learning within rural communities must reflect the contextual realities of infrastructural gaps and technical capabilities. The knowledge presented in this study is significant for current discourse on key digital learning strategies as Nigeria strives to achieve the goals of equitable and quality education for all learners. Further studies still need to be done to establish how other factors such as gender or disabilities contributed to digital exclusion during the COVID19 Pandemic in Nigeria.

Conflict of Competing Interest

None

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References

Abah, J. A. (2019). Theoretical and conceptual framework for digital inclusion among mathematics education students in Nigeria. In MA. J. Adejoh, A. D. E. Obinne, & A. B. Wombo (Eds.), *Global perspectives on educational issues. Makurdi: College of agricultural and science education* (pp. 79–111). Makurdi, Benue State, Nigeria: Federal University of Agriculture.

Abdullahi, U., Sirajo, M., Saidu, Y., & Bello, U. (2020). Stay-at-home order and challenges of online learning. *IOSR Journal of Research & Method in Education*, 10(4), 10–17. 10.9790/7388-1004061017.

Aborode, A., Anifowoshe, O., Ifeoluwapo, Ayodele, T., Rebecca, Ireteyio, A., & Oluwafemi, David, O. (2020). Impact of COVID-19 on education in sub-Saharan Africa. *Preprints*, 2890(October), 1–29. 10.20944/preprints202007.0027.v1.

Adarkwah, M. A. (2021). I'm not against online teaching, but what about us?": ICT in Ghana post Covid-19. *Education and Information Technologies*, 26(2), 1665–1685. 10.1007/s10639-020-10331-z.

Adebayo, S. B., & Adebayo, A. G. (2017). Teachers, curriculum reform for entrepreneurship education in Nigeria: Issues and consequences. *Journal of Current Studies in Comparative Education, Science and Technology*, 4(2), 10–21.

Adegoke, O., Dennis, E., & Kehinde, O. C. (2020). *Factors Mitigating Against E-Learning Platform Effective Utilization during COVID-19 Pandemic* 1., 7(6), 66–71.

Adeleke, R. (2021). Digital divide in Nigeria: The role of regional differentials. *African Journal of Science, Technology, Innovation and Development*, 13(3), 333–346. 10.1080/20421338.2020.1748335.

Adeoye, A., Adanikin, A., & Adanikin, A. F. (2020). COVID-19 and e-Learning: Nigeria tertiary education system experience. *International Journal of Research and Innovation in Applied Science (IJRIAS)* |, 2454–6194 V(V).

Afolayan, G. E. (2008). Uneven access to new technologies – A paradox of change in social inequalities. *INEquality08 International Conference July*. Retrieved from <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.452.1296&rep=rep1&type=pdf>.

Akanbi, B. E., & Akanbi, C. A. (2012). Bridging the digital divide and the impact on poverty in Nigeria. *Advances in Multidisciplinary & Scientific Research Journal Publication*, 3(4), 81–87. 10.22624/AIMS/CISDI/V3N4P2x.

Akinrinmade, B., Ammani, M., & Zuilkowski, S. (2021). Parental support for literacy development of early grade children during COVID-19 school closures in Northern Nigeria. *Afolayan*, 8, 1–13.

Akinrinola, A. A., Adebayo, S. B., Onakpoya, L. U., & Nwaozuru, U. C. (2020). Toward Culturally-Inclusive Educational Technology in a Globalized World. In *The Roles of Technology and Globalization in Educational Transformation* (pp. 177–194). Hershey, PA, USA: IGI Global.

Amorighoye, T. A. (2020). Coronavirus has exposed the education divide in Nigeria. *The World Economic Forum COVID Action Platform* <https://www.weforum.org/agenda/2020/06/education-nigeria-covid19-digital-divide/>. Accessed 20 March 2020.

Azubuikwe, O. B., Adegboye, O., & Quadri, H. (2020). Who gets to learn in a pandemic? Exploring the digital divide in remote learning during the COVID-19 pandemic in Nigeria. *International Journal of Educational Research Open*, (October), Article 100022. 10.1016/j.ijedro.2020.100022.

