DIGITAL COMPETENCIES AND READINESS OF EDUCATORS FOR DEPLOYING ARTIFICIAL INTELLIGENCE TOOLS IN PROCTORING HIGH-STAKES EXAMINATIONS IN COLLEGES OF EDUCATION IN NASARAWA STATE

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Abstract

This study assessed the digital competencies and readiness of educators for deploying artificial intelligence (AI) proctoring tools in two Colleges of Education in Nasarawa state, Nigeria. Guided by the Technological Pedagogical Content Knowledge (TPACK) and DigComp 2.1 frameworks, a mixed-methods design was employed involving 140 participants (academic = 68%, non-academic = 32%). Quantitative data were analyzed using descriptive and inferential statistics, while qualitative data were thematically interpreted. The results revealed generally low levels of digital competence, with mean scores (on a 5-point scale) of 2.45 for technical proficiency, 2.60 for data literacy, 2.85 for pedagogical integration, 2.30 for ethical awareness, and 2.15 for AI readiness. A significant association was found between infrastructural adequacy and digital competence levels ($\chi^2 = 45.23$, df = 4, $p < .001$), indicating that staff in institutions with reliable connectivity and updated hardware performed better across all competence domains. Qualitative findings underscored anxiety, low confidence in AI systems, and demand for contextualized, hands-on training. The study concludes that educators in Nasarawa state Colleges of Education possess only foundational digital skills, with critical gaps in ethical literacy and AI application. It recommends a state-specific digital competence framework, continuous professional development, and investment in infrastructure and AI governance policies to ensure sustainable, ethical, and inclusive technology adoption, advancing Nigeria's progress toward SDG 4 and UNESCO's 2023 Education Transformation Agenda.

Keywords: Digital Competencies, Readiness, Artificial Intelligence, High-Stakes Examinations.

Introduction

Technological innovations are rapidly reshaping education worldwide, with artificial intelligence gaining prominence across pedagogical delivery, learning analytics, and assessment systems (Yin, Zhang, & Chen, 2022). Among these applications, AI-enabled proctoring systems have emerged as a strategic response to examination integrity challenges. These systems deploy algorithms for facial recognition, behavior tracking, keystroke analysis, and environmental scanning to monitor candidates in real time or through recorded sessions (Mokhtar, Ali, & Ahmad, 2021). Their growing adoption reflects global efforts to strengthen quality assurance mechanisms in higher education. For Nigerian institutions seeking alignment with international standards, AI-driven assessment technologies represent both an innovative opportunity and a complex implementation challenge.

In Nigeria, Colleges of Education administer high-stakes examinations that determine teacher certification and professional licensing. The credibility of these examinations directly affects the quality of the nation's teaching workforce. However, examination malpractice, including cheating, impersonation, collusion, and digital misconduct, remains persistent. AI proctoring tools offer advantages such as automation, scalability, continuous monitoring, and digital documentation of irregularities. Yet, their effectiveness depends not only on technological availability but also on institutional readiness and staff digital competence (Mokhtar, Ali, & Ahmad, 2021). Institutional readiness in Nasarawa State Colleges of Education is constrained by infrastructural and human capacity limitations. Studies indicate persistent challenges, including unstable internet connectivity, limited ICT equipment, irregular electricity supply, and inadequate technical support systems (Abubakar, Muktar, & Olayemi, 2022). These constraints undermine the stable digital environment required for AI systems to function effectively. More critically, digital competency gaps among staff pose significant barriers to adoption.

Empirical evidence highlights the depth of this challenge. A UNESCO (2023) report shows that 68% of tertiary educators in sub-Saharan Africa lack adequate digital literacy, and less than 25% have received structured training in emerging educational technologies, including AI-based systems. This means that more than two-thirds of educators operate without the foundational competencies necessary for effective technology integration. At the national regulatory level, a baseline survey by the National Commission for Colleges of Education (NCCE, 2022) revealed that only 31% of College of Education staff in Nasarawa State have reliable access to ICT facilities, while fewer than 20% express confidence in applying AI-related tools for teaching or assessment purposes. These figures demonstrate a significant readiness gap: roughly seven out of ten staff lack dependable ICT access, and four out of five are not confident in using AI tools.

