

ARTIFICIAL INTELLIGENCE AND DIGITAL COMPETENCES AMONG UNIVERSITY-LEVEL TECHNICAL VOCATIONAL EDUCATION AND TRAINING TEACHERS IN SOUTH-EAST, NIGERIA

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Abstract

This study investigated the awareness of artificial intelligence (AI) and its relationship with digital competences among university-level Technical and Vocational Education and Training (TVET) teachers in South-East Nigeria. Specifically, the study examined the level of AI awareness, assessed teachers' digital competence, determined the relationship between AI awareness and digital competence, and evaluated whether demographic characteristics influence these variables. A correlational survey research design was adopted. Data were collected from 141 TVET teachers using structured questionnaires and analyzed using descriptive statistics, Pearson Product Moment Correlation, independent samples t-test, and one-way Analysis of Variance (ANOVA). The findings revealed that TVET teachers possessed high levels of AI awareness ($M = 4.10$, $SD = 0.57$) and digital competence ($M = 4.21$, $SD = 0.52$). A strong positive and statistically significant relationship existed between AI awareness and digital competence ($r = 0.655$, $p < 0.001$). However, age, gender, and years of teaching experience did not significantly influence either AI awareness or digital competence ($p > 0.05$). The study concludes that enhancing AI awareness can contribute substantially to strengthening digital competence among TVET teachers and support technology-driven instructional practices. It recommends sustained professional development programmes, institutional support for AI integration, and inclusive capacity-building initiatives for all TVET educators to promote effective digital transformation in higher education.

Keywords: Artificial Intelligence, Digital Competences, TVET Teachers, University-Level TVET

Introduction

The global integration of digital technologies and artificial intelligence (AI) into education systems has transformed the way knowledge is delivered, assessed, and managed. In the context of higher education, particularly in science and technical-based disciplines, AI has introduced new possibilities in teaching, learning, research, and curriculum development (Abbasi et al., 2025; Chen et al., 2020). AI-powered tools like intelligent tutoring systems, data-driven instructional platforms, virtual simulations, and automated assessment systems are increasingly reshaping educational practices and are essential to preparing students for the Fourth Industrial Revolution (4IR) (Imamguluyev et al., 2024).

Technical education with options in automobile trades, building trades, electrical trades, metalworks, among others, which prepares students for roles in the industry, must embrace current technological advances to remain relevant. The emergence of smart

technologies, AI-assisted project design, robotics, and predictive analytics in construction further highlights the need for integrating AI knowledge into the training of future professionals (Chukwu, 2026a; George, 2023). Therefore, teachers of TVET in universities must not only be aware of such innovations but also demonstrate adequate digital competence to use them effectively in instructional delivery and curriculum integration.

Digital competence, defined as the confident and critical use of digital technology for work, communication, and education, is a foundational requirement for any teacher operating in a 21st-century learning environment (Caena & Redecker, 2019; Jannah et al., 2020). For TVET teachers, this competence includes the ability to use CAD software, collaborate online, evaluate digital resources, and facilitate virtual learning. Awareness of AI is believed to enhance digital competence (Gaber et al., 2023) by fostering interest in new tools and encouraging the adoption of intelligent systems in educational practice.

Awareness of AI is the degree to which TVET teachers possess the conceptual understanding, pedagogical insight, and critical evaluation skills needed to recognize AI's role in their discipline, make informed decisions about AI tools in teaching, and to prepare learners for AI-mediated work environments, thereby contributing to the development of learners' digital competence (Kandlhofer et al., 2023; Moravec et al., 2024). Thus, this awareness cuts deeper into the digital competence of teachers as it showcases professional engagement, teaching and learning, assessment, and facilitating the learners' digital competence. Contextually, awareness of AI for TVET teachers buttresses having knowledge of what AI is and is not, AI's basic types and how it differs from traditional software. It means being able to explain to learners how AI can be integrated and used in their trade areas, such as predictive maintenance in the mechanical trade, design in the construction trade, and diagnostics in electrical work.

In the areas of trades, technology, and workforce development, university-level Technical and Vocational Education and Training (TVET) is expected to be at the forefront of innovation and skills advancement. TVET is broadly "understood as comprising education, training and skills development relating to a wide range of occupational fields, production, services and livelihoods" (UNESCO, 2015). Unlike TVET at lower educational levels, university-level TVET integrates practical occupational competencies with advanced academic scholarship, leading to qualifications ranging from bachelor's degrees to doctoral degrees (Chukwu, 2025). This unique positioning places university-level TVET at the intersection of industry practice, technological innovation, research, and knowledge creation.