Bahia, K., & Suardi, S. (2019). Connected society: the state of mobile internet connectivity 2019. *GSMA*. Retrieved from <https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2019/07/GSMA-State-of-Mobile-Internet-Connectivity-Report-2019.pdf>.

Belay, D. G. (2020). COVID-19, Distance learning and educational inequality in rural Ethiopia. *Pedagogical Research*, 5(4), em0082. 10.29333/pr/9133.

Blimpo, M. P., & Cosgrove-Davies, M. (2019). Electricity access in Sub-Saharan Africa: Uptake, reliability, and complementary factors for economic impact. *Africa Development Forum*. Washington, DC: World Bank.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. 10.1191/1478088706qp0630a.

Buabeng-Andoh, C. (2012). Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 8(1), 136–155.

Budiman, E. (2020). Mobile data usage on online learning during Covid-19 pandemic in higher education. *International Journal of Interactive Mobile Technologies*, 14(19), 4–16. 10.3991/ijim.v14i19.17499.

Calandro, E., & Wang, R. (2012). Predictors of mobile internet usage in 10 African countries. *19th ITS Biennial Conference, Bangkok 2012: Moving Forward with Future Technologies - Opening a Platform for All 72487*. International Telecommunications Society (ITS).

Chair, C., & De Lannoy, A. (2018). Youth, deprivation and the internet in Africa. Retrieved from https://researchafrica.net/after-access-survey-papers/2018/After_Access

Creswell, J. W., & Plano Clark, V. (2011). *Designing and conducting mixed methods research* (2nd ed.). Los Angeles: SAGE Publications.

Creswell, J. W., Plano Clark, V., Gutmann, M., & Hanson, W. (2003). Advanced mixed methods research designs. In A. Tashakkori, & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioural research* (pp. 209–240). Thousand Oaks, CA: Sage.

Crow, G., Wiles, R., Heath, S., & Charles, V. (2006). Research ethics and data quality: The implications of informed consent. *International Journal of Social Research Methodology*, 9(2), 83–95. 10.1080/13645570600595231.

Dayagbil, F. T., Palompon, D. R., Garcia, L. L., & Olvido, M. M. J. (2021). Teaching and learning continuity amid and beyond the pandemic. *Frontiers in Education*, 6, 678692. 10.3389/educ.2021.678692

Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crisis. *Journal of Educational Technology Systems*, 49(1), 5–22. 10.1177/0047239520934018.

Drori, G. S. (2010). Globalisation and technology divides: Bifurcation of policy between the "Digital Divide" and the "innovation Divide. *Sociological Inquiry*, 80(1), 63–91. 10.1111/j.1475-682X.2009.00316.x.

Dube, B. (2020). Rural online learning in the context of COVID19 in South Africa: Evoking an inclusive education approach. *Multidisciplinary Journal of Educational Research*, 10(2), 135. 10.17583/remie.2020.5607.

Esteban-Navarro, Á., García-Madurga, Á., Morte-Nadal, T., & Nogales-Bocio, A. (2020). The rural digital divide in the face of the COVID-19 pandemic in Europe—recommendations from a scoping review. *Informatics*, 7(4), 54. 10.3390/informatics7040054.

