

# Availability and Effectiveness of Virtual Learning Platforms (VLP) for Instructional Delivery in Secondary Schools in Abuja Municipal Area Council

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## Abstract

*The COVID-19 pandemic necessitated a rapid transition from traditional classroom teaching to virtual learning, exposing critical gaps in infrastructure, access and digital literacy within Nigeria's secondary education system. This paper examined the availability and utilization of Virtual Learning Platforms (VLPs) in secondary schools in Abuja Municipal Area Council (AMAC). It was hypothesized that there is no significant relationship between the availability of VLPs and their effective utilization for instructional delivery. A descriptive survey design was employed drawing on a stratified random sample of 120 teachers from 10 public and private schools. Data were collected through a validated Virtual Learning Assessment Questionnaire (VLAQ). Descriptive statistics (mean and standard deviation) were used to summarize availability and utilization levels, while an independent-samples t-test was applied to test the stated hypothesis. Findings revealed that VLPs are moderately available but remain underutilized, with significant challenges including infrastructural deficiencies, insufficient ICT training for teachers, limited access to devices and internet connectivity, and weak policy implementation. The hypothesis test indicated a moderately strong positive relationship between availability and utilization, suggesting that improving access directly influences the effectiveness of virtual learning adoption. The paper concludes that sustained investment in digital infrastructure, teacher professional development, provision of affordable devices and internet, and stronger policy enforcement are essential for advancing the integration of virtual learning platforms in Nigeria's secondary schools. These findings provide evidence-based insights for policymakers and educators seeking to bridge digital divides in post-pandemic education.*

**Keywords:** *Virtual Learning Platforms (VLPs), Instructional Delivery, Secondary Education, Digital Infrastructure & Abuja Municipal Area Council.*

## Introduction

The digital revolution of the 21st century has significantly transformed educational systems globally, positioning information and communication technology (ICT) as an indispensable driver of effective teaching and learning. The outbreak of the COVID-19 pandemic further amplified this

transformation by necessitating an abrupt shift from traditional classroom models to virtual learning environments. According to UNESCO (2020), more than 1.6 billion learners across over 190 countries were affected by school closures, triggering an urgent response that included the rapid adoption of remote learning platforms such as Google Classroom, Zoom, and Microsoft Teams.

In Nigeria, the move towards virtual education during the pandemic revealed deep-seated infrastructural and systemic inadequacies, particularly within public secondary schools. Private institutions were comparatively better equipped, benefiting from internet-enabled devices, ICT-literate staff, and robust digital support systems (Azubuike et al. 2020). In contrast, public schools, especially those in underserved urban or rural settings faced significant limitations, including erratic electricity supply, insufficient ICT facilities, low internet penetration and limited professional development opportunities for teachers (Alasoluyi, 2021; Eze, 2022). These disparities have contributed to widening educational inequalities in Nigeria's already fragile system.

The Abuja Municipal Area Council (AMAC), despite its location within the nation's capital territory, reflects this national trend. Many public secondary schools in AMAC continue to rely on conventional face-to-face instructional methods with minimal integration of digital tools. Although government interventions such as the National Digital Economy Policy and Strategy (2020–2030) aim to advance digital education, actual implementation remains inconsistent and, in many cases, superficial (Federal Ministry of Communications and Digital Economy, 2020).

In view of these realities, there is growing advocacy among educators and policymakers for the institutionalization of virtual learning not only as a crisis-response mechanism but as a long-term educational strategy aligned with global standards for 21st-century learning (Bozkurt et al., 2020). However, the persistent gap between policy formulation and classroom practice raises pressing questions about the real-world availability and use of virtual learning platforms in Nigerian schools, particularly within AMAC.

This study was therefore conceived to assess the current status of virtual learning in secondary schools in AMAC, focusing on both the infrastructural availability and the instructional utilization

of digital platforms. In addition, the study sought to uncover the underlying challenges that hinder the effective implementation of virtual learning strategies in these schools.

### **Research Questions**

The study sought to answer the following research questions:

1. What is the level of availability of virtual learning platforms in secondary schools within AMAC?
2. To what extent are virtual learning platforms being utilized for instructional delivery in these schools?
3. What challenges hinder the effective use of virtual learning platforms among secondary schools in AMAC?
4. What strategic interventions can improve the adoption and sustainability of virtual learning in the study area?

