

Digital Resilience as a Moderator in the Adoption of Digital Tools for Teaching Vocational Subjects in Nigerian Universities: A TAM Perspective

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Abstract: This study explores the moderating role of digital resilience in the adoption of digital tools for teaching vocational subjects in Nigerian universities through the lens of Technology Acceptance Model (TAM). Data were collected from 173 lecturers teaching vocational subjects across six universities using a structured questionnaire. Structural equation modeling (SEM) was used to test the relationships among perceived usefulness (PU), perceived ease of use (PEOU), digital resilience (DR), and adoption intention (AI). Results indicate that PU and PEOU significantly predict AI; however, digital resilience moderates only the relationship between PEOU and AI but not between PU and AI. These findings highlight the importance of developing digital resilience to enhance technology adoption especially in educational settings. Implications for policy, practice, and future research are discussed, emphasizing the need for targeted interventions to support lecturers teaching vocational subjects in adopting digital tools for vocational education programmes.

Keywords: Digital Resilience, Technology Acceptance Model, Digital Tools, Vocational Education, Nigerian Universities

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Introduction

The advent of 2020 COVID 19 pandemic became a turning point for all sphere of our lives including our educational establishments which requires certain level of ingenuity to overcome the challenges post by the pandemic. This gave rise to the rapid advancement of digital technologies which has been transforming higher education industry (HEI) especially in developing countries (Fletcher & Griffiths, 2020; Klein, & Todesco, 2021). Digital tools such as learning management systems (LMS), virtual labs, and e-assessment platforms are becoming integral part of teaching and learning in almost all the strata of the educational system (Li, & Wang, 2023; Borojević & Petrovski, 2024). The desire to expand access to higher education has further amplified the need for its deployment in the entire educational landscape (Anwar, Sofyan, Ratnaningsih & AM, 2024). Nigeria as a developing country, cannot afford to be left behind especially in the areas of vocational education training programmes where hands-on training is usually emphasized.

Vocational education is a form of education that is designed to prepare an individual for employment in a recognized occupation (Federal Republic of Nigeria, 2013). These occupations usually referred to as programmes in Nigerian universities include business education, agricultural education, technical/technology education and home economics education. Vocational education plays a pivotal role in equipping students with practical skills needed for economic development of the country (Auta, 2015; Auta, 2016; Auta, 2017; Igbongidi, 2022) especially in the areas of income and revenue generation, enhancing people's standard of living, providing manpower among others (Osuyi & Mochi, 2022). The importance of use of digital tools in the delivery of this vital educational pursuit therefore remains crucial in the digital transformation of education.

However, it is disheartening to observed that the adoption of digital tools in Nigerian universities faces significant barriers such as inadequate infrastructure to support the system, limited digital literacy on the part of both the staff and the students, and resistance to technological change by many individuals (Shittu, Gambari & Obielodan, 2016); Akinola & Adeyemi, 2022). These challenges are particularly pronounced in vocational education

programmes, where hands-on training is required, thereby making the integration of digital tools a difficult endeavour.

The Technology Acceptance Model (TAM), developed by Davis (1989), provides a robust framework for studying issues surrounding technology adoption especially in Nigerian universities where vocational education programmes are obtained. TAM posits that perceived usefulness (PU), that is, the belief that a technology could enhance job efficiency and performance and perceived ease of use (PEOU) which referred to the belief that using the technology requires just a little effort are key determining factors of adoption intention (AI). Though, TAM has been widely applied in educational contexts (Scherer, Siddiq & Tondeur, 2019; Lin & Yu, 2023), its application in a country like Nigeria where budgetary provisions for education at all levels appear not to be adequate (Adeyemi & Adeyinka, 2019). This requires consideration of certain relative factors, one of these factors is digital resilience.

