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# Readiness of TVET Educators for AI-Supported Instruction: A Multi-Dimensional Assessment of Competencies and Pedagogical Adaption

## Abstract

Artificial intelligence (AI) is transforming teaching and learning in technical and vocational education and training (TVET), yet educators' readiness for AI-supported instruction remains underexplored in developing contexts. This study assessed the levels and interrelationships of AI readiness, digital literacy, pedagogical adaptability, perception of AI, and attitudinal competencies among TVET educators, as well as differences across selected demographic variables. A cross-sectional survey design was adopted, involving 416 university-based TVET educators. Data were analysed using descriptive statistics, ANOVA, and correlation techniques. Findings revealed moderate levels of AI readiness and digital literacy, alongside high levels of pedagogical adaptability, perception of AI, and attitudinal competencies. Educators demonstrated strong foundational competencies but limited engagement with advanced AI-enabled instructional practices. Significant differences were observed in pedagogical adaptability across age groups, while attitudinal competencies were highest among educators with six to ten years of teaching experience. The competency dimensions were positively and significantly interrelated, indicating a coherent readiness ecosystem. Overall, while TVET educators exhibit favourable dispositions towards AI, their readiness for AI-supported instruction is still emerging, highlighting the need for structured professional development, improved digital infrastructure, and institution-wide AI integration frameworks.

***Keywords:*** *AI readiness, TVET educators, digital literacy, pedagogical adaptability, AI perception, vocational education.*

## 1 Introduction

Artificial intelligence (AI) represents one of the most transformative developments in 21st-century education, reshaping instructional design, assessment, and curriculum delivery through personalization, automation, and data-driven insight. In Technical and Vocational Education and Training (TVET), this shift is particularly critical, aligning educational delivery with competencies required in a rapidly evolving digital economy (Johnson 2022; Do 2025). Adoption of AI extends beyond intelligent tools; it requires rethinking how educators design lessons, support learners, and sustain professional identity within digital environments (Ifeanyi & Okoye 2023; Ibrahim et al. 2025). In developing contexts such as

Nigeria, readiness for AI-supported instruction depends on educators' digital literacy, pedagogical adaptability, and attitudinal dispositions that foster innovation (Ogunode 2022; Oviawe 2020). Globally, AI-driven systems, including adaptive learning platforms, predictive analytics, and intelligent tutoring, are reshaping education by enabling efficient, personalized, and interactive learning (Zawacki-Richter et al. 2019; Ejiofor & Nwakile 2016). Within TVET, these technologies facilitate simulations, automate assessments, and feedback mechanisms that strengthen practical and cognitive skills essential for employability (Bakar et al. 2024; Do 2019). Yet disparities in preparedness persist, particularly in developing countries where institutional support, infrastructure, and professional capacity remain limited (Mishra et al. 2023; Nwakile et al. 2025). Nigerian educators face the dual challenge of mastering AI applications while adapting teaching practices to meet emerging standards of digital competence (Okwelle & Okoye 2022; Chinedu-Eze et al. 2018), underscoring the need to assess their readiness comprehensively.

Readiness is multidimensional, encompassing digital literacy, pedagogical adaptability, perceptions, and attitudinal competencies (Eze & Nwosu 2021). Digital literacy involves navigating platforms, evaluating information, and applying technology effectively (Ng & Park 2022). Pedagogical adaptability reflects flexibility in adjusting strategies to diverse learner needs and technological innovations (Bates 2021). These competencies are vital in AI-supported environments where teachers must balance machine-assisted learning with human interaction. However, outdated curricula, infrastructural gaps, and limited exposure to AI tools hinder their development (Onyema et al. 2023). Teachers' perceptions and attitudes also shape adoption, positive views encourage experimentation, while concerns about ethics, privacy, or job security may inhibit use (Dwivedi et al. 2021; Adebayo & Musa 2022). Attitudinal competence, openness, ethical reflection, and professional commitment ensure AI integration remains aligned with human values (Emejulu & Ogbuanya 2020; Usman et al. 2024).

This study provides a holistic analysis of Nigerian TVET educators' readiness for AI-supported instruction. Apart from measuring the level of TVET educators' AI readiness, this study answers the following research questions:

i. What are the levels of digital literacy, pedagogical adaptation, perception of AI and attitudinal competencies among TVET educators?

ii. Are there significant differences in these competency dimensions across demographic variables?

iii. What relationships exist among AI readiness and the competency dimensions?

By addressing these objectives, the study contributes empirical evidence to inform professional development, curriculum design, and institutional frameworks that support sustainable AI integration in Nigerian TVET institutions. The findings are expected to strengthen educators' capacity to harness AI for skill development, innovation, and inclusive vocational education.

