

# Technology Ease of Use and Adoption for Open and Distance Learning: Challenges from Rural Nigerian Communities

Osagie Oseghale<sup>1\*</sup> and Bilikis Adefunke Babarinde<sup>2</sup>

<sup>1</sup>Kenneth Dike Library, University of Ibadan, Oyo State, Nigeria.

<sup>2</sup>Department of Library, Archival and Information Studies, Faculty of Education, University of Ibadan, Oyo State, Nigeria.  
Corresponding author email: [osagiezion@gmail.com](mailto:osagiezion@gmail.com)

## ABSTRACT

*Perceived ease of use is a critical determinant of technology adoption and effective utilization, particularly in educational contexts. While previous studies have primarily linked ease of use to factors such as system design, training, and user support, the influence of technology availability, accessibility, individual differences, and geographic location has received comparatively little attention. This study examined the perceived availability, accessibility, and ease of use of technology among Open and Distance Learning (ODL) students residing in rural communities across Nigeria. Using a mixed-methods approach, data were collected from 453 students through a structured questionnaire designed to measure their perceptions of technology-related variables. Descriptive statistics, including frequency distributions, means, and percentages, were employed for data analysis. The findings indicated that ODL technologies were generally perceived as available (mean = 3.31 > 3.0), accessible (mean = 3.12 > 3.0), and relatively easy to use (mean = 3.03 > 3.0). However, students reported several challenges that hindered effective technology utilization, such as erratic power supply, poor internet connectivity, high data costs, and financial constraints. These infrastructural, economic, and skills-related barriers were found to significantly limit both access to and effective use of ODL technologies. The study concludes that improving technology availability and usability requires targeted investment in digital infrastructure, affordable connectivity, and continuous digital literacy training. It further recommends that ODL platforms be designed with user-centered principles to promote inclusivity and ensure equitable access to higher education opportunities for learners in underserved rural communities.*

**Keywords:** Technology Accessibility, Availability, Adoption, Distance Learning, Rural communities, Nigeria



Article information  
Received 5 August 2025  
Accepted 21 September 2025  
Published 13 October 2025  
<https://doi.org/10.26765/DRJSSSES15719082>

Citation: Oseghale, O., & Babarinde, B. A. (2025). Technology Ease of Use and Adoption for Open and Distance Learning: Challenges from Rural Nigerian Communities. Direct Research Journal of Social Science and Educational Studies. Vol. 13(3), Pp. 90-99. This article is published under the terms of the Creative Commons Attribution License 4.0.

## INTRODUCTION

From inception, ODL has been a means of providing educational opportunities for individuals who, for various reasons, could not pursue higher education immediately after high school or those employed but seeking flexible learning opportunities. Unlike the traditional teacher-centred education approach, ODL is a structured learning approach that takes place when instructors and learners engage from separate locations. Accordingly, it involves a uniquely specialized administrative procedure and the deployment of digital technologies. Digital technologies are a diverse range of tools, platforms, and applications designed to promote communication, engagement and interaction while advancing the global reach of education to people in different environments, contexts, and settings. The integration of digital technologies in education has transformed the landscape of Open and Distance Learning (ODL). However, the perceived Ease of technology use has remained a critical factor that determines their effective utilization and adoption, particularly in rural communities. Rural communities in many developing nations are typically characterized by poverty, inadequate infrastructure, and limited access to essential services and recreational opportunities (Olaleye & Ayeni, 2019; Aruleba & Jere, 2022). Students in most Nigerian rural communities are particularly challenged by geographic isolation, resource limitations and job opportunities, which may contribute to difficulties in accessing and utilizing digital technologies for ODL activities (Kumar et al., 2021). Though digital technologies offer significant advantages for Open and Distance Learning (ODL), widespread poverty and inadequate infrastructure in rural communities severely limit their adoption and use (Han et al., 2023). According to the Anker & Anker (2020), poverty rates in rural areas (52.1%) are considerably higher than in urban areas (18.0%), making the cost of technology prohibitive for most residents. Furthermore, while mobile internet access has improved, broadband infrastructure and service quality in rural regions continue to lag behind urban areas (Bisong et al., 2023), further constraining access to digital technologies for ODL.

ODL offers a valuable pathway for expanding educational opportunities to underserved rural communities in Nigeria, but its successful adoption depends heavily on the availability, accessibility, and perceived ease of use of technological platforms for both learners and educators. The ease of technology use in ODL contexts, particularly in rural areas, is crucial for user adoption and effective utilization. Studies have shown that ease of use is a key factor influencing technology adoption, especially in mobile and web-based learning applications (Lee et al., 2019).

While much of the existing literature emphasizes system design and user training as the primary determinants of ease of use (Johnson & Turner, 2018; McKnight et al., 2018), other critical elements, including perceived technology availability, accessibility, individual differences,

and geographic location, are often overlooked (Akbulut, 2009; Liu & Li, 2020). Social and economic inequalities due to individual geographic locations also contribute to uneven access to resources, unstable technology usage and disparities in digital participation, all of which can influence technology ease of use and adoption (Habibi et al., 2023).

Perceived availability influences user behavior by determining if a technology is seen as present and reachable, while perceived accessibility relates to the apparent ease of interacting with the technology in a user's specific context, including cultural and economic factors (Han et al., 2023). Geographic location further affects adoption by influencing both availability and accessibility, often resulting in regional disparities in technology use (Habibi et al., 2023). Perceived technology availability and accessibility include factors such as affordability, convenience, simplicity, and the absence of obstacles related to poor connectivity, inadequate infrastructure, and restrictive access controls, all of which can hinder effective use and adoption.