Previous capacity-building initiatives have not sufficiently bridged these gaps. Programmes such as the TETFund ICT Enhancement Programme (2018–2021) and the Digital Teachers Initiative (2020) aimed to strengthen ICT integration in Nigerian tertiary institutions. However, evaluations indicate that many interventions struggled to achieve sustainable impact due to inadequate follow-up mechanisms, limited infrastructural upgrades, and insufficient contextual adaptation (World Bank, 2022). Without sustained investment and structured professional development, digital transformation efforts remain fragmented and short-lived. Beyond infrastructural and training deficits, the adoption of AI proctoring raises ethical and operational concerns. Misapplication can result in false accusations, algorithmic bias, privacy violations, and system failures. In contexts where over 68% of educators lack adequate digital literacy and less than one-quarter have received formal training, the risks of improper deployment are substantial. Limited familiarity with AI concepts, data governance frameworks, and troubleshooting procedures increases vulnerability to misuse and institutional liability.

Globally, frameworks guiding digital transformation emphasize educator preparedness as central to sustainable innovation. UNESCO's Digital Education Action Plan (2022) and subsequent guidance (UNESCO, 2023) stress capacity-building for inclusive and ethical AI

adoption. Similarly, OECD (2021) recommendations underscore equitable technology access and professional development as prerequisites for effective integration. In low- and middle-income contexts, infrastructural inequities continue to hinder innovation efforts (World Bank, 2022). Yet, there remains limited localized empirical evidence on AI-readiness within Nigeria's teacher education institutions, particularly in sub-national contexts such as Nasarawa State.

This study responds directly to these gaps by examining digital competency levels among staff in Nasarawa State Colleges of Education. By interrogating why only 31% have reliable ICT access, why fewer than 20% feel confident using AI tools, and how broader trends such as the 68% digital literacy deficit and less than 25% structured training exposure influence readiness, the research provides critical baseline evidence. It identifies specific infrastructural, training, and policy deficits while proposing context-sensitive capacity-building strategies for ethical AI integration. In doing so, the study contributes to data-driven policymaking and sustainable digital transformation in Nigeria's teacher education sector, positioning Nasarawa State as a potential model for localized, inclusive, and responsible AI adoption in higher education assessment systems.

The Technological Pedagogical Content Knowledge (TPACK) framework developed by Mishra and Koehler (2006) underpins this study, providing a robust conceptual lens for understanding the integration of technology into teaching, learning, and assessment. The TPACK model argues that effective technology use in education emerges from the dynamic intersection of three interrelated knowledge domains. Content Knowledge (CK) refers to mastery of the subject matter to be taught or assessed; Pedagogical Knowledge (PK) involves an understanding of instructional methods, learning processes, and classroom management; and Technological Knowledge (TK) denotes proficiency in using digital tools, software, and systems to enhance educational delivery.

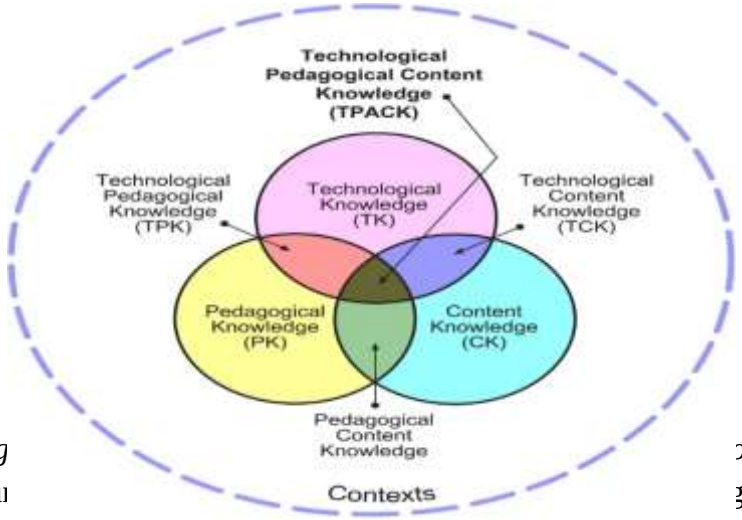

Fig *ɔehler (2006)*

The framework fu *ʒogical Knowledge* (TPK), Technological Content Knowledge (TCK), and Pedagogical Content Knowledge (PCK), which together converge to form the comprehensive TPACK construct. This intersection represents the ideal state where educators seamlessly integrate technology to support meaningful learning experiences. In the context of AI-enabled proctoring, the TPACK

framework is particularly relevant because it emphasizes that educators must not only understand AI systems and their operational mechanisms (TK) but also know how to align these technologies with sound pedagogical principles (PK) and maintain content validity and fairness (CK). By applying this framework, the study identifies areas of digital competency deficiency and informs structured professional development strategies for effective, ethical, and context-sensitive AI adoption in assessment environments.