# 2 Methodology

## 2.1 Context, Design, and Participants

This study was situated within the context of TVET in higher education across Nigeria's six geopolitical zones, where artificial intelligence (AI) tools such as GitHub Copilot and ChatGPT are adopted to support instruction. The region's universities are actively exploring AI-supported pedagogies to enhance TVET education. Still, questions remain about the readiness of educators in digital literacy, pedagogical adaptability, perceptions of AI and attitudinal competencies for AI-supported instruction. Based on a correlational survey design, the study specifically targeted TVET educators, who provide authentic opportunities for teachers to encounter both the benefits and challenges associated with AI-assisted learning. Using a convenience sampling technique, we collected 416 valid responses from educators. The TVET educators comprise higher education teachers from Agricultural education 151 (36.3%) lecturers, Business Education 120 (28.8%) lecturers, Computer education 38 (9.1%) lecturers, Home Economics education 36 (8.75), Industrial Technical Education 60 (14.4%) and others 11 (2.6%), including those in communication, GSM repairs, Graphic designs etc. The gender, age, educational qualification, and teaching experience of the respondents are presented in Table 1.

## 2.2 Data Collection Instrument

We employed five validated constructs, which were adapted to the context of TVET educators in Nigeria. Each construct was adapted from prior work, refined through expert review, and subjected to reliability and validity checks during pilot testing. All items were measured using a 5-point Likert scale, ranging from 1 = Strongly Disagree to 5 = Strongly Agree, allowing mixed responses rather than the traditional 4-point scale, ensuring sensitivity to gradual changes in perception over time (see full-scale items in the appendix).

The *AI Readiness for TVET Educators* was adapted from Asmaa'Hussein et al. (2025), with modifications to reflect TVET educators' context. The construct comprised 6 items, on four key dimensions: perceived usefulness, pedagogical and professional alignment, concerns and risks, and ease of use and confidence. The Digital Literacy Scale was adapted from Zhang and Zhang (2024) and Baskara (2025), who outlined digital literacy for AI in education and society. The construct comprised 12 items. Similarly, the pedagogical adaptability construct with 10 items was adapted from Alqarni (2025) and Dewi et al. (2025), with slight modifications. Furthermore, the perception of AI construct was adapted from Asmaa'Hussein et al. (2025). The construct comprised 12 items, modified to reflect TVET educators' perceptions of AI. Lastly, a 10-item Attitudinal Competencies construct was adapted from Lāma & Lastovska (2025), with modifications to reflect the TVET educators' context.

## 2.3 Data Collection Procedure & Analysis

Data collection spanned four months of the 2024/2025 academic session (May–August 2025) and followed a structured, ethically approved process ensuring anonymity, voluntary participation, and confidentiality. Approval was obtained from institutional Research Ethics Committees, and participants provided written informed consent. The questionnaire was administered in both print and online via Google Forms, with links distributed via email and professional WhatsApp groups. Before full deployment, the instrument was pilot-tested with 37 TVET educators, yielding strong internal consistency (Ordinal alpha > 0.80). Responses from 416 educators were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics (mean, standard deviation, frequency, percentage) summarized demographic characteristics and assessed levels of readiness, digital literacy, pedagogical adaptability, AI perception, and attitudinal competencies. The interpretation of mean scores was based on real limits of numbers. Given that Likert-scale items yield discrete numerical responses but are intended to approximate a continuous latent construct, real limits were employed. Each observed scale value was therefore assumed to represent a class interval extending 0.50 units above and below the integer score. Since the instrument was structured on a five-point Likert scale, the mean scores between 0.50-1.49 were interpreted as very low, 1.50–2.49 as low, 2.50–3.49 as moderate, 3.50–4.49 as high, and 4.50–5.49 as very high. Furthermore, one-way analysis of variance (ANOVA) was employed to examine differences in digital literacy, pedagogical adaptability, perceptions of AI, and attitudinal competencies across demographic categories (gender, age, teaching experience, degree and TVET specialization), at 0.05 level of significance. Pearson Product–Moment Correlation (PPMC) was used to determine the relationships among digital literacy, pedagogical adaptability, perceptions of AI, attitudinal competencies, and AI readiness. The strength of the correlations was interpreted based on conventional benchmarks. This multi-stage analytical strategy strengthened methodological rigour and captures the structural complexity of AI readiness without reducing it to a single predictive pathway.

# 3 Results

## 3.1 Demographic Information of Respondents

According to the sample statistics in Table 1, the respondents were predominantly male (70%), indicating that, to a large extent, male figures still dominate the TVET skill areas. While most respondents were 34 years and above, slightly more than half (56.5%) had 6-10 years of teaching experience, indicating that securing employment as an educator requires both time and experience that can only be built over the years. Other demographic variables in Table 1 show that 78.4% of the respondents have obtained a PhD degree, which is one major requirement to lecture in Nigerian Universities; and Table 1 also shows that the largest TVET specialization represented among the respondents was from Agricultural Education (36.3%) and Business Education (28.8%).