These external factors can directly affect perceptions of technology usefulness, ease of use and adoption for ODL, ultimately influencing academic performance. Without a clear understanding of these determinants, efforts to implement and scale up ODL initiatives in rural communities may prove ineffective, thereby deepening educational inequalities. Recognizing these challenges is therefore critical to designing and implementing systems that bridge the technological and educational divide and improve access to quality education in underserved regions. In view of these challenges, this study examined technology ease of use and adoption for ODL in rural communities of Southwest Nigeria, focusing on users' perceptions of availability, accessibility, user-friendliness, and associated challenges. The investigation was guided by the following research question:

- i. What is the extent of perceived technology availability among ODL students in Nigerian rural communities?
- ii. What is the extent of perceived technology accessibility among ODL students in the rural communities?
- iii. What is the level of perceived ease of technology use among ODL students in rural communities?
- iv. What challenges do students in rural communities face regarding the perceived ease of technology use?

### Literature review

Technology ease of use is an important factor in the successful adoption and utilization of digital tools. Derived from Technology Acceptance Model (TAM) Davis (1989), technology perceived ease of use is described as the extent to which individuals perceive the use of a system as

free of cognitive and physical efforts (Venkatesh et al., 2018; Lee et al., 2019; Wang & Wang, 2020; and Holden & Rada, 2021). Technology perceived usefulness and ease of use explain the degree to which a person believes that a technology can enhance the performance of a task and can be used without difficulties or stress, on which basis it is adopted for use (Davis, 1989). Among the two key factors influencing technology adoption, perceived ease of use is more critical, especially in relation to mobile and Web applications, which are very important for distance learning activities (Lee et al., 2019). Perceived ease of use encompasses intuitive design, ease of navigation, and the minimization of user effort (Lee et al., 2019). It is critical in ensuring that technology aids rather than hinders users in performing tasks, especially in high-stakes environments like healthcare (Holden and Rada, 2021). Perceived ease of use is described as the simplicity and effortlessness with which humans interact with technology, leading to its adoption and effective utilization (Hadalgekar & Desai, 2025). The importance of perceived ease of use lies in its significant impact on user satisfaction and continued usage intentions (Wang & Wang, 2020). They describe perceived ease of use as the degree to which users feel comfortable and unburdened when interacting with technology.

Recent studies have identified both personal and external factors influencing technology perceived ease of use, particularly in rural communities. Key personal factors include digital literacy, age and gender (Billanes & Enevoldsen, 2021), education and training (McKnight et al., 2018), economic prosperity (Anderson & Kumar, 2019), employment in digital entrepreneurship (Palvia et al., 2020), and attitudes towards technology (Beaunoyer et al., 2020). External factors include improved Internet infrastructure (Boliek et al., 2019) and access to affordable digital devices (Livingstone et al., 2021), perceived ease of use in rural areas and local technical support (Fischer et al., 2014) and initiatives to encourage continued use and practice of digital tools (Helsper & Van Deursen, 2020).

Technology ease of use in rural communities is greatly enhanced by social networks and community support (Smith et al., 2019), cultural factors, local needs and preferences (Huggins & Thompson, 2025), development of technology interfaces in local languages (Cyr et al., 2006), technology usability and design (Norman & Nielsen, 2021), compatibility (Davis, 1989) and technological functionality (Goodhue & Thomson, 1995). The reviewed literature consistently highlights that the perceived ease of use of technology in rural areas is influenced by more than just the technical features of the technology itself. Key contributing factors include strong community support, culturally sensitive approaches, the availability of local language interfaces, and the overall design and functionality of the technology. In addition, successful technology adoption often depends on community-led initiatives, adequate training, and the alignment of technology with the existing rural infrastructure. These findings emphasize that perceived ease of use in rural

settings is a multi-dimensional concept shaped by social, cultural, and contextual factors. This insight is significant because it shifts the focus from individual user skills and system design to a broader ecosystem of influences, suggesting that any intervention aiming to introduce technology in rural communities must consider these interconnected elements. Understanding these dynamics provides a foundation for developing a theoretical framework that integrates sociocultural and contextual variables into models of technology diffusion, adoption and acceptance, such as the TAM, to better reflect the realities of rural environments.

### **Technology acceptance model**

While several theories address. In the Technology Acceptance Model (TAM), Davis (1989) offers a framework to explain how individuals adopt and utilize technology in information systems (Figure 1). According to the model, if a user perceives a technology ease of use and acceptance, this study is anchored in the theories of technology diffusion, adoption, and acceptance technology as easy to use, it increases the likelihood of using it and ultimately fosters acceptance of the technology (Davis, 1989). TAM identifies perceived usefulness and ease of use as influential factors in individuals' decisions to adopt and use technology (Figure 1).

According to TAM, technology acceptance is a three-stage process, whereby external variables (such as availability, accessibility, system design features etc.) trigger cognitive responses (perceived ease of use and perceived usefulness), which, in turn, form an emotional response (attitude toward using technology/intention), influencing user behaviour to use and adopt the system (Misra et al., 2023). In the original TAM, Davis did not specify a detailed list of external variables. Instead, he left room for future researchers to identify which external factors might be relevant in different contexts.

This flexibility is one reason TAM has been so widely adopted and extended over time (Mukred et al., 2024). For that reason, most researchers have extended external variables determining technology perceived usefulness and ease of use to include system design, user training and support, experience with similar systems and demography, organizational context, social influence, task characteristics and technological complexity (Misra et al., 2023; Mukred et al., 2024). However, other external factors, such as technology availability and accessibility, as well as individual differences (Akbulut, 2009; Liu & Li, 2020), have received less attention. It is this perceived gap in knowledge that this study has filled.