Accordingly, TVET teachers in universities are not only expected to impart practical and technical skills but also to engage in research, innovation, curriculum development, and the generation of new knowledge that responds to emerging workplace realities. As technological advancements continue to reshape industries globally, university-level TVET educators have a professional responsibility to remain current with emerging technologies that influence teaching, learning, and occupational practice. One such transformative development is Artificial Intelligence (AI), which is rapidly changing the way knowledge is created, disseminated, and applied across virtually all sectors of the economy.

The growing integration of AI into manufacturing, construction, engineering, business, healthcare, and educational systems have significant implications for TVET. Modern workplaces increasingly require employees who can interact with AI-enabled tools, analyze data, automate routine processes, and make informed decisions in technology-rich environments (Chukwu, 2026). Consequently, TVET teachers must possess sufficient awareness and understanding of AI to prepare students for these evolving workplace demands. Their awareness is necessary not only for enhancing their own instructional effectiveness but also for ensuring that graduates acquire competencies that are relevant to the emerging digital economy.

Furthermore, the academic dimension of university-level TVET demands that teachers continuously update their knowledge base through lifelong learning and engagement with contemporary developments in their fields. Artificial intelligence has emerged as one of the most influential technological innovations of the twenty-first century (Joshi et al., 2025), with growing applications in curriculum design, instructional delivery, assessment, student support, educational research, and professional development. Therefore, university-level TVET teachers are expected to keep abreast of developments in AI, understand its potentials and limitations, and explore appropriate ways of integrating AI-driven technologies into teaching and learning processes (Ng et al., 2023; Pratiwi et al., 2025). Doing so is essential for maintaining the relevance, quality, and responsiveness of university-level TVET programmes in an increasingly digital and technology-driven society.

Despite the acknowledged potential of AI in enhancing educational delivery, many university educators in developing countries, including Nigeria, may have limited exposure to or understanding of AI and its applications. Existing studies have largely focused on ICT integration or digital literacy among educators in general education, but have paid limited attention to technical education teachers (Ajah & Chigozie-Okwum, 2019; Ekwevugbe, 2025; Madu & Musa, 2024). The South-East geopolitical zone of Nigeria, home to several federal

and state universities, offers a unique context to examine this issue, considering the region's efforts in promoting technical and vocational education.

Moreover, demographic characteristics such as age, gender and years of teaching experience are known to shape educators' engagement with emerging technologies, including AI. Prior research indicates that male and female TVET teachers may differ in their exposure to technical tools related to digital practice, which can influence both AI awareness and digital competence (Ohanu & Chukwuone, 2018). Similarly, age is often associated with varying levels of digital familiarity, with younger teachers typically exhibiting greater comfort with new digital platforms, while older teachers may rely more on established pedagogical routines. Years of teaching experience has been found to also influence digital competence, as experienced educators may possess strong pedagogical judgment for evaluating AI applications, yet may also face challenges in adapting to rapidly evolving digital environments (Krumsvik et al., 2016). Understanding how these demographic variables related to AI awareness and digital competence is thus important for contextualizing the position of TVET teachers in South-east Nigeria, thereby providing rationale for examining these variables in the hypotheses section.

This study, therefore, seeks to investigate the awareness of artificial intelligence and its relationship with the digital competences of TVET teachers in universities in South-East Nigeria. Findings from this study will provide valuable insights into the readiness of educators to embrace AI-driven innovations and identify professional development needs in digital competence for improving the quality of technical education.

Statement of the Problem

Ideally, the university-level TVET teachers would possess a high level of awareness of Artificial Intelligence (AI) and demonstrate robust digital competencies. The teachers would effectively integrate AI-driven tools into instructional planning, delivery, and assessment, thereby equipping students with skills relevant to modern technologies and the digital economy, as required in today's industry. TVET institutions would support continuous professional development and promote the adoption of AI in pedagogy.

However, in reality, many TVET teachers in Nigerian universities may have limited awareness of AI concepts and applications. Anecdotal evidence and preliminary observations suggest that AI is not yet widely integrated into TVET curricula, and teachers often lack opportunities for training in emerging digital technologies. Digital competence levels vary significantly, with some educators relying on basic ICT tools without progressing to advanced

or AI-assisted teaching strategies. This situation is further complicated by infrastructural constraints, inadequate training, and insufficient institutional policies supporting digital transformation in education.

Thus, despite the growing global emphasis on digital transformation in education, there is a noticeable gap in empirical research specifically assessing the level of AI awareness among TVET teachers and how this awareness correlates with their digital competence in the Nigerian university context. Most related studies focus broadly on ICT usage or digital literacy in general education, leaving a gap in understanding the preparedness of technical educators to adapt to AI trends. Addressing this gap is crucial for aligning technical education with global technological advancements and national development goals.