- Eze, S. C., Chinedu-Eze, V. C., & Bello, A. O. (2018). The utilisation of e-learning facilities in the educational delivery system of Nigeria: a study of M-University. *International Journal of Educational Technology in Higher Education*, 15(1). 10.1186/s41239-018-0116-z.
- Ferri, F., Grifoni, P., & Guzzo, T. (2020). Online learning and emergency remote teaching: Opportunities and challenges in emergency situations. *Societies*, 10(4), 86. 10.3390/soc10040086.
- Frankfurter, Z., Kokoszka, K., Newhouse, D., Silwal, A. R., & Tian, S. (2020). Measuring Internet in access in Sub-Saharan Africa (SSA). *Poverty and Equity Notes*. Washington, DC: World Bank.
- Google, & International Finance Corporation. (2020). *economy Africa 2020*. 1–98.
- Hanson, W. E., Clark, Plano, V. L., Petska, K. S., Creswell, J. W., & Creswell, J. D (2005). Mixed methods research designs in counselling psychology. *Journal of Counseling Psychology*, 52(2), 224–235. 10.1037/0022-0167.52.2.224.
- Hart, S. A., & Laher, S. (2015). Perceived usefulness and culture as predictors of teachers attitudes towards educational technology in South Africa. *South African Journal of Education*, 35(4), 1–3.
- Hedge, N., & Hayward, L. (2004). Redefining roles: University e-learning contributing to lifelong learning in a networked world? *E-Learning and Digital Media*, 1(1), 128–145. 10.2304/elea.2004.1.1.3.
- Ifijeh, G., Iwu-james, J., & Adebayo, O. (2016). Digital inclusion and sustainable development in Nigeria : The role of libraries. In *3rd International Conference on African Development Issues* (pp. 52–57).
- ILO. (2017). *Preparing the future of work we want: The digital economy and labour skills and competences*.
- International Monetary Fund. (IMF). (2020) Digitalizing Sub-Saharan Africa: Hopes and hurdles. [online] Available at: <https://www.imf.org/en/News/Articles/2020/06/15/na061520-digitalizing-sub-saharan-africa-hopes-and-hurdles> [Accessed 20 October 2021]
- Katz, R. (2020). Economic impact of COVID-19. Report of an economic experts roundtable. *Imc*, July, 1–35.
- (2019). *Measuring digital development. Facts and figures 2019* (pp. 1–15). ITU Publications. <https://www.itu.int/myitu/-/media/Publications/2020-Publications/Measuring-digital-development-2019.pdf>.
- Kekić, D., & Miladinović, S. (2013). *Functioning of Educational System During an Outbreak of Acute Infectious Diseases*, 269–276 November 2016.
- Lawrence, K. C., & Fakuade, O. V. (2021). Parental involvement, learning participation and online learning commitment of adolescent learners during the COVID-19 lockdown. *Research in Learning Technology*, 29, 1–16 (1063519). 10.25304/rlt.v29.2544.
- Lynch, P., Singhal, N., & Francis, G. A. (2020). EdTech for learners with disabilities in primary school settings in LMICs: A systematic literature review. *Zenodo*. 10.5281/ZENODO.4348995.
- Mahaye, E. (2020). *The impact of COVID-19 pandemic on South African education : Navigating forward the pedagogy of blended learning*. Retrieved from https://www.researchgate.net/publication/340899662_The_Impact_of_COVID-19_Pandemic_on_South_African_Education_Navigating_Foward_the_Pedagogy_of_Blended_Learning
- McBurnie, C., Adam, T., & Kaye, T. (2020). Is there learning continuity during the COVID-19 pandemic? A synthesis of the emerging evidence. *Journal of Learning for Development*, 7(3), 485–493 <https://jld.org/index.php/ejld/article/view/461>.
- Nwegbu, M. U., Osadebe, N. E., & Asadu, B. (2011). The impact of digital divide on e-learning in Nigeria. *Journal of Applied Information Science and Technology*, 5(1), 73–79. http://www.jaistonline.org/NwaegbuOsadebeAsadu_2k11.pdf.
- Obuekwe, G. I., & Eze, R. A. (2017). Promoting best practice in teaching and learning in Nigerian universities through effective e-learning: Prospects and challenges. In *International Conference E-learning* (pp. 184–188).
- OECD. (2000). The creative society of the 21st Century. *World Futures*, 58(4), 339–342. 10.1080/02604020213003.