Perceived technology availability and accessibility are considered external factors that exist outside of an individual or organization's control and can impact their ability to utilize or benefit from and adopt technology (Wilson et al., 2021). Technology availability and accessibility can be due to various reasons, such as a lack

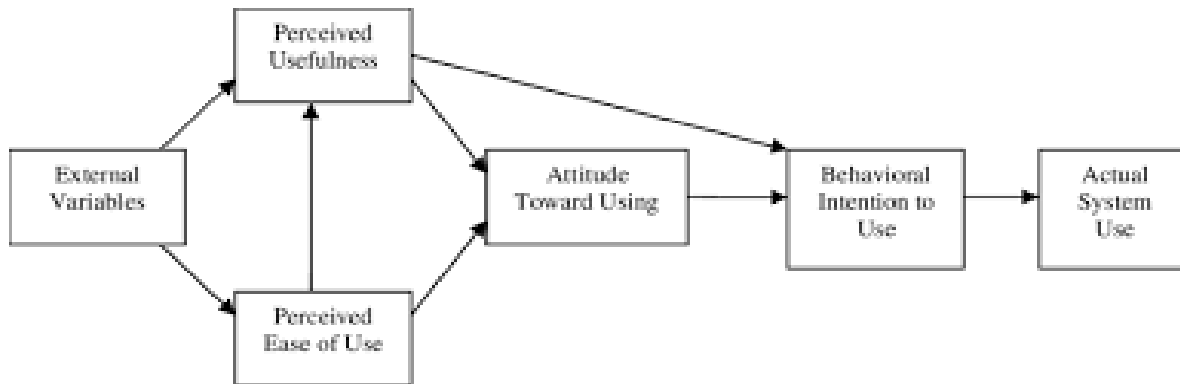


Figure 1: Technology Acceptance Model (Davis et al., 1989)

of Internet access, malfunctioning infrastructure, or issues of limited resources (Hamutoglu & Basarmak, 2020), which typically characterise most rural communities in developing economies (Olaleye & Ayeni, 2019). Perceived availability and accessibility are exacerbated particularly by geographic isolation, resource limitations and job opportunities, contributing to difficulties in using technology for ODL activities by students in rural communities (Kumar et al., 2021). According to Chan et al. (2023), people may lack access to technology because of low income, where they live, poor infrastructure, or limited digital skills.

Perceived availability and accessibility can significantly impact perceived usefulness, ease of use and adoption of new technologies. It can limit individuals' ability to participate in education, employment, and social activities (Cheraghalizadeh et al., 2021). It is against this background that this study has examined technology ease of use for ODL in rural areas of Southwest Nigeria, with a specific focus on perceived availability, accessibility and ease of use.

## METHODOLOGY

The study adopted a descriptive research design to investigate distance learning students' perceptions of technology use in federal universities in Southwest Nigeria. The population of the study comprised 46,042 distance learning students enrolled in federal universities within the region. A multi-stage sampling technique was employed to select the study sample. In the first stage, purposive sampling was used to select the three oldest federal universities renowned for their open and distance learning programmes. These include University of Ibadan (UI), the University of Lagos (UNILAG), and Obafemi Awolowo University (OAU), Ile-Ife. Four faculties including Arts, Education, Social Sciences and Science were then selected from each of these universities to ensure adequate representation. In the second stage, a stratified random sampling technique was applied to draw a sample of 453 distance learning students, representing

approximately 10% of the total population. Stratification was based on faculty and gender to ensure balanced representation.

Data were collected using a structured questionnaire consisting of two sections. The first section employed a five-point Likert scale to measure students' perceptions of technology availability, accessibility, and usability in their learning environments. The second section included an open-ended question designed to elicit qualitative responses on the challenges encountered by students in using technology for distance learning. Quantitative data were analysed using descriptive statistics (means, frequencies, percentages). Qualitative responses underwent thematic analysis to identify recurring issues. Ethical protocols, including institutional approval, informed consent, confidentiality, and anonymity, were strictly observed. Data collection was conducted online via Google Forms.

## RESULTS

The distribution of respondents showed that the University of Ibadan had the highest number of respondents (36.4%), followed by the University of Lagos (34.2%) and the University of Ilorin (29.4%). Table 1 revealed that the majority (55%) of the respondents was female students, and 58.2% of the respondents were single. While a considerable number of participants (32.2%) fell within the age range of 25 to 31 years, most of the respondents (51.4%) were employed. Table 1 presents respondents' perceptions of the availability of various technologies that support Open and Distance Learning (ODL) in rural communities in Southwest Nigeria. The weighted mean scores range from 2.83 to 3.70, with an overall mean of 3.30 (SD = 0.60), indicated a moderate level of technological availability in the study area. Technologies perceived as readily available include smartphones (Mean = 3.70), email and messaging platforms (Mean = 3.65) and ODL websites or portals (Mean = 3.55). These findings suggest that most students and learners have access to basic communication and learning technologies that require relatively low bandwidth. Conversely, technologies

**Table 1:** Perceived availability of technologies for ODL in rural communities in southwest, Nigeria.

Technologies	SA %	A %	UD %	D %	SD %	Mean	St dev.
Smartphones are available.	30.9	37.5	11.0	12.1	8.4	3.70	0.99
Email & messaging platforms are available.	28.7	37.5	12.1	13.2	8.4	3.65	0.93
ODL website and portal are available.	26.5	36.4	12.8	14.3	9.9	3.55	0.83
Internet network is available.	27.6	35.3	12.1	14.3	10.6	3.55	0.81
Digital libraries & repositories are available.	26.5	35.3	12.1	14.3	11.7	3.51	0.78
Laptop/desktop computers are available	25.4	34.2	13.2	15.5	11.7	3.46	0.71
Tablets/ipads are available	24.3	33.1	13.2	16.6	12.8	3.40	0.65
Satellite TV is available	22.1	28.7	14.3	17.7	17.2	3.21	0.42
Open educational resources (OER) are available.	17.7	25.4	15.5	21.0	20.5	2.99	0.28
Video Conferencing Tools are available.	17.2	25.4	14.3	21.0	22.1	2.95	0.32
Online assessment tools are available.	16.6	24.3	15.0	22.1	22.1	2.91	0.30
Course management systems (CMS) are available	15.5	23.2	15.5	21.0	24.9	2.83	0.33
Total	23.3	31.4	13.4	16.9	15.0	3.31	0.6