Research Questions

This study examined the relationship between awareness of AI and digital competences among University-Level TVET teachers in South-East Nigeria. Specifically, the study answered the following research questions:

1. What is the level of awareness of artificial intelligence among TVET teachers?
2. What is the level of digital competence among these teachers?
3. Is there a significant relationship between AI awareness and digital competence?
4. Do demographic factors significantly influence AI awareness and digital competence?

Hypotheses

H₀₁: There is no significant relationship between AI awareness and digital competence among TVET teachers.

H₀₂: There is no significant difference in AI awareness based on gender, age, or years of teaching experience.

H₀₃: There is no significant difference in digital competence based on gender, age, or years of teaching experience.

Methodology

This study adopted a correlational survey design, aimed at determining the relationship between variables, in this case, AI awareness and digital competence. Correlational survey design is a non-experimental research method that uses surveys to measure two or more variables and assess the statistical relationship between the constructs, without manipulating any (Devi et al., 2022). This is deemed necessary for the study as it explores how AI awareness and digital competence are related, alongside the demographic variables of interest.

The study was carried out in South East, Nigeria with attention to seven (7) government universities offering TVET programmes. The population for the study is 462 university-level TVET teachers. This encompasses all TVET lecturers in the institutions. However, a priori analysis was conducted using G*Power 3.1.9.7 to determine the minimum sample size required for detecting a medium effect size in a bivariate correlation analysis. This sample analysis was based on the following parameters: a t-test, medium effect size of $\rho = 0.30$ following Cohen's conventions, alpha level set at 0.05 and statistical power of 95%. The correlation bivariate normal model test was selected as it aligns with the study's objectives of examining the relationship between two continuous variables. G*Power output indicated that a minimum sample of 138 participants was required to achieve 95% power at the 0.05 level of significance. But, to account for potential non-response and incomplete questionnaire, an additional 15% was added, making the total target sample size of 159 participants. The targeted participants were conveniently drawn in line with field realities, as data collection involved multiple visits to the institutions. During these visits, some teachers will be available while others may not be, hence the over-sampling ensures that the required minimum sample size is attained despite intermittent availability.

The instrument for data collection was a questionnaire developed by the researchers based on literature review. The questionnaire has three sections, A-C. Section A ascertained the demographic information of the lecturers – age, gender, and years of experience. Respondents were asked to check the box that best matches their personal information. Section B has 8 items, which ascertained the AI awareness of TVET lecturers using five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). Respondents were asked to indicate their level of agreement to the 8-item statements. Lastly, Section C ascertained the digital competence of the lecturers using 9 items. The items verified the digital competence of the respondents, using five-point Likert scale ranging from Not Competent (1) to Highly Competent (5).

The instrument was subjected to content validity and pilot tested for reliability. To ensure content validity, three experts in the Faculty of Vocational and Technical Education, two in the Department of Industrial Technical Education and one in the Department of Computer and Robotics Education, were given copies of the instrument with the purposes, research questions and hypotheses. The experts were asked to perform face-validity and ensure that the items are coherent, and are able to elicit the required information. The experts' suggestion and corrections in terminologies were integrated into the final version of the questionnaire distributed for pilot testing. The pilot testing was done across 20 TVET lecturers

who were not a part of the population, and analyzed for the reliability of the instrument, using Cronbach's alpha coefficient. A reliability coefficient of 0.905 was obtained. Since the acceptable Cronbach's alpha coefficient was 0.70, the instrument was judged reliable for data collection.

Data collection was by direct administration and retrieval. A total of 141 copies of the questionnaire were duly filled and retrieved after 6-weeks of data collection exercise. Data analysis was done using descriptive statistics (mean and standard deviation) for level of awareness and competence. The mean values were interpreted based on mean benchmark of 3.50. Pearson's correlation coefficient was used in analyzing the relationship between AI awareness and digital competence. T-test and Analysis of Variance (ANOVA) were used to test the demographic influences on AI awareness and digital competence.

Results

The analysis and results are presented.

Research Question 1:

What is the level of awareness of artificial intelligence among TVET teachers?

Table 1: Level of Awareness of Artificial Intelligence among TVET Teachers (N = 141)

Variable	Mean	Standard Deviation	Interpretation
AI Awareness (Overall)	4.10	0.57	High

Data in Table 1 show that university-level TVET teachers had a high level of awareness of artificial intelligence, with an aggregate mean score of 4.10 (SD = 0.57). Individual item means ranged from 4.01 to 4.31, indicating consistently high awareness across different aspects of AI. This suggests that most respondents are familiar with AI concepts and their applications in educational contexts.

