DIGITAL RESOURCE AVAILABILITY AND UTILIZATION AS PREDICTORS OF TEACHER INSTRUCTIONAL EFFICIENCY IN EDO NORTH SECONDARY SCHOOLS, NIGERIA

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To cite this article (APA): Omozuawo, S. E., & Bamidele, O. (2025). Digital resource availability and utilization as predictors of teacher instructional efficiency in Edo North Secondary Schools, Nigeria. *AAU Journal of Business Educators, 5* (2), 150-158.

Abstract

This study investigated the relationship between digital resource availability, utilization patterns, and teacher instructional efficiency in secondary schools across Edo North Senatorial District, Nigeria. Using a correlational research design, data were collected from 384 teachers across 48 secondary schools through structured questionnaires and observational checklists. Results revealed that digital resource availability ($r = 0.67$, $p < 0.01$) and utilization frequency ($r = 0.72$, $p < 0.01$) significantly predicted teacher instructional efficiency. However, only 43% of available digital resources were actively utilized in classroom instruction. Regression analysis indicated that digital resource utilization explained 52% of the variance in instructional efficiency ($R^2 = 0.52$, $F(2,381) = 206.45$, $p < 0.001$). Key barriers to utilization included inadequate digital literacy (68%), unstable electricity supply (74%), and limited technical support (61%). The study recommends comprehensive digital literacy training programs, infrastructure improvement, and establishment of dedicated ICT support units in schools.

Keywords: *Digital Resources, Educational Technology, Instructional Efficiency, Secondary Education, Teacher Utilization.*

Introduction

The integration of digital resources in education has become increasingly critical in the 21st century, transforming traditional pedagogical approaches and enhancing instructional delivery (Zhao & Watterston, 2021; Mishra & Koehler, 2006). In Nigeria, the Federal Government has invested substantially in educational technology infrastructure, with the Universal Basic Education Commission (UBEC) allocating approximately ₦2.3 billion for ICT equipment distribution to schools between 2018 and 2023 (Adeoye, Oluwole & Blessing, 2013; Okeke & Eze, 2020). Despite these investments, questions remain about the actual availability, utilization patterns, and impact of these digital resources on teacher instructional efficiency, particularly in secondary schools (Tella, Tella, Toyobo, Adika & Adeyinka, 2007).

Edo State, located in the South-South geopolitical zone of Nigeria, represents a unique context for examining digital resource integration in education. The state government has implemented various ICT-in-education initiatives, including the EdoSTEM program and the provision of computer laboratories to secondary schools (Agbatogun, 2010; Yusuf, 2005). However, preliminary observations suggest significant disparities between resource availability and actual classroom utilization, particularly in the Edo North Senatorial District, which comprises predominantly rural and semi-urban communities (Aduwa-Ogiegbaen & Iyamu, 2005).

Teacher instructional efficiency, defined as the optimal use of teaching time, resources, and strategies to maximize student learning outcomes, is influenced by multiple factors including pedagogical knowledge, resource availability, and technological competence (Harris, Mishra, & Koehler, 2009; Ertmer & Ottenbreit-

Leftwich, 2010). While existing literature has established relationships between technology integration and teaching effectiveness in developed contexts (Hew & Brush, 2007; Tondeur, van Braak, Ertmer, & Ottenbreit-Leftwich, 2017), limited empirical evidence exists regarding these relationships in Nigerian secondary schools, particularly concerning the specific predictive power of digital resource availability and utilization on instructional efficiency.

Statement of the Problem

Despite substantial governmental and organizational investments in digital educational resources for Nigerian secondary schools, concerns persist regarding the translation of these investments into improved instructional practices (Okonkwo, Ade-Ibijola, & Foster, 2022). Anecdotal evidence from Edo North Senatorial District suggests that many schools possess digital resources that remain underutilized or unutilized, potentially representing a significant waste of educational investment (Trucano, 2005; Pelgrum, 2001). Furthermore, the extent to which available digital resources and their utilization patterns predict teacher instructional efficiency remains empirically unverified in this context. This knowledge gap hinders evidence-based policy formulation and resource allocation decisions in the educational sector (Bingimlas, 2009; Buabeng-Andoh, 2012).