Mean criterion=3.0; Weighted Mean for technology perceived availability= 3.31>3.0

**Table 2:** Perceived accessibility to technology for ODL in rural communities in Southwest, Nigeria.

Technologies:	SA %	A %	UD %	D %	SD %	Mean	St dev.
Smartphones are accessible.	32.0	36.4	9.5	12.1	9.9	3.68	1.09
Email & messaging platforms are accessible.	28.5	35.3	10.8	13.2	12.1	3.55	0.93
Internet network is accessible.	27.8	34.2	11.0	13.9	13.0	3.50	0.87
Laptop/desktop computers are accessible.	26.5	34.2	12.1	15.5	11.7	3.48	0.83
ODL website/portal is accessible.	26.3	32.7	11.7	14.8	14.6	3.41	0.75
Digital libraries & repositories are accessible.	25.6	26.5	11.0	22.1	14.8	3.26	0.57
Open educational resources (OER) are accessible.	18.8	20.5	15.5	19.9	25.4	2.87	0.30
Online assessment tools are accessible.	17.7	21.6	15.5	21.0	24.3	2.87	0.29
Video conferencing tools are accessible.	18.8	20.5	14.3	19.9	26.5	2.85	0.37
Tablets/ipads are accessible.	19.9	18.1	13.2	23.2	25.6	2.83	0.40
Course management systems (CMS) are accessible.	16.6	17.9	15.5	26.3	23.8	2.77	0.40
Satellite TV is accessible.	7.3	14.8	17.0	31.3	29.6	2.39	0.85
Total	22.2	26.1	13.1	19.4	19.3	3.1	0.6

Mean criterion=3.0 Weighted Mean for technology perceived accessibility= 3.12>3.0

that require stronger internet connectivity or institutional support such as video conferencing tools (Mean = 2.95), online assessment tools (Mean = 2.91), and course management systems (Mean = 2.83), were rated lower. This indicates limited access to advanced or interactive learning technologies in rural settings. Overall, the findings imply that while mainstream technologies are moderately available and accessible to ODL learners in rural areas, infrastructural limitations continue to hinder access to high-bandwidth and institutional-level technologies essential for a fully digital learning experience.

Table 2 presents respondents' perceptions of the accessibility of technologies for Open and Distance Learning (ODL) in rural communities of Southwest Nigeria. The total mean score of 3.10 (slightly above the midpoint of 3.0) indicated that technology accessibility for ODL in rural communities is moderate. This suggests that while some technologies are fairly available, access remains inconsistent or limited for others. Smartphones (Mean = 3.68) ranked highest, indicating that mobile phones are the most accessible technology for ODL learners. Email and messaging platforms (Mean = 3.55) and internet networks (Mean = 3.50) also showed relatively high accessibility, suggesting that communication and connectivity tools are reasonably available to most users. Laptops/desktops (Mean = 3.48) and ODL websites/portals (Mean = 3.41) fall into the moderate accessibility range. This implies that

while some students or communities can access computing devices and institutional ODL platforms, availability may not be widespread. Digital libraries and repositories (Mean = 3.26) show lower accessibility, indicating limited access to academic and research databases. Open Educational Resources (Mean = 2.87), online assessment tools (Mean = 2.87), video conferencing tools (Mean = 2.85), tablets/iPads (Mean = 2.83) and Course Management Systems (Mean = 2.77) were rated below average, suggesting poor accessibility. Satellite TV (Mean = 2.39) was rated the lowest, showing that very few rural learners rely on or can access this medium for learning.

Table 3 presents respondents' perceptions of the ease of use of various technologies for Open and Distance Learning (ODL) in rural communities of Southwest Nigeria. The overall mean score of 3.03 indicated that respondents moderately agreed that ODL-related technologies are easy to use. This suggests that while some technologies are relatively user-friendly, others pose usability challenges to learners in rural communities. Smartphones (Mean = 3.50, SD = 0.91) ranked highest, indicating that most respondents find smartphones easy to use for learning-related tasks. Email and messaging platforms (Mean = 3.46) and laptop/desktop computers (Mean = 3.40) followed closely, showing that these commonly used tools are considered user-friendly and familiar to many

**Table 3:** Technology perceived ease of use for ODL in rural communities in southwest, Nigeria.

<b>Technologies:</b>	<b>SA %</b>	<b>A %</b>	<b>UD %</b>	<b>D %</b>	<b>SD %</b>	<b>Mean</b>	<b>St dev.</b>
Smartphones are easy to use.	26.5	35.5	9.9	17.7	10.4	3.50	0.91
Email & messaging platforms are easy to use.	29.4	31.1	9.3	16.6	13.7	3.46	0.84
Laptop/desktop computers are easy to use.	26.9	33.8	7.3	16.3	15.7	3.40	0.87
ODL website/portal is easy to use.	23.8	31.1	12.4	17.7	15.0	3.31	0.73
Internet is easy to use.	24.5	26.5	14.3	19.9	14.8	3.26	0.64
Open educational resources (OERs) are easy to use.	19.2	21.6	15.5	26.5	17.2	2.99	0.60
Digital libraries & repositories are easy to use.	17.9	19.9	19.6	21.0	21.6	2.91	0.54
Online assessment tools are easy to use.	16.1	19.9	18.8	24.3	21.0	2.86	0.57
Satellite TV is easy to use.	15.7	19.9	12.1	30.9	21.4	2.77	0.72
Tablets/ipads are easy to use.	14.3	17.4	16.3	29.1	22.7	2.72	0.67
Video conferencing tools are easy to use.	14.8	15.0	21.0	25.2	24.1	2.71	0.63
Course managements system (CMS) is easy to use.	9.9	12.4	19.6	28.9	29.1	2.45	0.82
<b>Total</b>	<b>19.9</b>	<b>23.7</b>	<b>14.7</b>	<b>22.8</b>	<b>18.9</b>	<b>3.03</b>	<b>0.7</b>