Research Question 2:

What is the level of digital competence among university-level TVET teachers?

Table 2: Level of Digital Competence among TVET Teachers (N = 141)

Variable	Mean	Standard Deviation	Interpretation
Digital Competence (Overall)	4.21	0.52	High

Table 2 reveals that TVET teachers demonstrated a high level of digital competence, with an overall mean score of 4.21 (SD = 0.52). The item means varied from 3.92 to 4.48, reflecting strong proficiency in the use of digital technologies for teaching and professional activities.

Research Question 3:

Is there a significant relationship between AI awareness and digital competence?

Table 3: Relationship between AI Awareness and Digital Competence

Variables	<i>R</i>	<i>p</i> -value	Decision
AI Awareness	0.655	< 0.001	Significant Positive Relationship
Digital Competence			

Data in Table 3 show the Pearson Product Moment Correlation analysis, revealing that a strong positive relationship between AI awareness and digital competence ($r = 0.655$, $p < 0.001$). This implies that as teachers' awareness of AI increases, their digital competence also tends to increase. Also, the relationship is statistically significant, indicating that the association is unlikely to have occurred by chance. Hence, hypothesis 1 which stated that there is no significant relationship between AI awareness and digital competence among TVET teachers, was not upheld.

Research Question 4:

Do demographic factors significantly influence AI awareness and digital competence?

Table 4: Influence of Age on AI Awareness and Digital Competence

Variable	<i>F</i>	<i>p</i> -value	Decision
AI Awareness	0.359	0.699	Not Significant
Digital Competence	0.895	0.411	Not Significant

The one-way ANOVA results in Table 4 showed that age did not significantly influence AI awareness ($F = 0.359$, $p = 0.699$) or digital competence ($F = 0.895$, $p = 0.411$) among TVET teachers. Therefore, teachers across different age groups exhibited similar levels of AI awareness and digital competence.

Table 5: Influence of Years of Teaching Experience on AI Awareness and Digital Competence

Variable	F	p-value	Decision
AI Awareness	0.727	0.575	Not Significant
Digital Competence	0.220	0.927	Not Significant

Similarly, the ANOVA results in Table 5 shows that years of teaching experience did not significantly influence either AI awareness or digital competence among the respondents. Teachers with varying lengths of professional experience reported comparable levels of awareness and digital skills.

Table 6: T-Test Analysis of the Influence of Gender on AI Awareness and Digital Competence

Variable	t	p-value	Decision
AI Awareness	-1.329	0.186	Not Significant
Digital Competence	-0.153	0.879	Not Significant

The independent samples t-test revealed no statistically significant gender differences in AI awareness ($t = -1.329$, $p = 0.186$) or digital competence ($t = -0.153$, $p = 0.879$). Male and female TVET teachers demonstrated comparable levels of awareness and competence.

Hypotheses Testing

Table 7: Summary of the Hypotheses Results

S/n	Null Hypotheses	Statistical Test	Result	Decision
1	No significant relationship exists between AI awareness and digital competence	Pearson Correlation ($r = 0.655$, $p < .001$)	Significant	Rejected
2	No significant difference in AI awareness based on gender, age, or years of experience	ANOVA and t-test	$p > .05$ in all cases	Not Rejected
3	No significant difference in digital competence based on gender, age, or years of experience	ANOVA and t-test	$p > .05$ in all cases	Not Rejected

Table 7 shows a summary of the hypotheses tested in this study. Among the tested hypotheses, only hypothesis 1 had p-value less than 0.001, and thus was rejected, hence there is significant relationship between AI awareness and digital competence. For hypotheses 2 and 3, age,

gender, and years of experience had no significant influence on TVET teachers' awareness of AI and digital competences.

Discussion

The study found that university-level TVET teachers in South-East Nigeria possess a high level of awareness of artificial intelligence. This finding suggests that AI has gained considerable visibility within higher education and professional circles, enabling lecturers to become increasingly familiar with AI technologies and their potential applications in teaching, learning, and research. The high awareness may also reflect institutional exposure through seminars, online learning platforms, and widespread access to AI-enabled digital tools. This finding is in line with Ekwevugbe (2025) who reported high awareness of AI tools among lecturers, and likewise Madu & Musa (2023) that found moderate awareness of AI and digital competences among lecturers.

The findings further revealed that TVET teachers exhibit a high level of digital competence. This indicates that respondents possess the necessary technological knowledge and skills required to use digital resources effectively in instructional delivery and professional practice. The result may be attributed to the growing digitization of university education and the increased reliance on digital technologies following recent calls for reforms and technological advancements, such as Ogunode and Ndayebom (2023), as well as John and Tamunomiebi (2024).