Purpose of Study

This study aimed to examine:

1. the availability of digital resources in secondary schools in Edo North Senatorial District.
2. the frequency and patterns of digital resource utilization by teachers.
3. teacher instructional efficiency levels across the study area.
4. the relationship between digital resource availability and teacher instructional efficiency.
5. the predictive power of digital resource utilization on teacher instructional efficiency.
6. barriers hindering effective digital resource utilization in classroom instruction.

Research Hypotheses

The following research hypotheses were formed.

Research Hypothesis 1: There is no significant relationship between digital resource availability and teacher instructional efficiency.

Research Hypothesis 2: Digital resource utilization does not significantly predict teacher instructional efficiency.

Research Hypothesis 2: There are no significant barriers affecting digital resource utilization in secondary schools.

Literature Review

Conceptual Framework

Digital resources in education encompass technological tools, platforms, and materials designed to facilitate teaching and learning processes (Hennessy, Harrison & Wamakote, 2010). These include hardware components (computers, tablets, projectors, interactive whiteboards), software applications (learning management systems, educational apps, subject-specific software), and digital content (e-books, multimedia presentations, online databases) (Balanskat, Blamire & Kefala, 2006). Teacher instructional efficiency represents the effectiveness with which educators utilize time, resources, and pedagogical strategies to achieve optimal learning outcomes within given constraints (Kyriakides, Christoforou, & Charalambous, 2013).

The Technology Acceptance Model (TAM), developed by Davis (1989) and extended by Venkatesh and Davis (2000), provides a theoretical foundation for understanding technology adoption in educational contexts. TAM posits that perceived usefulness and perceived ease of use are primary determinants of technology acceptance and utilization (Scherer, Siddiq, & Tondeur, 2019). In educational settings, this framework has been adapted to incorporate additional factors such as pedagogical beliefs, institutional support, and technological infrastructure, creating the Extended Technology Acceptance Model for Education (E-TAM) (Teo, 2011; Fathema, Shannon, & Ross, 2015).

Digital Resource Availability in Nigerian Schools

Recent studies on digital resource availability in Nigerian schools present mixed findings. Adeyemi and Olaleye (2021) conducted a survey of 120 secondary schools across six states and found that while 76%

possessed some form of computer laboratory, only 34% had functional internet connectivity, and merely 22% had integrated digital resources into regular classroom instruction. Similarly, Okonkwo et al. (2022) reported that computer-to-student ratios in Nigerian secondary schools averaged 1:47, far below the UNESCO-recommended 1:15 ratio for effective technology integration (UNESCO, 2011).

In Edo State specifically, the State Ministry of Education's 2023 report indicated that 89% of public secondary schools had received ICT equipment under various intervention programs. However, a gap analysis revealed that functional availability often differed significantly from nominal availability due to factors such as equipment obsolescence, lack of maintenance, and inadequate power supply infrastructure (Ifinedo Rikala, & Hämäläinen, 2020). This disparity between resource presence and resource functionality represents a critical challenge in assessing actual digital resource availability (Hennessy et al., 2010).

Digital Resource Utilization Patterns

Teacher utilization of digital resources varies considerably based on multiple factors. Eze, Chinedu-Eze, and Bello (2020) identified digital literacy, perceived relevance, and administrative support as primary determinants of utilization frequency. Their study of 256 teachers in South-Eastern Nigeria revealed that only 38% regularly incorporated digital resources in lesson delivery, while 45% used them occasionally, and 17% never utilized available digital tools. Barriers to utilization included inadequate training (cited by 71% of respondents), technical difficulties (64%), and time constraints (58%) (Kopcha, 2012; Ottenbreit-Leftwich, Glazewski, Newby & Ertmer, 2010).