Mean criterion=3.0; Weighted Mean for Technology perceived ease of use= 3.03

**Table 4:** Challenges of technology ease of use for ODL in rural communities in Southwest, Nigeria..

<b>Challenges of technology ease of use</b>	<b>Frequency</b>	<b>Percentage</b>
Erratic power supply	411	90.7
High cost of Internet access	392	86.5
Poor Internet connectivity	351	77.5
High cost of digital technology	313	69.1
Poor technology infrastructure	295	65.1
Low bandwidth	286	63.1
Inadequate digital technology use skills	258	57
Inadequate digital technology training	177	39.1
Coping with digital technology speed of change	142	31.3
<b>Mean</b>	<b>292</b>	<b>64.4</b>

learners. These findings reflect the widespread adoption and routine use of these technologies in daily communication and learning. ODL websites/portals (Mean = 3.31) and the Internet (Mean = 3.26) were rated as moderately easy to use, implying that while users can generally navigate these platforms, technical difficulties such as poor connectivity or limited digital skills might hinder smooth use. Technologies with mean scores below 3.0—including Open Educational Resources (OERs) (Mean = 2.99), digital libraries and repositories (Mean = 2.91), online assessment tools (Mean = 2.86), satellite TV (Mean = 2.77), tablets/iPads (Mean = 2.72), video conferencing tools (Mean = 2.71), and Course Management Systems (CMS) (Mean = 2.45) were perceived as less easy or difficult to use.

These results suggest that tools requiring higher digital literacy or more complex user interfaces may present challenges for learners in rural areas. In summary, respondents generally found basic and commonly used technologies—such as smartphones, email, and computers—easy to use, while specialized educational tools like CMS, OERs, and video conferencing applications were perceived as less user-friendly. This pattern suggests a digital skill gap and highlights the need for training and user support to enhance the effective use of ODL technologies in rural communities.

Table 4 shows responses to the open-ended question revealing the significant challenges affecting technology ease of use for ODL in rural areas of Nigeria. The most prominent issue, reported by 90.7% of respondents, is

erratic power supply, highlighting the fundamental problem of unstable electricity, which disrupts the use of all electronic learning tools. This is closely followed by challenges of high cost of Internet access (86.5%) and poor Internet connectivity (77.5%), both of which seriously hinder students' ability to participate in online learning activities.

Financial barriers are also evident, with 69.1% citing the high cost of ICT equipment and 65.1% pointing to poor digital technology infrastructure in their communities. Technical limitations such as low bandwidth (63.1%) further exacerbate connectivity issues. Moreover, inadequate digital technology skills (57%) and a lack of proper ICT training (39.1%) show that, beyond infrastructural challenges, there are significant gaps in user knowledge and competency. Additional concerns include coping with the rapid pace of technological change (31.3%), suggesting students struggle to keep up with evolving digital tools. Overall, the data reflect that rural students face a combination of infrastructure, financial, connectivity, and skills-related challenges, all of which heavily constrain their ability to effectively use ODL technologies.

## DISCUSSION

This study investigated the challenges of technology ease of use and adoption among open and distance learners in rural Nigerian communities. The findings revealed mixed perceptions regarding technology availability,

accessibility, ease of use and related challenges. Results presented in Table 1 show that students' perception of technology availability (Mean = 3.31 > 3.0) for ODL activities was moderate. The study suggests that some technologies, such as smartphones, email or messaging platforms, and laptops or desktop computers were relatively available to students. However, course management system (CMS), video conferencing tools, online assessment platforms, and digital libraries were reported as less consistently available. This reflects infrastructural gaps and uneven investment in ODL technologies across communities, which is consistent with earlier research that emphasizes limited institutional provision of core learning technologies in African contexts (Udanoh & Zouria, 2023; Enakrire et al., 2025).

Findings from Table 2 also showed overall (Mean = 3.12 > 3.0) slightly above average, indicating students' perceptions of technology accessibility was moderate in the rural communities. Most mainstream technologies, such as smartphones, email & messaging platforms, internet, laptops/ desktop computers and ODL website/portals were perceived as accessible in the rural communities. However, barriers emerge with tools requiring higher bandwidth or specialised access rights, such as digital libraries, video conferencing applications, and open educational resources (OERs). This disparity highlights the digital divide between basic communication technologies and advanced academic resources, with rural students often disadvantaged by weak connectivity and lack of institutional support (Pei-Yu, 2013). This disparity hinders effective learning, as they cannot effectively use the technology and internet necessary for modern education, leading to academic underperformance (Mwansa et al., 2025).

Table 3 shows that students generally perceive smartphones, email, and laptops as easy to use, whereas technologies such as course management systems (CMS), online assessment platforms, and video conferencing tools were considered more difficult to use. This may be attributed to inadequate user training, limited digital literacy, and complex interfaces that are not tailored to low-bandwidth environments (Song et al., 2025). These findings align with the Technology Acceptance Model (TAM), which emphasizes that perceived ease of use strongly influences technology adoption (Akpe et al., 2023).

Findings from Table 4 demonstrate that challenges of technology ease of use and adoption for ODL in rural areas cut across infrastructural, economic, and skill-based dimensions (Enakrire et al., 2025). Erratic power supply (90.7%), high cost of Internet access (86.5%), and poor Internet connectivity (77.5%) were the most critical challenges reported (Igboeli & Bisallah, 2021). Additionally, the high cost of digital devices (69.1%) and poor technology infrastructure (65.1%) further limit meaningful engagement with ODL technologies. On the skill side, inadequate digital literacy (57%) and insufficient

training opportunities (39.1%) hinder effective utilization. Finally, the rapid pace of technological change (31.3%) presents ongoing adaptation challenges. Taken together, the findings reveal that while certain technologies are available, accessible, and easy to use, systemic infrastructural and financial barriers continue to undermine technology ease of use and adoption in ODL in rural communities.