- (2020). *The impact of COVID-19 on student equity and inclusion: supporting vulnerable students during school closures and school re-openings* (pp. 1–37). Paris: OECD Publishing. Retrieved from. <https://www.oecd.org/coronavirus/policy-responses/the-impact-of-covid-19-on-student-equity-and-inclusion-supporting-vulnerable-students-during-school-closures-and-school-re-openings-d593b5c8/>.
- Ohemeng, F. L. K., & Ofosu-Adarkwa, K. (2014). Overcoming the digital divide in developing countries: An examination of Ghana's strategies to promote universal access to information communication technologies (ICTs). *Journal of Developing Societies*, 30(3), 297–322 <https://doi.org/10.1177/0169796x14536970>.
- Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd ed.). Sage Publications, Inc.
- Pontianus, V., & Oruonye, E. (2021). The Nigerian population: A treasure for national development or an unsurmountable national challenge. *International Journal of Science and Research Archive*, 2(1), 136–142. 10.30574/ijrsra.2021.2.1.0026.
- Rallet, A., & Rochelandet, F. (2007). ICTs and inequalities: The digital divide. In E. Brousseau, & N. Curien (Eds.), *Internet and Digital Economics* (pp. 693–717). Cambridge University Press. 10.1017/CBO9780511493201.025.
- Ramalingam, B., & Prabhu, J. (2020). Innovation, development and COVID-19: Challenges, opportunities and ways forward. *OECD Tackling Coronavirus (COVID-19): Contributing to a Global Effort*, 1–14.
- Reddick, C. G., Enriquez, R., Harris, R. J., & Sharma, B. (2020). Determinants of broadband access and affordability: An analysis of a community survey on the digital divide. *Cities*, 106, Article 102904. 10.1016/j.cities.2020.102904.
- Scheerder, A., van Deursen, A., & van Dijk, J. (2017). Determinants of Internet skills, uses and outcomes. A systematic review of the second- and third-level digital divide. *Telematics and Informatics*, 34(8), 1607–1624. 10.1016/j.tele.2017.07.007.
- Tayo, O., Thompson, R., & Thompson, E. (2015). Impact of the digital divide on computer use and internet access on the poor in Nigeria. *Journal of Education and Learning*, 5(1), 1. 10.5539/jel.v5n1p1.
- TEP Centre. (2020). *Learning in a pandemic: Nigeria's response to teaching and learning during the COVID-19 pandemic*. The Education Partnership (TEP) Centre [https://www.tepcentre.com/wp-content/uploads/2020/08/Learning-in-a-Pandemic\[1\]Report_TEP-NESG_2020.pdf](https://www.tepcentre.com/wp-content/uploads/2020/08/Learning-in-a-Pandemic[1]Report_TEP-NESG_2020.pdf).
- Thatcher, A., & Ndabeni, M. (2011). A psychological model to understand e-adoption in the context of the digital divides. In J Steyn, & G Johanson (Eds.), *ICTs and sustainable solutions for the digital divide: Theory and perspectives*. Hershey, PA: Information Science Reference Available at <https://ethnosproject.org/wp-content/uploads/digital-divide-theory-perspectives.pdf>. Accessed 4 July 2019.
- Ubi, O., & Ofre, R. (2021). *Covid-19 Pandemic-Challenges and Opportunities in the Development of Rural Areas in Nigeria*, 6, 41–48. 10.36758/jggsda/v6n1.2021/5.
- UNDESA. (2018). *World economic and social survey 2018: frontier technologies for sustainable development*. 175.
- United Nations Educational, Scientific and Cultural Organisation. (UNESCO). (2020). *COVID-19 educational Ddsruption and response*. [online] Available at: <https://en.unesco.org/news/covid-19-educational-disruption-and-response> [Accessed 18 October 2021].
- UNICEF. (2020). *COVID-19 and school closure: Are children able to continue learning during school closures*. UNICEF Accessed 20 June 2021 <https://data.unicef.org/resources/remote-learning-reachability-factsheet/>.
- Wong, Y. C., Law, C. K., Fung, Chu, J. Y., Lee, Ping, & V, W (2010). Digital divide and social inclusion: Policy challenge for social development in Hong Kong and South Korea. *Journal of Asian Public Policy*, 3(1), 37–52 doi.org/10.1080/17516231003634161.
- World Bank. (2020). *Guidance Note : remote learning and COVID-19*. Retrieved from <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/531681585957264427/guidance-note-on-remote-learning-and-covid-19>