International comparisons provide additional context. A meta-analysis by Sung, Chang, and Liu (2016) examining technology integration across 42 countries found that teacher utilization rates correlated more strongly with professional development quality ($r = 0.68$) than with resource availability ($r = 0.41$), suggesting that access alone does not guarantee utilization (Mumtaz, 2000). This finding aligns with Ajzen's Theory of Planned Behavior (1991), which emphasizes that behavioral intentions (in this case, intention to use digital resources) are influenced by attitudes, subjective norms, and perceived behavioral control (Teo & van Schaik, 2012).

Technology Integration and Instructional Efficiency

The relationship between technology integration and teaching effectiveness has been extensively studied internationally. Tamim, Bernard, Borokhovski, Abrami, and Schmid (2011) conducted a second-order meta-analysis of 25 meta-analyses examining technology's impact on student achievement, finding an overall positive effect size of 0.35. However, this relationship is mediated by implementation quality, teacher competence, and pedagogical approaches (Higgins, Xiao, & Katsipataki, 2012). Effective technology integration requires more than mere access; it demands pedagogical transformation and strategic alignment of digital tools with learning objectives (Ertmer, 2005; Voogt, Fisser, Pareja Roblin, Tondeur & van Braak, 2013).

Methods

Research Design

This study employed a correlational research design to examine the relationships between digital resource availability, utilization patterns, and teacher instructional efficiency (Creswell & Creswell, 2018). The correlational approach was deemed appropriate as it allows for the investigation of relationships between variables without manipulation, enabling the identification of predictive patterns while acknowledging the complexity of educational environments where multiple factors interact simultaneously.

Participants and Sampling Procedures

The study population comprised all 2,847 teachers in the 127 public secondary schools across Edo North Senatorial District. Using Krejcie and Morgan's (1970) sample size determination table, a sample of 384 teachers was selected through a multi-stage sampling procedure. First, schools were stratified by location (urban, semi-urban, rural) and ownership (government, mission). Subsequently, 48 schools (38% of total schools) were randomly selected using proportionate stratification (Cohen, Manion & Morrison, 2018). Finally, teachers within selected schools were randomly chosen, with selection probability proportional to school size.

Table 1: Sample Distribution by School Type and Location

Location	Government	Mission	Teachers	Percentage
Urban	12	4	128	33.3%
Semi-Urban	14	3	153	39.8%
Rural	11	4	103	26.8%
Total	**37**	**11**	**384**	**100%**

Instrument for Data Collection

Three primary instruments were developed and validated for data collection: Digital Resource Availability Inventory (DRAI): A 35-item checklist assessing the presence, functionality, and accessibility of various digital resources including hardware (computers, projectors, tablets, interactive boards), software (learning management systems, subject applications, productivity tools), connectivity infrastructure (internet access, LAN networks), and digital content repositories (Goktas, Yildirim, & Yildirim, 2009). The DRAI utilized a three-point scale: 2 = Available and Functional, 1 = Available but Non-functional, 0 = Not Available.

Digital Resource Utilization Questionnaire (DRUQ): A 28-item self-report instrument measuring frequency and patterns of digital resource use in instructional activities (Angeli & Valanides, 2009). Items were rated on a 5-point Likert scale ranging from 1 (Never) to 5 (Daily). The DRUQ covered four dimensions: lesson planning (7 items), content delivery (9 items), student assessment (6 items), and communication (6 items). Reliability analysis yielded Cronbach's alpha coefficients of 0.89 for the overall instrument and subscale reliabilities ranging from 0.82 to 0.91.

Teacher Instructional Efficiency Scale (TIES): A 32-item observational checklist and self-assessment tool measuring instructional efficiency across six domains: time management (6 items), resource optimization (5 items), pedagogical effectiveness (7 items), student engagement (6 items), assessment practices (4 items), and classroom management (4 items) (Stronge, Ward, & Grant, 2011). TIES employed a 4-point rating scale: 4 = Highly Efficient, 3 = Efficient, 2 = Moderately Efficient, 1 = Inefficient. Inter-rater reliability, assessed through independent observations by two trained raters for 15% of the sample, yielded a Cohen's kappa of 0.84, indicating substantial agreement (McHugh, 2012).