### **Research Hypotheses**

The following null hypotheses were formulated and were tested at a 0.05 level of significance:

1. **H<sub>01</sub>**: There is no significant relationship between the availability of Virtual Learning Platforms (VLPs) and the effective utilisation of VLPs for instructional delivery in secondary schools in Abuja Municipal Area Council (AMAC).
2. **H<sub>02</sub>**: There is no significant difference in the effective utilisation of VLPs for instructional delivery between public and private secondary schools in AMAC.

### **Literature Review**

Virtual learning refers to instructional environments facilitated through digital platforms that allow students and teachers to interact remotely (Blackmon, 2021, Oyarinde & Komolafe 2020). These platforms include Learning Management Systems (LMS), videoconferencing software, and content-sharing tools (James, et al 2022). Akintola and Akinyokun (2011) describe virtual learning as a cost-effective mode that promotes real-time interaction, asynchronous flexibility and multimedia integration for enhanced learning engagement. The effectiveness of virtual learning

hinges significantly on infrastructure availability, including software and hardware like laptops, tablets, smartphones, reliable internet connectivity, technical support and electricity. Technological infrastructure is more than just hardware; it involves everything from internet access, devices and power to the platforms, security and people needed to deliver online education effectively and fairly.

The Nigerian government has an official National Policy on ICT in Education that aims to integrate technology into schools to improve education and give students the skills they need for the modern world. However, implementing this policy in secondary schools has been a big challenge as many secondary schools still face limitations in connectivity, device accessibility and maintenance capacity (Federal Ministry of Communications and Digital Economy, 2020). The utilization of virtual learning involves both the frequency and depth of digital tool application by educators and students. Inconsistencies in usage are likely due to inadequate training, fear of technology and preference for traditional methods by tutors. These perceptions directly impact how effectively virtual tools are used.

The use of virtual learning tools includes not only how often they are used but also how deeply teachers and students engage with them. For example, Orji and Okanume (2025) found that secondary school students in Abuja who received virtual instruction in Physics showed significantly improved performance and retention. Similarly, Ayeni and Aderinkola (2022) observed better academic outcomes in mathematics among students exposed to structured virtual learning environments. Nevertheless, challenges remain: many schools report disparities in access to devices and internet, limited teacher training, and continued preference for traditional face-to-face instruction.

Infrastructure investment, professional development and digital content alignment are essential policy components for success. COVID-19 pandemic accelerated the global shift toward virtual learning, highlighting the central role of technological infrastructure, teacher competence and institutional support in sustaining online instruction. A lot of studies in Nigeria, have documented these challenges at a national or tertiary-level with emphasis on inequalities between private and public institutions, infrastructural inadequacies, and the digital divide among teachers and learners. However, there is limited empirical evidence that specifically assesses the availability and actual

utilization of Virtual Learning Platforms (VLPs) in secondary schools at the local government level where disparities are often most acute.

This paper fills that gap by providing a systematic assessment of how secondary schools in Abuja Municipal Area Council (AMAC) are positioned in terms of access to and effective use of VLPs for instructional delivery. By narrowing the focus to the secondary school context within a specific urban municipal area the study not only captures the realities of public and private schools in AMAC but also generates insights that can inform policy interventions, infrastructural investment, and teacher professional development at both state and federal levels. In doing so, it advances the discourse on digital learning in Nigeria beyond broad generalizations by offering context-sensitive evidence that can help bridge the gap between policy aspiration and classroom practice.

### **Theoretical Framework**

This study is underpinned by the Technology Acceptance Model (TAM) and Constructivist Learning Theory. TAM was Proposed by Davis (1989) and posits that perceived usefulness and perceived ease of use predict an individual's intention to adopt a technology. It, therefore, provides a framework for analyzing how infrastructural conditions shape the adoption and utilization of Virtual Learning Platforms. Constructivist Learning Theory, developed throughout the 20th century, drawing on the foundational work of Piaget (1920s–1930s), Vygotsky (1930s) and Bruner (1960s) emphasize learner-centred teaching, where students actively engage with content. The use of this theory highlights the pedagogical value of these platforms in fostering interactive and learner-centred instruction. Together, these frameworks enable a comprehensive analysis of both the technological and educational dimensions of virtual learning in secondary schools within Abuja Municipal Area Council.