A major finding of the study is the existence of a strong and statistically significant positive relationship between AI awareness and digital competence. This implies that teachers who are more knowledgeable about artificial intelligence are also more likely to possess stronger digital skills. The finding aligns with the notion that awareness often precedes adoption and effective utilization of emerging technologies. Since AI applications require a foundation in digital literacy, greater awareness naturally complements improved digital competence, in line with Rane et al. (2025). This finding is corroborated by Madu and Musa (2023) who reported positive relationship between lecturers' level of awareness of AI and their digital competence.

The study also established that age, gender, and years of teaching experience do not significantly influence AI awareness or digital competence. This suggests that technological awareness and competence among university TVET teachers are becoming increasingly democratized across demographic categories. Access to digital technologies and AI resources appears to transcend traditional demographic boundaries, enabling teachers regardless of age,

gender, or experience to develop similar competency levels. In support, Dringó-Horváth et al. (2025) also observed that there is no one-size-fits-all approach to AI, but a tailored approach to integration and utilization. Overall, these findings imply that institutional efforts aimed at improving AI integration in TVET should prioritize not just broad-based capacity building, but targeting specific demographic groups, to enhance adoption and integration across different TVET areas.

Conclusion

The study revealed that university-level TVET teachers in South-East Nigeria possess high levels of both artificial intelligence awareness and digital competence. Furthermore, AI awareness is strongly associated with digital competence, suggesting that improvements in one domain are likely to reinforce the other. The absence of significant demographic differences indicates that AI-related capacity building initiatives can be implemented broadly across the teaching workforce without demographic segmentation. However, given the nature of TVET trades, segmented implementation is still advocated for targeted adopting and integration. Strengthening AI awareness and digital competence is therefore essential for enhancing instructional innovation and preparing TVET systems for the demands of digital transformation.

Recommendations and Future Research

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

1. Universities should institutionalize regular professional development programmes on artificial intelligence applications in TVET teaching and learning to sustain and deepen existing awareness levels.
 2. University management and relevant government agencies should provide continuous training aimed at strengthening teachers' digital competences and AI integration skills.
 3. Faculties of education and TVET departments should incorporate practical AI literacy modules into staff development initiatives to facilitate effective instructional innovation.
 4. Since demographic variables were not significant predictors of AI awareness or digital competence, AI capacity-building programmes should be designed for all lecturers rather than restricted to particular age groups, genders, or experience levels.
 5. Policymakers should develop national guidelines for responsible and pedagogically sound integration of artificial intelligence technologies into TVET instruction.
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6. Future researchers should investigate other factors that may influence AI awareness and digital competence, such as institutional support, technological infrastructure, self-efficacy, attitudes toward technology, and organizational culture.

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APPENDIX

Research Title: Artificial Intelligence and Digital Competences Among University-Level TVET Teachers in South-East Nigeria.

Section A: Demographic Information

(Please Check [✓] the appropriate option)

1. **Gender**

- ☐ Male
☐ Female

2. **Age**

- ☐ Below 30 years
☐ 30–39 years
☐ 40–49 years
☐ 50 years and above

3. **Years of Teaching Experience**

- ☐ Less than 5 years
☐ 5–10 years
☐ 11–15 years
☐ More than 15 years

Section B: Artificial Intelligence (AI) Awareness Scale

Instructions: Please indicate your level of agreement with each of the following statements using the scale below:

S/N	Statement
1	I am aware of the basic concepts of Artificial Intelligence.
2	I understand how AI can be applied in TVET areas.
3	I have received training or attended seminars/workshops on AI.
4	I can identify real-world applications of AI in skill processes.
5	I am familiar with AI tools such as machine learning or expert systems.
6	I am aware of the ethical implications of AI in education and industry.
7	I actively seek information about developments in AI.
8	My institution encourages the use of emerging technologies like AI.

Section C: Digital Competence Scale

Instructions: Indicate how confident or skilled you are in each of the following digital areas using the scale below:

S/N	Competency Area
1	Using productivity programs (e.g., MS Word, Excel, PowerPoint)
2	Using the internet to search for academic and instructional resources
3	Using e-learning platforms and virtual classrooms (e.g., Zoom, Google Classroom)
4	Applying digital tools to design and deliver lessons
5	Communicating and collaborating online with students or colleagues
6	Creating and editing digital content (documents, presentations, media)

S/N	Competency Area
7	Ensuring data security and ethical use of digital tools
8	Troubleshooting basic hardware/software problems
9	Integrating digital technologies into student assessment and evaluation