Digital competence extends far beyond basic ICT literacy, representing a multifaceted set of skills, knowledge, and attitudes necessary for effective participation in today's digital society. According to Ferrari (2012), digital competence encompasses five key domains: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving. These competencies collectively empower individuals to engage critically and responsibly with digital technologies in both professional and personal contexts. The European Digital Competence Framework for Citizens (DigComp 2.1), developed by Carretero, Vuorikari, and Punie (2017), provides a structured taxonomy for assessing digital proficiency across eight proficiency levels. It offers a comprehensive model that helps policymakers, educators, and institutions design targeted capacity-building programs. Within educational settings, Angeli and Valanides (2020) emphasize that digital competence enables educators not only to use technology effectively but also to integrate it pedagogically, ethically, and inclusively. In the context of this study, digital competence is viewed as a foundational requirement for the successful adoption of AI-enabled proctoring systems. Educators must demonstrate not only technical proficiency but also digital ethics, adaptability, and critical judgment to ensure that AI tools are deployed in ways that uphold fairness, data protection, and educational integrity in assessment environments.

Artificial Intelligence (AI) proctoring represents a transformative innovation in digital assessment, leveraging advanced algorithms to monitor, detect, and mitigate examination malpractice in online and blended learning environments. These systems integrate technologies such as computer vision, pattern recognition, keystroke dynamics, gaze tracking, and audio/video analytics to ensure that examinations are conducted under secure and standardized conditions (Rao, Singh, & Yadav, 2021). Through continuous surveillance and intelligent behavior analysis, AI proctoring tools can automatically identify anomalies or suspicious behaviors, such as looking away repeatedly, multiple voices in the background, or the use of unauthorized devices, and flag them for human review (Zhou, Yang, & Sun, 2023).

Core features typically include identity verification, which authenticates examinees using facial recognition or biometric data; environment scanning, which checks for prohibited materials or additional persons in the room; and blind-spot detection, designed to minimize cheating through camera angle monitoring. Additionally, automated flagging systems apply machine learning models to categorize behaviors as low, medium, or high risk, enabling efficient post-exam audits (Bennett, Maton, & Kervin, 2022). These features enhance both efficiency and objectivity, reducing the dependence on human invigilators while allowing large-scale assessments to be conducted simultaneously across different locations. From an institutional perspective, AI proctoring offers numerous advantages including cost savings, scalability, and

flexibility, particularly for open and distance learning systems such as the National Open University of Nigeria. It minimizes logistical challenges related to physical exam centers, supports inclusive access for remote learners, and upholds examination integrity even in decentralized learning environments.

However, the adoption of AI proctoring is not without challenges. Ethical concerns surrounding privacy, data security, algorithmic bias, and student anxiety remain critical. Inadequate internet connectivity, camera quality, and inconsistent lighting conditions can also affect system reliability, especially in contexts like Nasarawa State, where digital infrastructure varies widely. Moreover, the interpretation of AI-generated flags requires careful human moderation to avoid false accusations. Thus, while AI proctoring provides a promising pathway toward more credible, flexible, and scalable assessment systems, its success depends on institutional readiness, digital competence of educators and students, and the development of clear policies that balance technological efficiency with fairness, transparency, and respect for learner dignity.

AI proctoring, despite its potential to enhance examination integrity, raises significant ethical, privacy, and surveillance concerns that must be critically addressed to ensure fairness and acceptance. One major issue is the invasiveness of constant digital surveillance, where students are continuously monitored through webcams and microphones. Such scrutiny can generate discomfort, anxiety, and feelings of mistrust, especially when data handling policies are unclear or consent mechanisms are weak (Cohen, Manion, & Morrison, 2021). A particularly troubling aspect is algorithmic bias in facial recognition systems. Research has shown that these algorithms often perform with lower accuracy for individuals from darker-skinned or underrepresented ethnic groups, leading to disproportionate misidentifications and false flags (Buolamwini & Gebru, 2018). In a diverse context such as Nigeria, this poses a serious equity challenge, potentially reinforcing digital marginalization among students of different ethnic and socioeconomic backgrounds.