To understand the concept of Digital Resilience (DR) one needs to realize what the term resilience means. Though the term has been defined by different authors (Zhang & Mao, 2020; Garcia & Garcia, 2025), the simplest definition was put forth by the American Psychological Association (2014). It defined the term as “the process of adapting well in the face of adversity, trauma, tragedy, threats or even significant sources of stress”. From this definition, Digital resilience (DR) can therefore be referred to as the ability to adapt to and recover from digital disruptions (Southwick, Bonanno, Masten, Panter-Brick & Yehuda, 2014). DR is a psychological state of mind which may vary from one individual to another. Though, it has been established that lecturers with digital resilience are better equipped to overcome the challenges associated with digital disruptions (Pennington & Rogerson-Revell, 2021), this attribute could have the potential to enhance their willingness to adopt digital tools.

Several studies were carried out on relationship between DR and other variables of interest (Zeng & Yousaf, 2022; Sgobbi & Codara, 2022), however, the findings do not specifically target at vocational teachers in Nigerian Universities. For instance, Zeng and Yousaf, (2022) explored how technology firms achieve digital innovation through Artificial Intelligence (AI) adoption, with digital resilience acting as a mediator and training protocols as a moderator. The findings confirm that AI adoption positively predicts digital

innovation in technology firms while DR mediates the relationship between AI adoption and digital innovation. In another study, Sgobbi and Codara (2022) examines how organizational resilience influences the successful adoption of digital technologies in two Italian manufacturing firms. It finds that resilience, characterized by cognitive, behavioural, and contextual factors, enables firms to adopt digital technologies effectively. It can therefore be seen that these studies do not specifically explore how DR could moderate AI. Hence the need for this study to investigate the moderating role of DR in the relationship between the two TAM constructs (PU and PEOU) and AI in the teaching of vocational subjects in Nigerian universities.

Based on the above theoretical framework and literature review, we hypothesized as follows:

H1: Perceived usefulness (PU) positively influences lecturers' adoption intention (AI) of digital tools. H2: Perceived ease of use (PEOU) positively influences lecturers' adoption intention (AI) of digital tools. H3: Digital resilience (DR) moderates the relationship between PU and AI. H4: Digital resilience (DR) moderates the relationship between PEOU and AI.

Method

Research Design

A cross-sectional survey design was employed to collect data from lecturers in Nigerian universities offering vocational programmes. The choice of this design is informed by the fact that it involves looking at data from a population at one specific point in time. The study targeted six public universities offering vocational education programmes (one from each of the six geo-political zones of Nigeria). The universities include Abubakar Tafawa Balewa University Bauchi (North-East), Federal University of Technology Minna (North-Central), Bayero University Kano (North-West), Nnamdi Azikiwe University Awka (South-East), Ignatius Ajuru University of Education Portharcourt (South-South) and Tai Solarin University of Education (South-West). A quantitative approach was chosen to test the hypothesized relationships using structural equation modeling (SEM).

Participants

The population comprised of all the lecturers who have been teaching vocational subjects in Nigerian universities. Six universities offering vocational education programmes (one from each of the six geo-political zone of Nigeria) were purposively sampled for the study. Their choices were informed by the fact that they have relatively large number of vocational subject lecturers with robust ICT platforms for digital interactions. All the 214 lecturers from the six sampled universities were targeted in the study. This is in agreement with Marsh and Hau (1999) and Hoyle (2019) who opined that SEM model could be meaningfully tested even if sample size is quite small. Additionally, Tabachnick and Fidel (2001) recommend a minimum of 100–150 respondents for studies involving SEM analysis. At the end of the data collection and cleaning exercise only 173 valid data were obtained which is considered to be adequate.

Measures

A 30 items structured questionnaire rated on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) was developed. The scale was adapted from previous studies with modifications to suit the Nigerian context as follows:

PU: Measured with 10 items adapted from Davis (1989) (e.g., “Using digital tools enhances my teaching effectiveness”).

PEOU: Measured with 10 items adapted from Davis (1989) (e.g., “I find digital tools easy to use for teaching”).

DR: Measured with six items adapted from Southwick et al. (2014) (e.g., “I can adapt to challenges when using digital tools”).