Data Collection Procedure

Data collection occurred over an eight-week period from September to October 2024. Prior to data collection, ethical approval was obtained from the Edo State Ministry of Education, and informed consent was secured from school principals and participating teachers. Research assistants, trained in standardized administration procedures, visited each selected school. The DRAI was completed through physical inspection of school facilities and verification with ICT coordinators. Teachers completed the DRUQ individually, with assurances of confidentiality. Classroom observations for TIES were conducted during regular instructional periods, with each teacher observed for two complete lessons (minimum 80 minutes total observation time). Observations were scheduled to capture diverse subject areas and class levels.

Data Analysis

Quantitative data were analyzed using SPSS version 27.0. Descriptive statistics (means, standard deviations, frequencies, percentages) summarized digital resource availability, utilization patterns, and instructional efficiency levels. Pearson product-moment correlation coefficients examined bivariate relationships between variables (Pallant, 2020). Multiple regression analysis tested the predictive power of digital resource availability and utilization on instructional efficiency, with preliminary tests confirming satisfaction of regression assumptions (linearity, homoscedasticity, normality of residuals, absence of multicollinearity) (Field, 2018). Statistical significance was established at $\alpha = 0.05$ level. Thematic analysis was applied to open-ended responses regarding barriers to digital resource utilization.

Results

Digital Resource Availability

Analysis of the DRAI revealed varying levels of digital resource availability across schools in Edo

North. Overall, schools possessed an average digital resource availability score of 56.3 out of 70 possible points (SD = 12.4), representing 80.4% availability. However, significant disparities existed between urban (M = 64.2, SD = 8.7), semi-urban (M = 55.8, SD = 10.3), and rural schools (M = 47.1, SD = 14.6). Table 2 presents detailed availability data by resource category.

Table 2: Digital Resource Availability by Category

Resource Category	Available %	Functional %	Mean Score	SD
Computer Systems	87.5	62.3	8.7	2.4
Projection Equipment	79.2	71.4	7.1	1.9
Internet Connectivity	54.2	41.7	5.4	2.8
Educational Software	68.8	68.8	6.9	2.2
Interactive Whiteboards	35.4	29.2	3.5	1.7
Digital Content Libraries	45.8	45.8	4.6	2.1

Digital Resource Utilization Patterns

Despite relatively high availability rates, digital resource utilization remained moderate. The overall DRUQ score averaged 72.4 out of 140 possible points (M = 72.4, SD = 18.7), indicating that teachers utilized available digital resources approximately 51.7% of the time. Analysis by utilization dimension revealed variations: lesson planning (M = 19.2, SD = 5.3, 54.9% utilization), content delivery (M = 28.1, SD = 8.2, 62.4% utilization), student assessment (M = 14.3, SD = 4.8, 47.7% utilization), and communication (M = 10.8, SD = 3.9, 36.0% utilization). Notably, only 43% of surveyed teachers reported daily or weekly utilization of digital resources for instructional purposes.

Teacher Instructional Efficiency Levels

Teacher instructional efficiency scores, measured through the TIES, demonstrated a mean of 89.6 out of 128 possible points (M = 89.6, SD = 15.2), representing a 70% efficiency level. Classification of teachers into efficiency categories revealed: 23.7% (n = 91) demonstrated high efficiency (scores ≥ 96), 52.3% (n = 201) showed moderate efficiency (scores 64–95), and 24.0% (n = 92) exhibited low efficiency (scores < 64). Urban teachers displayed significantly higher efficiency levels (M = 96.3, SD = 12.4) compared to their rural counterparts (M = 78.2, SD = 16.8), $t(382) = 8.47$, $p < 0.001$.

Relationship Between Variables

Pearson correlation analysis examined relationships between digital resource availability, utilization, and instructional efficiency. Results indicated statistically significant positive correlations between all variables (Table 3 and Figure 1).