Technical limitations also compound these ethical risks. Poor lighting conditions, unstable internet connectivity, or low-quality webcams can cause false positives, where innocent behaviors are mistakenly flagged as cheating (Yin et al., 2022). Such errors may undermine trust in assessment processes and erode confidence in AI systems. Furthermore, students often resist AI-based monitoring, particularly when there is no transparency about how data are collected, stored, or reviewed, and when institutions lack clear appeals or redress mechanisms. Without transparent communication, participatory design, and ethical safeguards, AI proctoring may unintentionally compromise students' rights and well-being, rather than strengthening academic integrity.

Digital competency among educators in Nigeria remains uneven and, in many cases, insufficient for the demands of contemporary technology-enhanced learning and assessment. Studies indicate that while most teachers possess basic ICT literacy, such as the ability to use word processors, spreadsheets, and presentation tools, few demonstrate proficiency in more advanced digital applications or artificial intelligence (AI)-enabled systems (Abubakar et al., 2022; Adebayo & Fadeyibi, 2022; Omodan & Dube, 2021). Teacher training programmes in

many colleges of education and universities still emphasize the use of productivity software rather than fostering skills in digital pedagogy, data-driven instruction, or ethical use of emerging technologies. This limited focus contributes to a persistent gap between policy aspirations and classroom realities (Eze, 2020).

In Nasarawa State, these challenges are further compounded by infrastructural and contextual barriers. Many institutions still grapple with inconsistent electricity supply, inadequate internet connectivity, and limited access to updated computer laboratories or digital devices (Nwankwo & Akintola, 2021). Such deficiencies restrict both staff and students from engaging meaningfully with e-learning platforms, online assessments, or AI-assisted proctoring systems. In particular, the disparity between urban and rural campuses widens digital inequality, as educators in less connected areas often lack both the tools and the institutional support necessary for developing digital fluency (Iloanusi, 2022).

Moreover, the professional development opportunities available to lecturers and administrative staff in Nasarawa State Colleges of Education are often sporadic and insufficiently aligned with technological innovation. Most workshops remain theoretical, focusing on general ICT awareness rather than on the pedagogical and ethical dimensions of digital competence (Okeke & Ofoha, 2021). This results in educators who may know *about* technology but struggle to integrate it meaningfully into instruction, assessment, or administrative operations.

Addressing these gaps requires a holistic capacity-building approach, integrating the TPACK framework to develop balanced proficiency across technical, pedagogical, and ethical domains. TPACK emphasizes not just the mastery of technology (TK), but also its alignment with pedagogical strategies (PK) and subject content (CK) (Mishra & Koehler, 2006). Embedding TPACK-informed training within Nasarawa State's teacher development programmes can foster deeper, contextually relevant digital competence. Without such integrated and sustained interventions, the promise of AI-driven education and assessment innovations will remain out of reach for many Nigerian educators, perpetuating digital exclusion and limiting the transformative potential of educational technology.

Objectives of the Study

The overarching aim is to assess digital competencies for deploying AI proctoring tools in Colleges of Education in Northwest Nigeria. The specific objectives are:

1. To evaluate the existing levels of digital competencies and gaps among educators and administrators relevant to AI proctoring.
2. To examine the influence of institutional infrastructure on staff competencies and readiness.
3. To elicit the training needs and perception of staff with respect to AI tool deployment in proctoring high-stakes examinations.

Research Questions

1. What are the existing levels of digital competencies among staff in Colleges of Education in Nasarawa State?
2. How does the adequacy of institutional infrastructure influence staff digital competence and readiness for AI proctoring?

3. What are the expressed training needs, perceptions, and attitudes of educators toward AI-enabled proctoring systems in assessment?

Hypothesis

The following hypothesis was tested at 0.05 level of significance:

H_0 1: There is no significant relationship between institutional infrastructure adequacy and the digital competence levels of educators in Colleges of Education in Nasarawa State.

Methodology

This study adopted a mixed-methods research design, integrating both quantitative and qualitative approaches to ensure comprehensive analysis and triangulation of findings. The study focused on the two Colleges of Education in Nasarawa State, Nasarawa State College of Education, Akwanga, and Federal College of Education, Keana, representing the two major categories of ownership (state and federal). This dual focus allowed for comparison of institutional readiness, infrastructural support, and digital competence within different governance structures. The target population comprised both academic and administrative (non-academic) staff in the two Colleges of Education. Using a stratified random sampling technique, participants were selected to ensure representation across departments and roles. A total of 140 respondents were drawn (70 per college), consisting of 50 academic staff and 20 non-academic staff from each institution.