Table 1: **Demographic Information of Respondents**

| Demographic Information | Category | Frequency | Percent |
|---|---|---|---|
| **Gender** | Male | 291 | 70.0 |
| | Female | 125 | 30.0 |
| **Age** | 29 - 33 Years | 38 | 9.1 |
| | 34 Years & Above | 378 | 90.9 |
| **Educational Qualification** | B.Sc/B.Ed | 12 | 2.9 |
| | M.Ed/M.Tech/M.Sc | 78 | 18.8 |
| | PhD | 326 | 78.4 |
| **Teaching Experience** | 1 - 5 Years | 42 | 10.1 |
| | 6 - 10 Years | 235 | 56.5 |
| | 11 Years & Above | 139 | 33.4 |
| **TVET Area** | Agricultural Education | 151 | 36.3 |
| | Business Education | 120 | 28.8 |
| | Computer Education | 38 | 9.1 |
| | Home Economics Education | 36 | 8.7 |
| | Technical Education | 60 | 14.4 |
| | Others | 11 | 2.6 |

## 3.2 Levels of digital literacy, pedagogical adaptation, perception of AI and attitudinal competencies among TVET educators

### *3.2.1 TVET Educators' Level of AI Readiness*

The educator's AI readiness items in Table 2 ranged from 3.09 to 3.53. Based on the real limits, only item 1, "I understand how to use AI tools relevant to my vocational teaching", marginally entered the high category (M = 3.53); most of the items fall within 2.50 – 3.49, indicating a moderate level of AI readiness among the TVET educators. Moreover, the cluster mean of 2.50 falls exactly at the lower boundary of the moderate level, thus confirming that TVET educators demonstrated a moderate level of readiness for AI-supported instruction, reflecting emerging but not yet robust preparedness.

Table 2: **TVET Educators' Level of AI Readiness**

| S/N | Items | Mean | Std. Deviation |
|---|---|---|---|
| 1 | I understand how to use AI tools relevant to my vocational teaching. | 3.53 | 1.04 |

| | | | |
|---|---|---|---|
| 2 | I can integrate AI-powered assessment tools (e.g., auto-grading, feedback) into my lessons. | 3.44 | 1.03 |
| 3 | I am confident that AI can personalize learning experiences for my students. | 3.30 | 1.11 |
| 4 | I am concerned that AI may introduce bias or unfairness in student evaluation | 3.22 | 1.16 |
| 5 | I know how to protect student data when using AI platforms. | 3.40 | 1.20 |
| 6 | I am willing to explore new AI tools to enhance vocational training delivery | 3.09 | 1.21 |
| | **Cluster Mean** | **2.50** | **0.53** |

### *3.2.2 TVET Educators' Level of Digital Literacy*

Table 3 shows the overall cluster mean of 3.43 (SD = 0.63), indicating a moderate level of digital literacy among TVET educators. Although some competencies were observed to be high, such as cybersecurity practices (M = 4.00), software installation (M = 3.85) and ethical use of digital resources (M = 3.82), some were also low, including integrating simulations or virtual labs into lessons (M = 2.27) and using digital assessment tools (M = 2.31). This outcome simply implies that TVET educators are less proficient in advanced technology-integrated instructional practices.

Table 3: **Digital Literacy Level of TVET Educators**

| S/N | Items | Mean | Std. Deviation |
|---|---|---|---|
| 1 | I can install and update software relevant to my teaching. | 3.85 | 1.23 |
| 2 | I can use cloud storage to organize and share teaching materials. | 3.39 | 1.05 |
| 3 | I can identify credible online sources for vocational training. | 3.72 | 0.97 |
| 4 | I can analyze digital data (e.g., spreadsheets, dashboards) to inform teaching. | 3.45 | 1.06 |
| 5 | I integrate simulations or virtual labs into my lessons. | 2.27 | 1.04 |
| 6 | I use digital assessment tools (e.g., quizzes, e-portfolios) to evaluate student learning. | 2.31 | 1.18 |
| 7 | I use digital platforms to maintain communication with industry stakeholders. | 3.09 | 1.21 |
| 8 | I encourage students to collaborate using online tools (e.g., Google Workspace, MS Teams). | 3.80 | 1.00 |
| 9 | I adapt open educational resources (OER) for my teaching context. | 3.15 | 1.04 |
| 10 | I design multimedia presentations that enhance practical demonstrations. | 3.12 | 1.11 |
| 11 | I model ethical use of digital resources (avoiding plagiarism, respecting copyright). | 3.82 | 1.06 |
| 12 | I implement cybersecurity practices (e.g., strong passwords, secure storage). | 4.00 | 0.94 |

| | | | |
|---|---|---|---|
| | **Cluster Mean** | **3.43** | **0.63** |

### *3.2.3 TVET Educators' Level of Pedagogical Adaptability*

Table 4 shows that the mean values ranged from 3.83 to 4.21, indicating a near-consistent high level of pedagogical adaptability among the TVET educators. The cluster mean of 4.02 clearly indicates a high level of pedagogical adaptability among TVET educators. This suggests strong flexibility in instructional strategies, learner support, industry integration and reflective practice.