The findings of this study corroborate those of Olayemi et al. (2021), who reported that limited digital infrastructure and unstable connectivity continue to impede effective ODL participation among rural learners in Nigeria. Similarly, Mukuni (2019) found that students' readiness for technology-mediated learning is influenced by access to reliable power and affordable internet services. However, unlike earlier studies that focused primarily on institutional factors, this study highlights the personal and contextual challenges faced by rural-based ODL students, thereby contributing to a more nuanced understanding of technology adoption in Nigerian ODL environments.

Technological barriers like Erratic power supply, High cost of Internet access and a lack of digital skills or access can significantly reduce learning engagement and hurt academic performance by impairing access self-learning and creating inequalities for students without necessary resources (Nyongesa & Van Der Westhuizen, 2025). Poor instructor use of technology and inadequate infrastructure create significant barriers to learning, leading to decreased student participation and lower academic outcomes by hindering effective teaching, creating poor learning environments, and causing teacher and student stress (John & Aliyu, 2024)

The perceived challenges in accessing technology have considerable negative impacts, resulting in decreased technology usage, widening digital divide and restricted economic opportunities (Olanrewaju et al., 2021). Technological barriers significantly discourage learning engagement, leading to lower participation and poor retention rates (Khan et al., 2020). Students who face difficulties in accessing technology are less likely to stay engaged with it (Adedoyin & Soykan, 2020). This affects both individual learners and overall programme participation as it discourages participation, particularly among learners from disadvantaged backgrounds.

Moreover, the perception that technology is difficult to access exacerbates existing inequalities, particularly between students from urban and rural areas. Rural communities, in particular, are proportionately affected by technological limitations, leading to unequal access to education. This digital divide undermines the promise of ODL as an equitable learning solution (James & Thériault, 2020). Learners who perceive technology as inaccessible often also have to invest additional resources, purchasing hardware, software, or improving Internet connections, to participate in ODL. This increases financial burden, particularly on students from low-income backgrounds (Zhao et al., 2020). Educational institutions also face

higher costs as they attempt to upgrade infrastructure to address accessibility concerns. The study supports the idea that digital technology access and availability are fundamental factors in technology integration and use in education (Habibi et al., 2023). It substantiates the claim by Owate (2018) that a high degree of relationship exists between technology accessibility and utilization, thus establishing that technology accessibility and utilization have a significant relationship with the attainment of academic goals among undergraduate students. In the study, mobile phones emerged as the most available, accessible, and user-friendly technology. This can be attributed to their widespread ownership, affordability, portability, and compatibility with various learning platforms. Most learners are already familiar with using mobile phones for communication and internet access, making them intuitive tools for learning.

Additionally, mobile phones support multiple content formats such as text, audio, and video, requiring minimal infrastructure, which is especially advantageous in low-resource settings. In contrast, conference tools like Zoom or Microsoft Teams were found to be the least available, least accessible, and least user-friendly. These platforms typically demand high-speed internet, more advanced devices, infrastructure and a certain level of digital literacy. Furthermore, they often require synchronized participation, which poses challenges for learners with connectivity issues, limited digital skills, or conflicting schedules. As a result, the disparity in infrastructure, cost, and ease of use makes mobile phones more suitable for ODL environments compared to real-time conferencing tools.

## Conclusion

Ease of use is a key factor in technology adoption. However, this study found that distance learners in rural Nigerian communities face major challenges, including erratic power supply, high Internet costs, poor connectivity, expensive digital technologies, and inadequate infrastructure. Additional barriers include low bandwidth, limited digital skills, insufficient training, and rapid technological change. These factors restrict availability, accessibility, and use, indicating that improving availability and access would directly enhance ease of use. Prior studies support these findings, underscoring the need for targeted interventions such as stable electricity, reliable and affordable Internet, adequate ICT infrastructure, and training and support centres in rural areas. Without addressing these issues, the potential of ODL to deliver inclusive education in rural Nigeria will remain unrealized. The findings of this study have practical and policy-oriented implications for improving the effectiveness of distance learning in rural communities. The study provides evidence that can inform institutional planning and government interventions. Specifically, it highlights the

need for targeted infrastructure development, digital literacy training and user-centered design of ODL platforms to ensure inclusivity and equity in access to higher education. Stakeholders such as university administrators, policymakers, and educational technology providers can use these insights to design more responsive and context-aware learning environments for deserving populations.

## Limitation

Despite the depth, significance, and implications of this study, it is not without limitations. The findings may be influenced by sampling bias, as participants were drawn solely from ODL students in three federal universities in Southwest Nigeria, which may not fully represent all open and distance learners across the country. Additionally, the cross-sectional survey design limits the ability to capture changes in technology adoption and ease of use over time. Furthermore, since the data were collected through self-reported questionnaires, responses may be subject to social desirability bias or inaccuracies in participants' perceptions. These limitations should be considered when interpreting the findings. Nevertheless, the study provides valuable insights into the accessibility and usability of ODL technologies in rural contexts, and future research employing longitudinal or mixed-method designs could further deepen understanding and validate these results.