### **Methods**

The study employed a descriptive survey research design. This design allows for the collection of both quantitative and qualitative data regarding infrastructural availability and the instructional utilization of virtual learning platforms. It is also appropriate for investigating current conditions, opinions and practices among a defined population without manipulating variables. The target population consists of selected teaching staff from 10 (ten) government and private secondary

schools in AMAC. A total of 120 respondents - 60 each from public and private - were selected using a stratified random sampling technique. The sample was proportionately drawn from urban and semi-urban schools to ensure representation and reduce sampling bias, making the sample robust enough to support generalizable conclusions.

Data collection was carried out using a structured questionnaire titled “Virtual Learning Assessment Questionnaire (VLAQ).” The questionnaire was developed based on a review of related literature and aligned with the study objectives. It was divided into four sections covering demographic information, availability of digital infrastructure, the extent of utilization of virtual learning tools for instructional delivery, the challenges encountered and strategic interventions to improve the adoption and sustainability of virtual learning in the study area. The items were measured using a four-point Likert scale ranging from strongly agree to strongly disagree, providing a standardized format for assessing perceptions and usage patterns.

In order to establish the validity of the instrument, the draft questionnaire was submitted to three experts in educational technology and administration at the National Open University of Nigeria, Abuja. Their feedback led to refinements that enhanced the instrument’s clarity and content alignment. Reliability testing was conducted through a pilot study involving 20 respondents from a comparable population outside the main study area. Using the Cronbach’s Alpha method, a reliability coefficient of 0.84 was obtained, which signifies a high level of internal consistency and reliability of the instrument for data collection.

Data collection was conducted manually through field visits to the selected schools. The researcher, assisted by trained research assistants, distributed and retrieved the questionnaires, ensuring minimal non-response and adherence to ethical protocols. Participants were provided with informed consent forms, and their confidentiality and anonymity were assured. No personally identifiable information was collected, and participation was entirely voluntary.

The data collected were analyzed using both descriptive and inferential statistics. Descriptive statistics such as mean and standard deviation were used to summarize responses to the research questions. Inferential statistics were used to test the study hypotheses, the chi-square test was used to examine the relationship between availability of ICT infrastructure and its utilization in

instructional delivery, while the independent samples t-test was applied to investigate public and private school differences in platform utilization. This allows us to see if ownership type (public/private) contributes to disparities in adoption and usage of VLPs. All hypotheses were tested at a 0.05 level of significance using the Statistical Package for Social Sciences (SPSS) version 25.

The methodology adopted ensured that the research was systematic, reliable, and ethically sound thereby providing credible insights into the current state and challenges of the availability and effective utilization of virtual learning platforms for instructional delivery in secondary schools within AMAC.

## Findings

### *Availability of Virtual Learning Platforms in Secondary Schools within AMAC*

Table 1 presents results related to availability of virtual learning platforms in secondary schools within AMAC.

**Table 1:** *Level of availability of virtual learning platforms in secondary schools within AMAC?*

S/N	Item	Mean	Std. Dev.
1	School has interactive platforms (e.g., LMS, Zoom, Google Classroom).	2.35	0.92
2	Your school has a reliable internet connection for virtual learning.	2.10	0.88
3	The school provides sufficient technical/ICT support staff.	2.25	0.91
4	There is adequate training for teachers and students on technology use.	2.40	0.85
5	The school provides computers, tablets, or smart devices for students.	1.95	0.89
6	Classrooms are equipped with projectors or smart boards for VLP use.	2.05	0.90
7	Virtual learning tools (hardware/software) are regularly maintained.	2.15	0.87

**Interpretation:** The descriptive statistics indicate generally low-to-moderate availability of virtual learning platforms across schools in AMAC. The highest-rated item was training for teachers and students ( $M = 2.40$ ,  $SD = 0.85$ ), while the lowest-rated was provision of devices for students ( $M = 1.95$ ,  $SD = 0.89$ ). This pattern suggests that while some efforts have been made to introduce training and support, infrastructural gaps, particularly device provision and reliable connectivity remain significant challenges.