Table 4: **Pedagogical Adaptability Level of TVET Educators**

| S/N | Items | Mean | Std. Deviation |
|---|---|---|---|
| 1 | I can switch between demonstration, discussion, and hands-on practice depending on learner needs. | 3.98 | 0.97 |
| 2 | I adjust lesson pacing when students require more time to grasp concepts. | 3.85 | 1.03 |
| 3 | I adapt my teaching to accommodate students with different learning styles. | 4.16 | 0.86 |
| 4 | I provide additional support for learners who are struggling without slowing down the whole class | 4.01 | 0.92 |
| 5 | I integrate real-world case studies from industry into my lessons. | 4.00 | 0.79 |
| 6 | I update my teaching content when new technologies or processes emerge in the workplace. | 4.21 | 0.84 |
| 7 | I use both practical and theoretical assessments to evaluate student competence. | 4.06 | 1.01 |
| 8 | I adapt assessment methods for learners with special needs or different learning contexts. | 3.83 | 0.76 |
| 9 | I reflect on my teaching after each lesson and make adjustments for improvement. | 4.09 | 0.81 |
| 10 | I try out new teaching strategies even if they may not work perfectly at first. | 4.05 | 0.75 |
| | **Cluster Mean** | **4.02** | **0.58** |

### *3.2.4 TVET Educators' Perception of AI Level*

In Table 5, the cluster mean (M = 3.81) indicates that TVET educators' overall perception of AI is high, reflecting strong recognition of AI's instructional value, relevance to competency development and potential for enhancing vocational training.

Table 5: **TVET Educators' Perception of AI Level**

| S/N | Items | Mean | Std. Deviation |
|---|---|---|---|
| 1 | AI can help personalize learning for students with different abilities. | 4.07 | 0.96 |
| 2 | AI can reduce my administrative workload (e.g., grading, scheduling). | 4.15 | 0.74 |
| 3 | AI can enhance student engagement in vocational training. | 4.12 | 0.82 |
| 4 | I understand how to use AI tools relevant to my teaching. | 3.70 | 0.96 |
| 5 | I would need significant training before I could use AI effectively. *(reverse-coded)* | 3.55 | 1.21 |
| 6 | I feel comfortable experimenting with AI-powered teaching tools. | 3.65 | 1.05 |
| 7 | AI may introduce bias or unfairness in student assessment. | 3.47 | 0.88 |
| 8 | I worry that students may become overly dependent on AI tools. | 4.02 | 1.04 |
| 9 | AI could threaten the professional role of educators in the future. | 3.42 | 1.18 |
| 10 | AI can simulate real-world industry scenarios for training purposes. | 3.88 | 0.91 |
| 11 | AI can complement, but not replace, hands-on practical training. | 3.93 | 1.00 |
| 12 | AI aligns with the competency-based approach of TVET. | 3.72 | 0.89 |
| | **Cluster Mean** | **3.81** | **0.49** |

*3.2.5 TVET Educators' Level of Attitudinal Competency*

Data in Table 6 show that all the items, including the cluster mean, had mean values above 4.00, indicating that TVET educators have a high level of attitudinal competence. This result reflects strong professional values, openness to innovation, industry collaboration, reflective practice, and a positive disposition towards teaching and mentorship.

Table 6: **TVET Educators' Attitudinal Competency Level**

| S/N | Items | Mean | Std. Deviation |
|---|---|---|---|
| 1 | I respect the diverse cultural and social backgrounds of my students. | 4.01 | 0.94 |
| 2 | I am patient when students struggle to master practical skills. | 4.04 | 0.77 |
| 3 | I continuously seek opportunities to improve my teaching practice. | 4.18 | 1.01 |
| 4 | I take pride in being a role model for professional conduct in my field. | 4.20 | 0.83 |
| 5 | I am open to experimenting with new teaching strategies. | 4.20 | 0.84 |

| | | | |
|---|---|---|---|
| 6 | I remain positive when faced with unexpected challenges in the classroom. | 4.07 | 0.80 |
| 7 | I value collaboration with industry partners to enrich student learning. | 4.36 | 0.69 |
| 8 | I willingly mentor less experienced colleagues. | 4.07 | 0.77 |
| 9 | I treat all students fairly, regardless of their performance level. | 4.38 | 0.78 |
| 10 | I reflect on my teaching to identify areas for improvement. | 4.24 | 0.75 |
| | **Cluster Mean** | 4.18 | 0.58 |

## 3.3 Competency Dimensions across Demographic Variables

### *3.3.1 Digital Literacy and Demographic Variables of TVET Educators*

Data in Table 7 show that, except for TVET specialization, none of the demographic variables showed a statistically significant effect on digital literacy levels. This implies that digital literacy among TVET educators is relatively consistent across age, gender, qualification, and experience, but varies by subject area, reflecting differences in technology exposure and instructional demands. Thus, the F-value (5.167) with a p-value of 0.000 < 0.05 indicates a statistically significant difference in digital literacy across TVET disciplines. Tukey HSD post-hoc comparison shows that TVET educators in Computer education and those in "others" scored significantly higher than educators in Home Economics and Business Education. This result indicates that disciplinary specialization has significant effects on digital literacy, likely due to differences in exposure to ICT-based teaching environments.