AI: Measured with four items adapted from Venkatesh, Morris, Davis and Davis (2003) (e.g., “I intend to use digital tools in my teaching in the next six months”).

Data Collection and Analysis Procedures

Data for this study were collected between May and June 2025 using Google Forms distributed through various WhatsApp groups where the targeted participants belong. All the participants were digitally literate and active since digital literacy is a requirement for employment as lecturer in any university in Nigeria and their respective universities have robust ICT infrastructure for their businesses. The Participants provided informed consent, and the researcher

confirmed to them that their anonymity was ensured. Out of the 214 potential respondents, 173 valid responses were received representing 80.1% response rate. The limited response (80.1%) stem from the inability of some of the targeted respondents to respond to the instrument and incomplete response from others. However, a >150 response is considered adequate for studies involving SEM (Tabachnick & Fidel, 2001). Data were analyzed using AMOS software and the Measurement Model via Confirmatory factor analysis (CFA) and Structural Model (SEM). The interaction terms (DR × PU, DR × PEOU) were tested to examine the moderating role of digital resilience.

Result and Discussion

The results obtained from the data collected and analyzed are presented in this section. Discussion on the findings that emerged from the study are also presented under this section.

Descriptive Statistics and Reliability

The sample included 81 male (46.8%) and 92 female (53.2%) vocational education lecturers. Their average age was 39. Most respondents (79%) had over five years of teaching experience, while 67% had access to digital tools through various ICT platforms provided by their institutions. The distribution across the various areas of vocational education was (Agricultural Education 14%, Business Education 41%, Home Economics Education 18% And Technical/Technology Education 27%). To validate the adapted scale for use, Cronbach's alpha, composite reliability (CR) and average variance extracted (AVE) values were used. Table 1 presents the descriptive statistics and reliability measures for the constructs. All the constructs demonstrated high reliability (Cronbach's $\alpha > 0.85$, CR > 0.8) and convergent validity (AVE > 0.5) which were above the recommended values of 0.70, 0.70 and 0.50 (Hair, Hult, Ringle, & Sarstedt, 2014), indicating that the scales demonstrated adequate reliability.

Table 1: Descriptive Statistics and Reliability of Constructs

Construct	Mean	SD	Cronbach's α	CR	AVE
PU	4.12	0.67	0.89	0.90	0.64

PEOU	3.98	0.72	0.87	0.88	0.61
DR	4.05	0.65	0.91	0.92	0.66
AI	4.15	0.69	0.90	0.91	0.65

The discriminant validity (DV) was used to measure the validity of the scales. The DV was established as the square root of AVE for each construct. The results shows that the square root of each AVE exceeded its correlations with other constructs as presented in Table 2. This is consistent with Hair, Hult, Ringle, and Sarstedt (2014) who recommended a minimum value of 0.70, suggesting the adequacy of the convergent validity of the scales.

Table 2: Discriminant Validity

Construct	PU	PEOU	DR	AI
PU	0.80			
PEOU	0.62	0.78		
DR	0.55	0.58	0.81	
AI	0.68	0.65	0.60	0.81

Measurement Model

The CFA results indicated a good fit for the measurement model: $\chi^2/df = 2.10$, CFI = 0.96, TLI = 0.95, RMSEA = 0.05. All factor loadings exceeded 0.7, confirming the validity of the measurement items.

Structural Model

Direct Effect Analysis

The direct effect of PU and PEOU on Vocational Lecturers AI was tested in this study. The result as presented in Table 3 shows that both PU ($\beta = 0.42$, $p < 0.001$) and PEOU ($\beta = 0.38$, $p < 0.001$) significantly predicted AI. Therefore, both H1 and H2 were accepted.