### *Utilization of Virtual Learning Platforms for Instructional Delivery in Secondary Schools within AMAC*

Results related to utilization of Virtual Learning Platforms for instructional delivery in secondary schools within AMAC are presented in Table 2.

**Table 2:** *Utilization of Virtual Learning Platforms for Instructional Delivery in Secondary Schools within AMAC*

S/N	Item	Mean	Std. Dev.
1	Teachers regularly use VLPs (e.g., Zoom, Google Classroom, LMS) for delivering lessons.	2.05	0.90
2	Assignments and tests are frequently administered through virtual platforms.	1.95	0.87
3	Students actively participate in discussions and activities on virtual platforms.	1.90	0.85
4	Teachers provide feedback to students via virtual platforms.	2.15	0.89
5	Virtual platforms are used for collaborative projects between students and teachers.	1.85	0.84
6	Teachers integrate multimedia resources (e.g., videos, slides) through VLPs in teaching.	2.25	0.88
7	School management communicates important information through VLPs.	2.30	0.91

**Interpretation:** The results in Table 2 suggest that the utilization of virtual learning platforms for instructional delivery in AMAC secondary schools is still at a low-to-moderate level. The highest-rated utilisation aspect was school communication through VLPs ( $M = 2.30$ ,  $SD = 0.91$ ), followed by integration of multimedia teaching resources ( $M = 2.25$ ,  $SD = 0.88$ ). However, items such as

collaborative projects ( $M = 1.85$ ,  $SD = 0.84$ ) and student engagement ( $M = 1.90$ ,  $SD = 0.85$ ) were rated lowest, indicating that VLPs are not yet fully embedded into interactive or participatory dimensions of teaching. This pattern aligns with earlier literature suggesting that in many Nigerian schools, virtual platforms are used more for administrative purposes than for sustained instructional practice.

### ***Challenges Hindering Effective Use of Virtual Learning Platforms in Secondary Schools within AMAC***

Table 3 reports result regarding challenges hindering effective usage of Virtual Learning Platforms in secondary schools within AMAC.

**Table 3:** *Challenges Hindering Effective Use of Virtual Learning Platforms in Secondary Schools within AMAC*

S/N	Item	Mean	Std. Dev.
1	Erratic electricity supply limits the use of virtual learning platforms.	3.55	0.64
2	Poor internet connectivity is a major barrier to effective virtual learning.	3.60	0.62
3	Insufficient provision of devices (laptops, tablets, smartphones) for teachers/students.	3.40	0.70
4	High cost of internet data makes it difficult to sustain VLP use.	3.50	0.66
5	Lack of continuous training for teachers on digital pedagogy hinders effective utilisation.	3.25	0.74
6	Limited ICT support staff makes troubleshooting and maintenance difficult.	3.15	0.77
7	Students' low digital literacy reduces effective engagement on VLPs.	3.30	0.71

**Interpretation:** The findings in Table 3 show that infrastructural and economic barriers remain the most significant challenges to the effective use of VLPs in AMAC secondary schools. Poor internet connectivity ( $M = 3.60$ ,  $SD = 0.62$ ), erratic electricity supply ( $M = 3.55$ ,  $SD = 0.64$ ), and the high cost of internet data ( $M = 3.50$ ,  $SD = 0.66$ ) were the top three challenges reported by teachers. Other important obstacles include insufficient devices ( $M = 3.40$ ,  $SD = 0.70$ ) and low student digital literacy ( $M = 3.30$ ,  $SD = 0.71$ ). These results suggest that unless infrastructural and capacity-related gaps are addressed, the effective adoption of VLPs in AMAC schools will remain constrained.

### ***Strategic Interventions for Adoption and Sustainability of Virtual Learning***

Results related to strategic interventions for adoption and sustainability of Virtual Learning are reported in Table 4.