Table 7: **ANOVA Results of Digital Literacy and Demographic Variables**

| **Variable** | **Source** | **Sum of Squares** | **df** | **Mean Square** | **F/t** | **Sig.** |
|---|---|---|---|---|---|---|
| **Gender** | Equal variances assumed | | 414 | | 1.438 | 0.151 |
| | | | | | | |
| **Age** | Between Groups | 0.061 | 1 | 0.061 | 0.155 | 0.694 |
| | Within Groups | 164.125 | 414 | 0.396 | | |
| | Total | 164.187 | 415 | | | |
| **Teaching Experience** | Between Groups | 0.449 | 2 | 0.224 | 0.566 | 0.568 |
| | Within Groups | 163.738 | 413 | 0.396 | | |
| | Total | 164.187 | 415 | | | |
| **Degree** | Between Groups | 0.193 | 2 | 0.096 | 0.242 | 0.785 |
| | Within Groups | 163.994 | 413 | 0.397 | | |
| | Total | 164.187 | 415 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **TVET Specialization** | Between Groups | 9.733 | 5 | 1.947 | 5.167 | 0.000 |
| | Within Groups | 154.454 | 410 | 0.377 | | |
| | Total | 164.187 | 415 | | | |

### *3.3.2 Pedagogical Adaptation and Age of TVET Educators*

After mean comparisons across demographic variables and pedagogical adaptations, Table 8 shows the ANOVA result ($F = 8.962$, $p < 01$), indicating a significant difference in pedagogical adaptations according to age groups. TVET educators aged 34 years and above (M = 4.05), demonstrated higher pedagogical adaptability than those aged 29 – 33 years (M = 3.76). This suggests that older educators are more capable of integrating new pedagogical strategies, likely because of their teaching experiences.

Table 8: **Descriptives & ANOVA of Pedagogical Adaptation and Age of TVET Educators**

| **Age** | **No.** | **Mean** | **Standard Dev.** | **Source** | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** |
|---|---|---|---|---|---|---|---|---|---|
| 29 - 33 Years | 38 | 3.76 | .58 | Between Groups | .992 | 2 | 2.994 | 8.962 | .003 |
| 34 Years & Above | 378 | 4.05 | .58 | Within Groups | 140.321 | 413 | .334 | | |
| Total | 416 | 4.03 | .58 | Total | 141.313 | 415 | | | |

### *3.3.3 Perception of AI and Years of Experience of TVET Educators*

Among the variables, Table 9 shows that only years of experience had a near-significant difference, yet not significantly different ($F = 2.914$, $p > 0.05$), in TVET educators' perception of AI across different years of teaching experience categories. Table 9 also shows a marginal difference in the mean values of the teaching experience of the educators, with those in the 6-10 years of experience (M = 3.86) category appearing slightly more positive towards AI than other groups. However, since the difference is not significant, it implies that TVET educators across the experience levels have generally consistent positive perceptions of AI.

Table 9: **Descriptives & ANOVA of the Perception of AI and Years of Experience among TVET Educators**

| **Years of Experience** | **No.** | **Mean** | **Standard Dev.** | **Source** | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** |
|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 - 5 Years | 42 | 3.7183 | .51236 | Between Groups | 1.409 | 2 | .705 | 2.914 | .055 |
| 6 - 10 Years | 235 | 3.8574 | .45703 | Within Groups | 99.883 | 413 | .242 | | |
| 11 Years & Above | 139 | 3.7482 | .54001 | Total | 101.292 | 415 | | | |
| Total | 416 | 3.8069 | .49404 | | | | | | |

### *3.3.4 Attitudinal Competencies and Years of Experience of TVET Educators*

The ANOVA result in Table 10 reveals a significant difference ($F = 3.630$, $p = 0.027 < 0.05$) in attitudinal competencies across teaching experience levels. TVET educators with 6-10 years of experience (M = 4.24) scored highest, indicating more favourable attitudes towards AI-supported instructions. This is interesting, as the group (6-10 years) likely represents educators in their professional prime, who are technologically confident, yet sufficiently experienced to appreciate pedagogical and ethical implications of AI tools. In contrast, early-career educators (1-5 years) may still be developing these attitudes, while senior educators (11 years and above) may experience inertia in adaptation.