Table 3: Direct Effects in the Structural Model

Hypotheses	Path	β	SE	p-value	Result
H1	PU → AI	0.42	0.05	<0.001	Accept
H2	PEOU → AI	0.38	0.06	<0.001	Accept

Moderation Analysis

To test the moderating effect of digital resilience, interaction terms (DR \times PU and DR \times PEOU) were included in the model as indicated in Table 4. The results show a non-significant interaction term for DR \times PU ($\beta = 0.12$, $p = 0.132$) which suggests that digital resilience does not moderate the PU and AI relationship, hence H3 was rejected. However, the results show a significant interaction term for DR \times PEOU ($\beta = 0.25$, $p < 0.01$) indicating that digital resilience moderates the relationship between PEOU and AI, hence H4 was accepted.

Table 4: Moderation Effects of Digital Resilience

Hypotheses	Interaction Path	β	SE	p-value	Result
H3	DR \times PU \rightarrow AI	0.12	0.08	0.132	Reject
H4	DR \times PEOU \rightarrow AI	0.25	0.07	<0.01	Accept

Discussion

This study provides empirical evidence on the adoption of digital tools for teaching vocational subjects in Nigerian universities. The study was carried out via extension of the TAM framework by incorporating digital resilience as a moderator. The findings confirm that both PU and PEOU significantly predict lecturers' adoption intention (H1 and H2 accepted). This finding is consistent with the previous studies in educational technology (Scherer et al., 2019; Teo, 2011). The findings also aligned with Faiz, Le and Masli (2024) who discovered that technological, organizational, and environmental factors directly impact adoption with some supported variables such adoption costs, top management support, human resources, digital culture, and trading partner pressure. This is a clear indication that adoption of technological tools requires some enablers for to flourish. These results suggest that vocational education lecturers in Nigerian universities are more likely to adopt digital tools when they perceive them as useful for enhancing their teaching and easy to use.

The non-significant moderation effect on the PU and AI relationship (H3 rejected) suggests that digital resilience may be less relevant when lecturers' adoption decisions are driven by perceived benefits rather than ease of use. This

could be due to the fact that PU is an outcome-oriented view, which may not have much regards for the desire to overcome the digital tool related challenges. However, the significant moderation effect of digital resilience on the PEOU and AI relationship (H4 accepted) highlights the critical role of DR in resource-constrained situations. Vocational Education lecturers with digital resilience are better equipped to handle critical challenges like unreliable internet or complex software interfaces; thus, making user-friendly tools more attractive. This finding is in agreement with Milošević and Milošević (2022), Odenwald and Fromm (2024) and Ahmed (2025), who noted that resilience enables individuals especially educators to persist in technology adoption despite numerous barriers. The findings also validate that of Faiz, Le and Masli (2024) who reported that SMEs' international orientation moderates the relationship between digital culture and adoption behavior. Though their study were carried out elsewhere and on SMEs, but the central focus are the salient variables that are critical to adoption intentions especially as it relates to digital tools.

Implications for Policy and Practice

The findings have several implications as outlined below:

Policy: Nigerian universities should invest in infrastructure such as reliable internet, updated digital devices and training programmes to enhance vocational lecturers' digital resilience. Partnerships with technology providers could facilitate access to user-friendly tools tailored for vocational education.

Practice: Vocational lecturers training and development programmes should emphasize hands-on training with intuitive digital tools to leverage the moderating effect of digital resilience. Peer mentoring and technical support systems should be emphasized since it they have the potentials to further enhance resilience.

Curriculum Design: Vocational programmes should should be designed or reviewed to integrate digital tools like virtual labs and e-portfolios to align with industry demands. This could be supplemented with adequate training to build lecturers' confidence and resilience.

Conclusion

This study advances the understanding of digital tool adoption in Nigerian universities by integrating digital resilience into the TAM framework. The findings confirm that PU and PEOU are critical drivers of adoption intention, with digital resilience significantly moderating the PEOU and AI relationship. In the context of vocational education, where practical skills are paramount, promotion of digital resilience can enhance vocational lecturers' ability to adopt digital tools despite infrastructural and technical constraints. Policymakers and educators should prioritize resilience-building initiatives, such as targeted training and infrastructure improvements, to support the digital transformation of vocational education in Nigeria.

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