The study utilized two main instruments: a Structured Questionnaire (SQ) and an In-Depth Interview Guide. The questionnaire contained Likert-scale items assessing technical proficiency, data literacy, pedagogical integration, ethical awareness, infrastructural support, and readiness for AI deployment. The interview guide included semi-structured questions exploring perceptions, infrastructural challenges, motivational factors, ethical concerns, and preferred models of AI training and support. Three experts in educational technology and measurement validated the instruments for face and content validity. A pilot test was conducted in an institution outside the main study area to refine the tools. Reliability was determined using Cronbach's alpha, with $\alpha \geq 0.75$ considered acceptable for internal consistency. Quantitative data were processed using SPSS version 20, and descriptive statistics (mean, standard deviation, and frequency) were used to summarize digital competence levels. Chi-square tests examined associations between variables such as infrastructure, competence, and training needs. Qualitative data, obtained from interviews, were transcribed and analyzed thematically using NVivo, identifying recurring patterns and narratives related to digital readiness, institutional barriers, and policy implications for AI integration in assessment. Ethical approval was obtained from the relevant institutional review boards of both Colleges of Education. Participants were informed of the study's objectives, confidentiality protocols, and their right to withdraw at any time. Informed consent was secured before data collection, and all responses were anonymized to ensure privacy and compliance with research ethics standards.

Results

Research Question 1: What are the existing levels of digital competencies among staff in Colleges of Education in Nasarawa State?

Table 1: Level of Digital Competencies

Competency Domain	Mean Score	Interpretation
Technical Proficiency	2.45	Low
Data Literacy	2.60	Low to Moderate
Pedagogical Integration	2.85	Moderate
Ethical & Privacy Awareness	2.30	Low
AI Readiness	2.15	Very Low

The findings in table 1 carry significant policy, institutional, and professional implications for AI integration in Colleges of Education. The low mean scores in ethical and privacy awareness (M = 2.30) and AI readiness (M = 2.15) suggest that educators are insufficiently prepared to address critical concerns such as data protection, algorithmic bias, informed consent, and accountability in AI-driven assessments. Without targeted intervention, deploying AI proctoring systems under these conditions could expose institutions to ethical violations, reputational risks, and legal liabilities.

Similarly, below-threshold scores in technical proficiency (M = 2.45) and data literacy (M = 2.60) imply limited capacity to manage digital platforms, interpret system-generated analytics, or troubleshoot technical disruptions. This undermines the reliability and effectiveness of AI-supported examinations. Although pedagogical integration recorded a relatively higher mean (M = 2.85), its moderate level indicates that digital tools are used more for instruction than for assessment innovation. Collectively, these disparities underscore the urgent need for structured capacity-building programmes, infrastructure upgrades, and institutional policies that prioritize ethical competence, technical mastery, and AI-specific professional development before large-scale implementation.

Research Question 2: How does the adequacy of institutional infrastructure influence staff digital competence and readiness for AI proctoring?

Table 2: Institutional infrastructure, staff digital competence and readiness for AI proctoring

Competence Domain	Adequate Infrastructure (n = 55)	Inadequate Infrastructure (n = 85)	Mean Difference
Technical Proficiency	M = 3.05, SD = 0.62	M = 2.25, SD = 0.74	0.80
Data Literacy	M = 3.00, SD = 0.58	M = 2.50, SD = 0.70	0.50
Pedagogical Integration	M = 3.20, SD = 0.60	M = 2.70, SD = 0.68	0.50

Competence Domain	Adequate Infrastructure (n = 55)	Inadequate Infrastructure (n = 85)	Mean Difference
Ethical & Privacy Awareness	M = 2.75, SD = 0.64	M = 2.15, SD = 0.70	0.60
AI Readiness	M = 2.85, SD = 0.66	M = 2.05, SD = 0.72	0.80

Table 2 shows how the adequacy of institutional infrastructure influences staff digital competence and readiness for AI proctoring. The descriptive results reveal that institutional infrastructure plays a crucial role in shaping staff digital competence and readiness for AI-proctored examinations. Respondents from colleges with adequate infrastructure, such as stable internet, modern computer laboratories, and ICT support units, recorded higher mean scores across all competence domains. The largest mean differences were observed in technical proficiency ($\Delta M = 0.80$) and AI readiness ($\Delta M = 0.80$), suggesting that reliable facilities directly enhance educators' capacity to use and trust AI systems. Similarly, ethical and privacy awareness improved in well-equipped settings (M = 2.75 vs. 2.15), reflecting that infrastructure not only supports skill development but also reinforces responsible technology use. Infrastructure adequacy aligns positively with staff digital readiness and pedagogical innovation.