Table 10: **Descriptives & ANOVA of the Attitudinal Competencies and Years of Experience among TVET Educators**

| | No. | Mean | Standard Dev. | Source | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|---|---|---|
| 1 - 5 Years | 42 | 4.0143 | .52941 | Between Groups | 2.385 | 2 | 1.193 | 3.630 | .027 |
| 6 - 10 Years | 235 | 4.2370 | .52537 | Within Groups | 135.695 | 413 | .329 | | |
| 11 Years & Above | 139 | 4.1216 | .65726 | Total | 138.080 | 415 | | | |
| Total | 416 | 4.1760 | .57682 | | | | | | |

## 3.4 Relationship Between Digital Literacy, Pedagogical Adaptation, Perception of AI, Attitudinal Competencies, and AI Readiness

Table 11 shows that digital literacy has a significant positive relationship with pedagogical adaptation ($r = .388$, $p < .01$), perception of AI ($r = .337$, $p < .01$) and attitudinal competences ($r = .284$, $p = < .01$). This implies that digitally literate educators are also more adaptable pedagogically, and have more positive perceptions and attitudes towards AI-supported instructions. Data in Table 11 also show that attitudinal competences strongly correlated with pedagogical adaptation ($r = .751$, $p = < .01$) and perception of AI ($r = .649$, $p = < .01$), indicating a consistent cluster of affective and instructional readiness dimensions. Readiness to support AI correlated significantly (but weakly) with attitudinal competences ($r$ = .131, $p$ = < .05), suggesting that those with stronger attitudinal orientations tend to express readiness in slightly higher dimensions.

Table 11: **Correlation Matrix of Readiness to Support AI among TVET Educators**

| **S/N** | | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|---|
| 1 | Digital Literacy | 1 | | | | |
| 2 | Pedagogical Adaptation | .388** | 1 | | | |
| 3 | Perception of AI | .337** | .644** | 1 | | |
| 4 | Attitudinal Competencies | .284** | .751** | .649** | 1 | |
| 5 | Readiness_Index | .013 | .088 | .060 | .110* | 1 |

## 4 Discussion of Findings

The major issue in this study is to examine the readiness of TVET educators for AI-supported instruction across Nigeria's six geopolitical zones, where artificial intelligence (AI) tools such as GitHub Copilot, ChatGPT, Google Gemini, among others, are adopted to support the instructional process. This study specifically examines the levels of AI readiness, digital literacy, pedagogical adaptation, perception of AI and attitudinal competencies among TVET educators. This study also contributes to the competency dimensions across demographic variables and relationships among AI readiness and the competency dimensions of TVET educators.

### 4.1 Demographic Information of Respondents

The demographic analysis revealed a predominantly male workforce (70%), reflecting the gender imbalance historically associated with technical fields. This aligns with Oviawe (2020) and Okwelle and Okoye (2022), who attribute such disparities to societal perceptions that discourage female participation. Nonetheless, the 30% female representation signals gradual inclusivity, consistent with national gender equity policies (Adebayo & Musa 2022). The age distribution showed that most respondents were 34 years and above, suggesting maturity and accumulated teaching or industry experience, corroborating the findings of Usman et al. (2024). Academic qualifications were notably high, with 78.4% holding PhDs, underscoring professional credibility and potential confidence in adopting advanced technologies (Ng & Park 2022). Teaching experience was concentrated among mid-to-late-career educators, a group often receptive to pedagogical innovation (Emejulu & Ogbuanya 2020). Specialization patterns reflected national enrolment trends, with Agricultural and Business Education dominant (Bakar, Ghafar & Abdullah 2024). Collectively, these demographics establish a mature, highly qualified, and experienced educator population, providing a robust foundation for interpreting readiness for AI integration (Sholikhah et al. 2025)

### 4.2 Levels of digital literacy, pedagogical adaptation, perception of AI and attitudinal competencies among TVET educators

The study examined four critical dimensions of technology integration and instructional readiness among TVET educators: digital literacy, pedagogical adaptation, perception of AI, and attitudinal competencies. Together, these dimensions provide a holistic understanding of how educators navigate the challenges and opportunities of technology-mediated TVET education. Table 2 revealed that TVET educators demonstrated a moderate level of AI readiness. Although educators showed relatively strong understanding of AI tools relevant to vocational teaching and expressed willingness to explore new AI applications, their confidence in integrating AI-powered assessment tools, managing ethical risks such as bias, and protecting student data remained cautious. This pattern suggests that AI readiness among TVET educators is emergent rather than consolidated, reflecting openness and awareness without full operational confidence. This aligns with the findings of Ifeanyi and Okoye (2023) who reported that in developing contexts, educators demonstrate interest in AI-supported instruction but lack structured institutional support and sustained professional development to translate interest into practice. The moderate readiness level also reflects concerns surrounding fairness, data privacy, and professional role integrity, which Dwivedi et al. (2021) and Adebayo and Musa (2022) identified as common moderating factors in AI adoption among educators.