## REFERENCES

- Adedoyin, O. B., & Soykan, E. (2020). COVID-19 pandemic and online learning: The challenges and opportunities. *Interactive Learning Environments*, 1–13. <https://doi.org/10.1080/10494820.2020.1813180>
- Akbulut, Y. (2009). Investigating underlying components of the ICT indicators measurement scale: The extended version. *Journal of Educational Computing Research*, 40(4), 405–427. <https://doi.org/10.2190/EC.40.4.b>
- Akpe, O.-E. E., Mgbame, A. C., Ogbuefi, E., Abayomi, A. A., & Adeyelu, O. O. (2023). *Technology acceptance and digital readiness in underserved small business sectors*. *Journal of Frontiers in Multidisciplinary Research*, 4(1), 252–268. <https://doi.org/10.54660/IJFMR.2023.4.1.252-268>
- Anderson, M., & Kumar, M. (2019). Digital divide persists even as lower-income Americans make gains in tech adoption. *Pew Research Center*. <https://www.urbanismnext.org/resources/digital-divide-persists-even-as-lower-income-americans-make-gains-in-tech-adoption>
- Anker, R., & Anker, M. (2020). *Living income reference value: Rural Nigeria 2020*. Global Living Wage Coalition. <https://globallivingwage.org/wp-content/uploads/2021/01/Rural-Nigeria-LI-Reference-Value.pdf>
- Aruleba, K., & Jere, N. (2022). Exploring digital transforming challenges in rural areas of South Africa through a systematic review of empirical studies. *Scientific African*, 16, e01190. <https://doi.org/10.1016/j.sciaf.2022.e01190>
- Beaunoyer, E., Dupere, S., & Guittou, M. J. (2020). COVID-19 and digital inequalities: Reciprocal impacts and mitigation strategies. *Computers in Human Behavior*, 111, 106424. <https://doi.org/10.1016/j.chb.2020.106424>
- Billanes, J., & Enevoldsen, P. (2021). A critical analysis of ten influential

- factors to energy technology acceptance and adoption. *Energy Reports*, 7, 6899–6907. <https://doi.org/10.1016/j.egy.2021.09.118>.
- Bisong, A. E., Nkanu, C. U., Imoke, J. E., & Akpo, F. A. (2023). Challenges and prospects of using information and communication technologies (ICT) in instructional delivery in Cross River State Secondary Schools. *Library Philosophy and Practice (e-journal)*, Article 7739, 1–20. <https://digitalcommons.unl.edu/libphilprac/7739>
- Boliek, B., Makuch, K., Matraves, C., & Yankelevich, A. (2019). Economics at the FCC 2018–2019: Competition, broadband deployment, and transaction review. *Review of Industrial Organisation*, 55, 625–646. <https://doi.org/10.1007/s11151-019-09740-3>
- Chan, D. Y. L., Lee, S. W. H., & Teh, P.-L. (2023). Factors influencing technology use among low-income older adults: A systematic review. *Heliyon*, 9(9), e20111. <https://doi.org/10.1016/j.heliyon.2023.e20111>.
- Cheraghizadeh, R., Olya, H., & Tumer, M. (2021). The effects of external and internal factors on competitive advantage—Moderation of market dynamism and mediation of customer relationship building. *Sustainability*, 13(7), 4066. <https://doi.org/10.3390/su13074066>.
- Cyr, D., Head, M., & Ivanov, A. (2006). Design aesthetics leading to m-loyalty in mobile commerce. *Information & Management*, 43(8), 950–963. <https://doi.org/10.1016/j.im.2006.08.009>
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340. <https://doi.org/10.2307/249008>
- Enakrire, R. T., Fombad, M. C., & Morodi, L. (2025). *Skills required of academics to use digital technologies in open distance learning institutions*. *Innovative Higher Education*, 50, 843–866. <https://doi.org/10.1007/s10755-024-09758-w>
- Fischer, S. H., David, D., Crotty, B. H., Dierks, M., & Safran, C. (2014). Acceptance and use of health information technology by community-dwelling elders. *International Journal of Medical Informatics*, 83(9), 624–635. <https://doi.org/10.1016/j.ijmedinf.2014.06.005>
- Goodhue, D. L., & Thompson, R. L. (1995). Task-technology fit and individual performance. *MIS Quarterly*, 19(2), 213–236. <https://doi.org/10.2307/249689>.
- Habibi, A., Sofyan, S., & Mukminin, A. (2023). Factors affecting digital technology access in vocational education. *Scientific Reports*, 13(1), 5682. <https://doi.org/10.1038/s41598-023-32755-6>
- Hadalgekar, S., & Desai, N. (2025). Role of perceived ease of use and perceived usefulness in adoption of mobile computing technology. *International Journal of Social Science and Human Research*, 8(6), 4458–4462. <https://doi.org/10.47191/ijsshr/v8-i6-58>.
- Hamutoglu, N. B., & Basarmak, U. (2020). External and internal barriers in technology integration: A structural regression analysis. *Journal of Information Technology Education: Research*, 19, 17–40. <https://doi.org/10.28945/4497>
- Han, J., Wang, J., & Zhang, W. (2023). Digital adoption levels and income generation in rural households in China. *Heliyon*, 9(11), e21045. <https://doi.org/10.1016/j.heliyon.2023.e21045>
- Helsper, E. J., & Van Deursen, A. J. (2020). Digital skills in Europe: Research and policy. In *Perspectives on Internet Use: Access, Adoption and Effects on Digital Inequalities* (pp. 187–204). Routledge.
- Holden, R. J., & Rada, D. (2021). Usability and user experience in health technology: Understanding and improving the human-technology interaction. *Health Technology*, 11(2), 101–113. <https://doi.org/10.1007/s12553-020-00496-1>
- Huggins, R., & Thompson, P. (2025). Behavioural theory and regional development: Nurturing cultures of possibility. *Spatial Economic Analysis*. Advance online publication. <https://doi.org/10.1080/17421772.2025.2474769>
- Igboeli, U. H., & Bisallah, H. I. (2021). ICT infrastructural and technical challenges: A major impediment towards the development of open and distance learning (ODL) in Nigeria. *International Journal of Distance Education and E-Learning (JDEEL)*, 6(1), 1–12.
- James, N., & Thériault, V. (2020). Adult education in remote communities: Digital divide and the promise of online learning. *Journal of Education for Teaching*, 46(3), 263–275. <https://doi.org/10.1080/02607476.2020.1734222>
- John, M. O., & Aliyu, U. L. (2024, December). *Educational infrastructure and its impact on academic performance in Nigerian schools*. *IRE Journals*, 8(6), 497–502. <https://irejournals.com>
- Johnson, M., & Turner, H. (2018). User-friendly interfaces and technology usability. *Human-Computer Interaction Journal*, 37(1), 55–72.
- Khan, M. A., Vivek, Nabi, M. K., Khojah, M., & Tahir, M. (2020). Students' perception towards e-learning during COVID-19 pandemic in India: An empirical study. *Sustainability*, 12(21), 1–11. <https://doi.org/10.3390/su12218942>
- Kumar, R., Sharma, V., & Gupta, A. (2021). Geographic disparities in technology availability. *International Journal of Rural Technology*, 29(4), 399–415.
- Lee, Y., Kozar, K. A., & Larsen, K. R. T. (2019). The technology acceptance model: Past, present, and future. *Communications of the Association for Information Systems*, 12(1), 752–780.
- Liu, X., & Li, Y. (2020). Economic factors and technology adoption: A study on cost and availability. *Economic Technology Review*, 45(3), 245–262.
- Livingstone, S., Stoilova, M., & Nandagiri, R. (2021). Data and privacy literacy: The role of the school in educating children in a datafied society. *Children & Society*, 35(1), 16–29.
- McKnight, P. E., McKnight, D. J., Sidani, S., & Figueredo, A. J. (2018). *Missing data: A gentle introduction*. Guilford Press.
- Misra, S., Adtani, R., Singh, Y., Singh, S., & Thakkar, D. (2023). Exploring the factors affecting behavioral intention to adopt wearable devices. *Clinical Epidemiology and Global Health*, 24, 101428. <https://doi.org/10.1016/j.cegh.2023.101428>
- Mukred, M., Mokhtar, U. A., Hawash, B., AlSalman, H., & Zohaib, M. (2024). The adoption and use of learning analytics tools to improve decision making in higher learning institutions: An extension of technology acceptance model. *Heliyon*, 10(4), e26315. <https://doi.org/10.1016/j.heliyon.2024.e26315>.
- Nyongesa, W. J., & Van Der Westhuizen, J. (2025). *The impact of digital teaching tools on student engagement and learning outcomes in higher education in Africa*. *International Journal of Innovative Research and Scientific Studies*, 8(4), 264–280. <https://www.ijriss.com>
- Norman, D. A., & Nielsen, J. (2021). The definition of user experience (UX). *Nielsen Norman Group*. <https://www.nngroup.com/articles/definition-user-experience>.
- Mukuni, J. (2019). *Challenges of educational digital infrastructure in Africa: A tale of hope and disillusionment*. *Journal of African Studies and Development*, 11(5), 59–63. <https://doi.org/10.5897/JASD2019.0539>.
- Mwansa, G., Ngandu, M. R., & Mkwambi, Z. (2025). *Bridging the digital divide: Exploring the challenges and solutions for digital exclusion in rural South Africa*. *Discover Global Society*, (3), 54. <https://doi.org/10.1007/s44282-025-00189-2>
- Olaleye, Y. L., & Ayeni, A. O. (2019). Distance education in rural areas: Preserving the strength of the community development in Nigeria. *African Journal of Educational Management*, 17(4), 1–13. <https://www.academia.edu/39313937/>
- Olanrewaju, G. S., Adebayo, S. B., Omosho, A. Y., & Olajide, C. F. (2021). Left behind? The effects of digital gaps on e-learning in rural secondary schools and remote communities across Nigeria during the COVID-19 pandemic. *International Journal of Educational Research Open*, 2, Article 100092. <https://doi.org/10.1016/j.ijedro.2021.100092>
- Olayemi, O. M., Adamu, H., & Olayemi, K. J. (2021). *Perception and readiness of students towards online learning in Nigeria during COVID-19 pandemic*. *Library Philosophy and Practice (e-journal)*, 5051. <https://digitalcommons.unl.edu/libphilprac/5051>
- Owate, C. N. (2018). Accessibility and utilization of e-learning resources of undergraduate students in academic libraries: A precursor to academic goals. *Information and Knowledge Management*, 8(9), 28–33. <https://core.ac.uk/download/pdf/234672709.pdf>
- Palvia, S., Aeron, P., Gupta, P., Mahapatra, D., Parida, R., Rosner, R., & Sindh, S. (2020). Online education: Worldwide status, challenges, trends, and implications. *Journal of Global Information Technology Management*, 23(4), 233–241.
- Pei-Yu, W. (2013). Examining the digital divide between rural and urban schools: Technology availability, teachers' integration level and students' perception. *Journal of Curriculum and Teaching*, 2(2), 127–139. <https://doi.org/10.5430/jct.v2n2p127>
- Smith, J., Brown, L., & Green, P. (2019). Infrastructure development and