Table 3: Correlation Matrix of Study Variables

Variables	Availability	Utilization	Efficiency
Digital Resource Availability	1.00	—	—
Digital Resource Utilization	0.58**	1.00	—
Teacher Instructional Efficiency	0.67**	0.72**	1.00

*Note: ** = $p < 0.01$ (2-tailed)*

Digital resource availability demonstrated a moderate positive correlation with instructional efficiency ($r = 0.67$, $p < 0.01$), while utilization showed a stronger relationship ($r = 0.72$, $p < 0.01$). The correlation between availability and utilization was also significant ($r = 0.58$, $p < 0.01$), suggesting that greater resource access facilitates increased use, though other factors clearly influence utilization decisions.

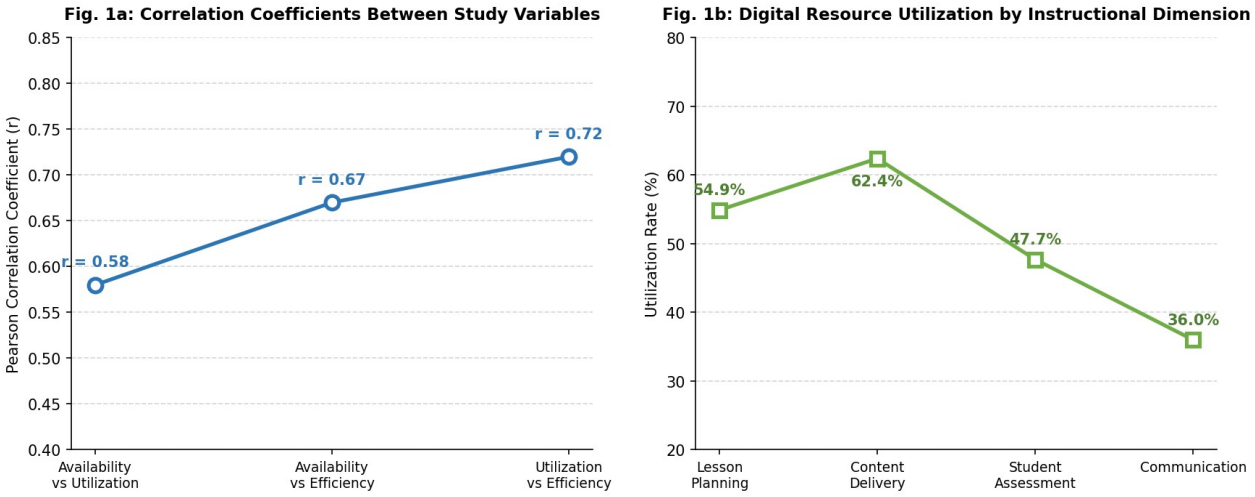

Figure 1: Line Diagrams Showing (a) Correlation Coefficients Between Study Variables and (b) Digital Resource Utilization Rates by Instructional Dimension

Predictive Model of Instructional Efficiency

Multiple regression analysis was conducted to determine the extent to which digital resource availability and utilization predicted teacher instructional efficiency. The regression model was statistically significant, $F(2, 381) = 206.45$, $p < 0.001$, with an R^2 of 0.52, indicating that the two predictor variables collectively explained 52% of the variance in instructional efficiency. Examination of standardized beta coefficients revealed that digital resource utilization ($\beta = 0.54$, $t = 9.87$, $p < 0.001$) was a stronger predictor than availability ($\beta = 0.28$, $t = 5.12$, $p < 0.001$). The variance inflation factor (VIF) values for both predictors were below 2.0, confirming absence of multi-collinearity concerns.

Barriers to Digital Resource Utilization

Analysis of open-ended responses and barrier assessment items identified multiple obstacles to effective digital resource utilization. Table 4 presents the frequency and percentage of teachers reporting each barrier category.