Table 3 revealed a moderate level of digital literacy among TVET educators. This finding suggests that while educators possess foundational digital skills, their proficiency in advanced technology-integrated practices remains limited. High mean scores were observed in cybersecurity practices, software installation, and ethical use of digital resources, reflecting strong awareness of responsible digital behaviour. However, competencies such as integrating simulations or virtual labs and using digital assessment tools were notably low, implying limited adoption of innovative instructional technologies. These results align with Ogunode (2022) and Oviawe (2020), who reported that Nigerian educators often struggle with the practical application of digital tools due to infrastructural gaps and insufficient training. Similarly, Tondeur et al. (2020) emphasized that digital competence requires continuous institutional support and hands-on experience. Within the framework of the Technology Acceptance Model (Davis 1989), perceived ease of use strongly influences adoption; thus, educators with limited exposure to complex technologies may perceive them as difficult to use. Interestingly, demographic variables such as gender, age, qualification, and teaching experience did not significantly influence digital literacy, except for specialization. This suggests that digital literacy is fairly evenly distributed among educators, though those in computing-related disciplines demonstrate higher competence due to greater exposure to technology-based learning environments, corroborating Zawacki-Richter et al. (2019).

Table 4 indicates a consistently high level of pedagogical adaptability among TVET educators. This reflects strong flexibility in instructional strategies, learner support, industry integration, and reflective practice. Notably, adaptability differed significantly by age, with older educators demonstrating greater flexibility in modifying instructional approaches.

This finding supports Dwivedi et al. (2021), who argued that adaptability grows through reflective practice and accumulated teaching experience. Usman et al. (2024) similarly observed that professional development enhances alignment between pedagogy and technology, while Eze and Nwosu (2021) reported higher adaptability among experienced Nigerian educators. Pedagogical adaptability is particularly critical in AI-supported instruction, where educators must continuously adjust to evolving learner needs and technological innovations. Within TAM, perceived usefulness of technology strongly influences adoption, and adaptability reflects educators' recognition of AI's instructional value. Thus, age and experience appear to strengthen confidence and flexibility in technology-mediated environments.

Table 5 revealed that TVET educators hold generally positive perceptions of AI. This reflects strong recognition of AI's instructional value, relevance to competency development, and potential for enhancing vocational training. Although differences across teaching experience were not statistically significant, mid-career educators (6–10 years) expressed slightly higher positivity, suggesting that this group combines competence with curiosity for innovation.

These findings align with Dwivedi et al. (2021) and Nguyen et al. (2023), who noted that perceptions are often shaped by awareness rather than practical engagement. Adebayo and Musa (2022) similarly observed that enthusiasm for technology adoption peaks among mid-career educators. Within TAM, perceived usefulness is a critical determinant of acceptance, and positive perceptions are essential for fostering adoption. However, limited practical exposure suggests that institutional training is necessary to transform favorable perceptions into functional readiness.

Table 6 showed a high level of attitudinal competence among TVET educators. This reflects strong professional values, openness to innovation, industry collaboration, reflective practice, and a positive disposition toward teaching and mentorship. Attitudinal competencies varied significantly across teaching experience, with mid-career educators scoring highest. This suggests that professional maturity fosters openness, confidence, and motivation to integrate AI into pedagogy. The findings correspond with Emejulu and Ogbuanya (2020), who emphasized that attitudes are shaped by exposure and confidence, and with Kim and Kim (2022), who highlighted the role of professional experience in shaping favorable dispositions. Attitudinal competence is critical because it combines ethical awareness, openness to innovation, and motivation to use emerging technologies responsibly (Eze & Nwosu 2021). Within TAM, this dimension mirrors perceived usefulness, as educators who view AI as beneficial are more likely to maintain positive attitudes and integrate it into practice. Thus, attitudinal strength among mid-career educators positions them as potential champions of AI adoption. Summarily, the findings highlight a nuanced profile of TVET educators. While digital literacy remains moderate, pedagogical adaptability, perception of AI, and attitudinal competencies are consistently high. This suggests that educators are flexible, positive, and ethically grounded, but require targeted training and infrastructural support to strengthen advanced digital practices. The Technology Acceptance Model provides a useful lens, showing that perceived ease of use and perceived usefulness shape adoption. Therefore, institutional interventions that simplify technology use and demonstrate its instructional value can accelerate integration. Mid-career educators, with their balance of experience and openness, emerge as key drivers of AI-supported instruction, capable of championing innovation in vocational education.

Hence, the findings on digital literacy, pedagogical adaptability, perception of AI, and attitudinal competencies provide a coherent explanation for the observed level of AI readiness among TVET educators. While digital literacy remains moderate and constrains engagement with advanced AI-enabled instructional practices, high pedagogical adaptability, positive perceptions of AI, and strong attitudinal competencies create a favourable foundation for readiness. These dimensions are mutually reinforcing rather than independent; pedagogical flexibility enables experimentation, positive perceptions motivate engagement, and attitudinal competence sustains ethical and reflective use of AI. Consequently, the moderate level of AI readiness observed in this study reflects a transitional stage, where foundational competencies and favourable dispositions exist, but deeper technical proficiency and institutional scaffolding are required for full readiness.