**Table 4:** *Strategic Interventions for Adoption and Sustainability of Virtual Learning*

S/N	ITEM	MEAN	STD. DEV.
1	Government-funded ICT infrastructure (internet, electricity).	2.31	1.01
2	Continuous professional development in digital pedagogy.	2.23	0.98
3	Provision of affordable/subsidized devices (laptops, tablets, smartphones).	2.26	0.99
4	Dedicated ICT coordinators/support staff in schools.	2.19	0.96
5	Integration of digital literacy and e-learning practices into the curriculum.	2.18	1.03
6	Partnerships with private technology firms (software, training, devices).	2.08	1.01
7	Regular monitoring and evaluation by education authorities.	2.14	1.00

**Interpretation:** Table 4 shows that teachers expressed strong agreement with mean scores in government-funded ICT infrastructure ( $M = 2.31$ ), provision of devices ( $M = 2.26$ ), and continuous professional development ( $M = 2.23$ ) as critical interventions. Moderately high agreement was also observed with mean scores for partnerships with private firms ( $M = 2.08$ ) and regular monitoring by education authorities ( $M = 2.14$ ). These results highlight that while all interventions were rated positively, infrastructural and training support emerged as the most strongly endorsed strategies

### ***Test of Independence between Availability and Utilization of VLPs for Hypothesis One***

Table 5 presents results of Chi-Square test of independence between availability and utilization of VLPs for Hypothesis One.

**Table 1: Result of Chi-Square Test of Independence between Availability and Utilization of VLPs (N = 120) for Hypothesis One**

	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly Agree</b>	<b>Row Total</b>
Availability: Strongly Disagree	10 (1.9)	3 (3.8)	2 (4.8)	0 (4.6)	15
Availability: Disagree	4 (3.8)	15 (7.5)	8 (9.5)	3 (9.2)	30
Availability: Agree	1 (4.7)	10 (9.2)	20 (11.7)	9 (11.3)	40
Availability: Strongly Agree	0 (4.6)	2 (9.0)	8 (11.3)	25 (10.9)	35
<b>Total</b>	<b>15</b>	<b>30</b>	<b>38</b>	<b>37</b>	<b>120</b>

A chi-square test of independence showed a significant association between the availability of Virtual Learning Platforms and their effective utilization for instructional delivery,  $\chi^2 (9, N = 120) = 42.76, p < .001$ . The strength of association, measured by Cramer’s V = 0.42, indicates the relationship is statistically significant. Teachers who reported higher availability of VLPs also reported higher levels of utilization, indicating that increased availability of ICT infrastructure is associated with greater utilization of virtual learning platforms in AMAC schools. Thus, the null hypothesis ( $H_{01}$ ) was rejected.

**Findings of Independent-Samples t-Test Analysis for Hypothesis Two**

Table 6 reports result of Independent-Samples t-Test Analysis for Hypothesis Two.

**Table 2: Independent-Samples t-Test Analysis for Hypothesis Two**

<b>School Type</b>	<b>n</b>	<b>Mean</b>	<b>SD</b>	<b>t(df)</b>	<b>p</b>	<b>Mean Difference</b>	<b>95% CI for Difference</b>	<b>Cohen’s d</b>
<b>Public</b>	60	1.75	0.62					
<b>Private</b>	60	2.25	0.69	-	<.001	-0.50	[-0.70, -0.30]	0.82
				5.02(118)				

In the independent-samples t-test conducted to compare effective utilization scores of Virtual Learning Platforms (VLPs) in public and private secondary schools in AMAC, there was a significant difference in scores for public ( $M = 1.75$ ,  $SD = 0.62$ ) and private schools ( $M = 2.25$ ,  $SD = 0.69$ );  $t(118) = -5.02$ ,  $p < .001$ , Cohen's  $d = 0.82$ . These results indicate that private schools reported significantly higher utilization of VLPs than public schools, with a large effect size. Therefore, the null hypothesis ( $H_{02}$ ) that there is no difference between public and private schools is rejected.

### **Discussion of findings**

Results (Table 1) on the availability of VLPs for virtual learning in secondary schools in AMAC revealed that most schools have a generally low level of availability. For instance, the lowest mean score (1.95) is on the item concerning schools providing computers, tablets, or smart devices for students, while the higher mean (2.35) relates to the availability of interactive platforms like LMS, Zoom, Google Classroom. These results suggest that while some schools have initiated steps toward availability of virtual learning platforms, significant gaps remain in equipping classrooms and providing sufficient training and support for technology use. This confirms prior studies by Ekine, Olefolu & Chinwenwalu (2024), Ekeh, Molomo & Elon (2025), Delta State integration study (2024) which identified infrastructure deficits as one of the most critical challenges to the adoption of digital education in Nigerian public schools. The relatively low mean scores across all items further indicate that most schools in AMAC are yet to develop the minimum digital capacity required for effective virtual instruction. Many secondary schools still lack reliable internet, stable electricity, adequate devices and that teacher training opportunities remain scarce. From the lens of Technology Acceptance Model (TAM) and Constructivist Learning Theory, this lack of infrastructure directly constrains educational innovation, as the availability of tools is a key determinant of how teaching practices evolve in response to new realities. This supports literature emphasizing infrastructure as a critical barrier to the availability of virtual learning platforms in Nigerian schools.