Table 4: Barriers to Digital Resource Utilization

Barrier Category	Frequency	Percentage
Unstable electricity supply	284	74.0%
Inadequate digital literacy skills	261	68.0%
Limited technical support and maintenance	234	60.9%
Insufficient training opportunities	227	59.1%
Time constraints and curriculum pressure	198	51.6%
Lack of internet connectivity	192	50.0%
Inadequate digital content aligned to curriculum	176	45.8%
Resistance to change from traditional methods	142	37.0%

Note: Respondents could identify multiple barriers; percentages calculated from total sample (N = 384)

Discussion

This study's findings illuminate the complex relationship between digital resource availability, utilization, and teacher instructional efficiency in Edo North secondary schools. The high availability rate (80.4%) coupled with moderate utilization (51.7%) and the strong predictive power of utilization on efficiency

(β = 0.54) suggest that mere resource provision is insufficient for educational transformation (Zhao & Frank, 2003). This pattern aligns with the Technology Acceptance Model's emphasis on perceived usefulness and ease of use as mediating factors between availability and actual utilization (Scherer et al., 2019).

The significant discrepancy between nominal availability (87.5% for computer systems) and functional availability (62.3%) represents a critical policy concern (Hennessy et al., 2010). This 25.2 percentage-point gap suggests substantial resource wastage, likely stemming from inadequate maintenance protocols and insufficient technical support infrastructure (Ifinedo et al., 2020). The finding that 74% of teachers identified unstable electricity as a barrier reinforces Nigeria's broader infrastructure challenges and their cascading effects on educational technology integration (Aduwa-Ogiegbaen & Iyamu, 2005). This infrastructure deficit effectively nullifies investments in digital resources, creating what might be termed 'phantom availability'—resources exist but cannot be reliably accessed or utilized.

The stronger correlation between utilization and efficiency (r = 0.72) compared to availability and efficiency (r = 0.67) validates the hypothesis that how resources are used matters more than what resources exist (Higgins et al., 2012). This finding challenges purely resource-centric approaches to educational improvement, supporting instead a capability-building perspective where teacher competence, training, and support systems are paramount (Ertmer & Ottenbreit-Leftwich, 2010; Kopcha, 2012). The regression model's explanation of 52% variance in efficiency is substantial, though the unexplained 48% suggests that other factors—possibly including teacher motivation, pedagogical knowledge, class sizes, and student characteristics—also significantly influence instructional outcomes (Voogt et al., 2013).

Conclusions

This study demonstrates that while digital resources are increasingly available in Edo North secondary schools, their potential for enhancing instructional efficiency remains substantially underrealized. Digital resource utilization emerges as a more potent predictor of instructional efficiency than mere availability, explaining over half the variance in teacher effectiveness. However, systemic barriers—particularly infrastructure deficits, inadequate digital literacy, and insufficient support systems—constrain optimal utilization. The research validates the Extended Technology Acceptance Model in the Nigerian educational context, confirming that technology integration success depends on factors beyond hardware and software provision, encompassing human capacity, organizational support, and enabling infrastructure (Teo, 2011; Fathema et al., 2015).

Recommendations

Based on the findings of the study, the following recommendations are proposed:

1. Edo State Ministry of Education should mandate quarterly professional development programs focusing on pedagogical technology integration rather than mere technical skills training. Programs should emphasize practical classroom applications, subject-specific digital tools, and student-centered learning approaches utilizing technology.
2. Priority investment in reliable electricity supply through a combination of grid strengthening and alternative energy sources (solar installations) is essential. Schools should be equipped with uninterruptible power supply (UPS) systems and inverter backups to ensure minimal disruption to technology-enabled instruction.
3. Establishment of zonal ICT support centers staffed with qualified technicians to provide regular maintenance, troubleshooting, and upgrade services. Each school should designate an ICT coordinator with reduced teaching load to facilitate technology integration and provide peer support.
4. Collaborative development of localized digital learning materials aligned with the Nigerian curriculum, addressing the 45.8% of teachers who reported inadequate relevant content. This initiative should involve subject specialists, experienced teachers, and instructional designers.
5. Implementation of a robust monitoring framework tracking both resource functionality and utilization patterns. Regular assessments should inform policy adjustments and resource allocation decisions, creating feedback loops for continuous improvement.
6. Development of recognition and reward systems for teachers demonstrating innovative and effective technology integration practices. This could include reduced teaching loads for technology

champions, opportunities for professional advancement, and showcasing best practices through annual conferences.

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