### 4.3 Competency Dimensions Across Demographic Variables

The study revealed selective influences of demographic variables on TVET educators' competencies, suggesting that readiness-related competencies are shaped more by contextual exposure than by demographic characteristics alone. Digital literacy was generally consistent across age, gender, qualification, and experience, but varied significantly by specialization. Educators in Computer Education and related fields scored higher than those in Home Economics and Business Education, reflecting greater exposure to ICT-based instructional environments (Zawacki-Richter et al. 2019). This supports earlier findings that moderate digital literacy persists due to infrastructural gaps and limited access to advanced training opportunities (Ogunode 2022; Oviawe 2020; Tondeur et al. 2020). Pedagogical adaptability differed significantly by age, with older educators showing greater flexibility, indicating that instructional adaptability strengthens through accumulated teaching experience and reflective practice (Dwivedi et al. 2021; Eze & Nwosu 2021). Perceptions of AI were consistently positive across experience levels, though mid-career educators expressed slightly higher enthusiasm (Nguyen et al. 2023; Adebayo & Musa 2022). Attitudinal competencies varied significantly, with mid-career educators scoring highest ($M = 4.24$), reflecting confidence, openness, and ethical awareness associated with professional maturity (Emejulu & Ogbuanya 2020; Kim & Kim 2022).

### 4.4 Relationships between AI Readiness and the Competency Dimensions

Table 11 highlights significant positive relationships among digital literacy, pedagogical adaptation, perception of AI, and attitudinal competencies. Digital literacy correlated with pedagogical adaptation, perception of AI, and attitudinal competence, suggesting that digitally skilled educators are more adaptable and hold favorable perceptions and attitudes toward AI-supported instruction. Attitudinal competence showed strong correlations with pedagogical adaptation and perception of AI, underscoring the interconnectedness of affective and instructional readiness. This indicates that openness, ethical awareness, and professional commitment reinforce educators' capacity to adapt pedagogically and engage constructively with AI-enabled tools. Readiness to support AI correlated weakly but significantly with attitudinal competence, indicating that positive professional orientations modestly enhance readiness, even when advanced technical skills are still developing. These results support Zawacki-Richter et al. (2019), who emphasized the synergy between technology and pedagogy, and Usman et al. (2024), who noted that emotional and pedagogical orientations improve instructional outcomes. Similar conclusions were reached by Dwivedi et al. (2021) and Adebayo and Musa (2022), who argued that educators' psychological readiness often precedes full technological adoption. Overall, readiness appears more dependent on psychological and instructional dimensions than demographic factors.

## 5 Conclusion and Recommendations

This study examined TVET educators' readiness for AI-supported instruction in Nigerian higher education, focusing on digital literacy, pedagogical adaptability, AI perception, attitudinal competencies, and demographic influences. Educators displayed moderate digital literacy, with stronger basic skills but weaker advanced AI applications such as simulations, analytics, and virtual labs. Older educators showed greater pedagogical adaptability, while mid-career educators demonstrated stronger attitudinal competencies, reflecting openness and confidence. Although skill-based variables were positively interrelated, overall readiness for AI-supported instruction remained moderate, suggesting that preparedness is still emerging within the TVET context. Collectively, educators are receptive yet under-prepared, constrained by structural enablers rather than willingness. Universities and TVET faculties should implement sustained, discipline-specific AI capacity-building programs emphasizing instructional applications, learning analytics, simulations, and AI-assisted assessment design, alongside improvements in institutional infrastructure and support systems.

## 6 Limitations and Suggestions for Further Studies

This study relied on self-reported data, which may introduce bias and not fully capture classroom practices or AI proficiency. Its cross-sectional design offered only a snapshot, while the regression explained limited variance, leaving institutional factors unmeasured. Nonetheless, diverse regional sampling strengthens contextual validity. Future research should employ longitudinal or experimental designs, integrate institutional variables and direct usage measures, and pursue comparative studies across systems to deepen understanding and inform scalable AI integration in TVET education.

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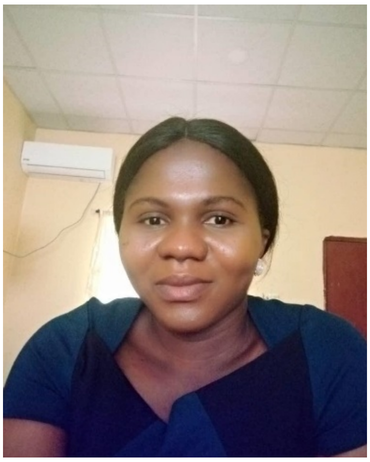


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