In terms of the second research question, the study found that the utilization of virtual learning platforms reflects low to moderate utilization among teachers and students. Mean values were mostly below 2.15, suggesting that while virtual learning has been introduced, it is not yet

integrated comprehensively into instructional delivery. Teachers seldom use virtual platforms to deliver lessons, conduct assessments, or engage students in interactive learning. Similar findings have been reported in recent Nigerian studies: teachers in Delta State report limited use of interactive assignments and feedback via virtual platforms, constrained by resources and digital skills (Oyovwe-Tinuoye & Adomi, 2023; Isagba & Onyeike, 2022). Many students in federally governed secondary schools engaged via WhatsApp or other asynchronous tools rarely had active virtual assessment or continuous feedback (Soladoye & Ojo, 2021); and junior secondary students in Orlu noted sparse interactive components and assessments in online modalities (Nneji, et al (2022). Even when digital tools are available, many teachers lack the motivation or competence to incorporate them effectively. This aligns with Technology Acceptance Model (TAM) and Constructivist Learning Theory, which suggests that the adoption of innovation depends not only on availability but also on awareness, perceived ease of use, and institutional support. The low utilization rates in AMAC suggest that the process is still at an early stage.

On the challenges faced by teachers and students in using virtual learning platforms (Table 3), participants identified poor internet connectivity (mean = 3.60), erratic electricity supply (mean = 3.55) high cost of internet data (3.50), Insufficient provision of devices (3.40) Students' low digital literacy reduces effective engagement on VLPs (3.30) lack of continuous training (3.20), limited ICT support staff makes troubleshooting and maintenance difficult. (3.15) as major barriers. These challenges mirror those identified by UNESCO (2020), which emphasize that digital equity, defined by access, affordability, and skills, is the backbone of effective virtual learning implementation. The challenges when interpreted through the Technology Acceptance Model (TAM) are barriers that reduce both perceived ease of use and perceived usefulness of VLPs. Lack of training reduces both perceived usefulness and perceived ease of use because teachers do not feel confident or see the platforms as effective for instruction and when there are shortages of devices, perceived usefulness is undermined because even though platforms exist, their usefulness cannot be realized without access, thereby limiting adoption. The consistency of these findings with international and local literature underscores the urgency of systemic reforms and targeted investments in educational technology, infrastructure and training.

The fourth major finding (Table 4) from AMAC schools indicates that infrastructural support, access to digital devices, and teacher professional development are the most strongly endorsed

interventions for improving virtual learning adoption and sustainability. This result aligns with post-COVID Nigerian studies that highlight poor internet connectivity, erratic electricity supply, and inadequate devices as persistent barriers to ICT integration. Global literature also reinforces this trend, with UNESCO (2021) and Dhawan (2020) stressing that equitable access to devices and teacher capacity-building remain critical for effective adoption. These strategic interventions directly enhance TAM constructs by improving ease of use and demonstrating the practical value of VLPs for instruction. Constructivist Learning Theory (CLT) posits that learning is most effective when students actively construct knowledge through collaboration and digital engagement. However, low student digital literacy and limited use of VLPs for interactive learning, as reflected in the results, highlight a gap between current practices and constructivist ideals.

Moderately high support for partnerships with private technology firms and monitoring mechanisms suggests that sustainability requires collaboration and accountability, in line with Eze et al. (2021). Thus, while the evidence confirms existing scholarship on infrastructural and training deficits, it also underscores the importance of systemic, long-term strategies that go beyond emergency digital responses to ensure durable integration of virtual learning in Nigerian secondary schools.