- technology ease of use. *Journal of Technological Advances*, 34(2), 101–117.
- Song, Y., Qiu, X., & Liu, J. (2025). The impact of artificial intelligence adoption on organizational decision-making: An empirical study based on the technology acceptance model in business management. *Systems*, 13(8), 683. <https://doi.org/10.3390/systems13080683>.
- Udanoh, M. U., & Zouria, A. (2023). Impact of investment in EdTech: Government and entrepreneurial partnership venture in education in North and West Africa. *Advances in Educational Research and Evaluation*, 4(1), 233–238. <https://doi.org/10.25082/AERE.2023.01.003>
- Venkatesh, V., Thong, J. Y. L., & Xu, X. (2018). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS Quarterly*, 36(1), 157–178.
- Wang, Y., & Wang, Y. (2020). Development and validation of a mobile computing acceptance scale. *Journal of Research in Interactive Marketing*, 14(3), 209–226.
- Wilson, J., Heinsch, M., Betts, D., Booth, D., & Kay-Lambkin, F. (2021). Barriers and facilitators to the use of e-health by older adults: A scoping review. *BMC Public Health*, 21(1), 1556. <https://doi.org/10.1186/s12889-021-11623-w>.
- Zhao, Y., Pinto Llorente, A. M., & Sánchez Gómez, M. C. (2020). Digital competence in higher education research: A systematic literature review. *Computers & Education*, 159, 104075. <https://doi.org/10.1016/j.compedu.2020.104075>.