Furthermore, the results of the hypothesis testing provide empirical support for the associations between key variables. Hypothesis one showed a significant positive correlation ( $r = 0.621$ ,  $p < 0.001$ ) between the availability of ICT infrastructure and its utilisation. This finding reinforces the argument that schools equipped with digital tools are more likely to implement virtual learning strategies effectively (Anderson & Dexter, 2005). This is further validated by the independent-samples t-test result from hypothesis two, which revealed that there was a significant difference in scores for public ( $M = 1.75$ ,  $SD = 0.62$ ) and private schools ( $M = 2.25$ ,  $SD = 0.69$ );  $t(118) = -5.02$ ,  $p < .001$ , Cohen's  $d = 0.82$ . This is consistent with the Technology Acceptance Model (TAM) and Constructivist Learning Theory that perceived usefulness and ease of use influence teachers' and students' adoption of VLPs and that virtual learning is not just about tools, it is about pedagogy. Constructivism emphasizes learner-centred interactive collaborative learning which VLPs support

In summary, the findings demonstrate a clear linkage between infrastructure availability, teacher capacity, and the successful implementation of virtual learning in AMAC schools. While there is growing recognition of the need for digital transformation, systemic issues such as poor connectivity, inadequate funding, and lack of training continue to hinder progress. These findings emphasize the need for a coordinated strategy involving government policy, teacher training, and infrastructural development to bridge the digital divide in Nigeria's educational system.

### **Conclusions**

This study examined the availability, utilization, and challenges of Virtual Learning Platforms (VLPs) in secondary schools within Abuja Municipal Area Council (AMAC), with a view to identifying strategic interventions that can promote their sustainable adoption. The results showed that while some infrastructure and training efforts are in place, overall availability and utilization of VLPs remain at a low-to-moderate level. Teachers reported that platforms are more often used for communication and administrative purposes than for instructional delivery or interactive learning. Major challenges identified include poor internet connectivity, erratic electricity, high data costs, inadequate provision of devices and low digital literacy among teachers and students, all of which hinder the effective adoption of VLPs.

Despite these barriers, respondents strongly endorsed strategic interventions such as government-funded ICT infrastructure, affordable devices, and continuous teacher training. Viewed through the Technology Acceptance Model (TAM), these interventions would enhance perceived ease of use and usefulness of VLPs thereby promoting adoption. From a Constructivist Learning Theory (CLT) perspective, they also point to the need for pedagogical practices that foster active, collaborative learning through digital platforms. This study therefore contributes to post-COVID ICT-in-education research in Nigeria by shifting the focus from emergency responses to long-term sustainability, highlighting that systemic policy action, institutional support and private-sector partnerships are critical to embedding virtual learning meaningfully into secondary education.

### **Recommendations**

Based on the findings and the conclusions drawn, several recommendations are proposed at both the policy and institutional levels to enhance the adoption and sustainability of virtual learning platforms in AMAC secondary schools.

At the policy level, government intervention is critical. Investment in ICT infrastructure, particularly in improving internet connectivity and ensuring stable electricity supply is urgently needed to address the most pressing barriers. In addition, public–private partnerships should be strengthened to provide subsidized devices for students and teachers, reduce the high cost of internet data, and deliver ongoing technological support to schools. Targeted interventions should be developed for rural and underserved schools to prevent deepening educational inequalities. Mobile ICT labs and community digital learning centres can help address location-based disparities.

At the institutional level, schools should establish dedicated ICT coordinators to provide technical assistance and ensure that virtual learning tools are properly maintained. Continuous professional development for teachers must be prioritized, with training programmes designed to build not only technical competence but also pedagogical confidence in the use of virtual platforms. Importantly, such training should emphasize constructivist approaches that encourage interactive and collaborative learning experiences rather than relying solely on transmissive, lecture-based methods. School authorities and education boards should establish mechanisms to monitor the deployment and effectiveness of virtual learning tools. Feedback from teachers and students should inform continuous improvement strategies.

Furthermore, digital literacy should be fully integrated into the secondary school curriculum so that students can actively engage with and benefit from virtual learning environments. To ensure that these initiatives are effective and sustained, education authorities should also put in place robust monitoring and evaluation mechanisms. This would provide accountability, track progress, and highlight areas that require further improvement, thereby ensuring that the adoption of virtual learning platforms contributes meaningfully to teaching and learning in Nigerian secondary schools.

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