Research Question 3: What are the expressed training needs, perceptions, and attitudes of educators toward AI-enabled proctoring systems in assessment?

The qualitative analysis of interview data generated three dominant and interrelated themes reflecting educators' perceptions, fears, and expectations regarding the adoption of AI-driven proctoring systems in Nasarawa State Colleges of Education.

Theme A: Anxiety and Lack of Confidence – Many respondents expressed deep apprehension about the reliability, transparency, and fairness of AI proctoring tools. Concerns centered on potential system malfunctions, false flags, and the risk of penalizing innocent students. One lecturer stated, "I would worry about false accusations if the AI flags an innocent student—what recourse would I have?" Such fears reveal limited knowledge of AI ethics, data governance, and appeal mechanisms, highlighting the urgent need for institutional frameworks that guarantee fairness, transparency, and accountability in AI-based assessment.

Theme B: Desire for Hands-On, Contextual Training – Participants consistently emphasized the importance of experiential, context-sensitive learning approaches. They preferred demonstration-based and simulation-driven capacity development rather than theoretical workshops. Simulation exercises, peer mentoring, and real-time proctoring trials were considered essential for fostering confidence, practical understanding, and skill transfer. This

reinforces the importance of adopting UNESCO's competency-based, participatory training models for digital capacity building.

Theme C: Institutional Support and Policy Frameworks – Respondents noted that individual competence alone cannot sustain technological innovation. Sustainable AI integration requires clear institutional policies, dedicated technical support units, and budgetary commitments for system maintenance and periodic upgrades. Without these systemic enablers, participants warned, AI initiatives may replicate the failures of previous ICT reforms in Nasarawa State—short-lived, underfunded, and poorly institutionalized.

Hypothesis (Ho): There is no significant relationship between institutional infrastructure adequacy and the digital competence levels of educators in Colleges of Education in Nasarawa State.

Table 3: Relationship Between Infrastructure Adequacy and Staff Digital Competence

Variable	χ^2 Value	df	p-value	Relationship Description
Infrastructure Adequacy vs Digital Competence	45.23	4	< .001	Significant

Table 3 shows relationship between infrastructure adequacy and staff digital competence. A Chi-square test revealed a statistically significant relationship between infrastructure adequacy and digital competence levels ($\chi^2 = 45.23$, df = 4, $p < .001$). Staff in institutions with stable internet connectivity and modern hardware scored higher on all competency dimensions. This finding indicates that access to robust infrastructure directly influences the capacity of educators to engage with AI tools and maintain digital confidence. The result also suggests that infrastructural equity is critical for achieving sustainable digital transformation in the education sector.

Discussion of Findings

The findings of this study highlight significant gaps in digital competence and infrastructural readiness among educators in the two Colleges of Education in Nasarawa State, reflecting broader challenges within Nigeria's teacher education ecosystem. The results reveal that while staff exhibit moderate proficiency in pedagogical integration, their AI readiness and ethical awareness remain critically low. This aligns with recent studies across sub-Saharan Africa showing that most educators possess basic digital literacy but lack advanced skills for integrating emerging technologies like artificial intelligence into assessment or instructional systems (Adebayo & Fadeyibi, 2022; UNESCO, 2023).

According to the UNESCO 2023 Global Education Monitoring (GEM) Report, teacher readiness is a determining factor in successful digital transformation. Teachers must not only know *how* to use technology but must also understand its pedagogical and ethical implications. The low mean scores for ethical awareness and AI readiness in this study thus point to a significant capacity gap that extends beyond ICT literacy. It suggests that educators require a more holistic competence framework, one encompassing digital ethics, data privacy, and critical understanding of algorithmic decision-making. The TPACK model provides a suitable theoretical lens for this interpretation. Effective integration of AI in education demands a

balanced synergy of technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK) (Mishra & Koehler, 2006). However, the present study demonstrates that this synergy is underdeveloped among educators in Nasarawa State. The low scores on technical and ethical dimensions suggest that most teachers are operating at the level of isolated technological knowledge, without integrating it meaningfully into pedagogical and content domains.

Infrastructure remains a major determinant of competence. The significant relationship found between infrastructure adequacy and digital competence ($\chi^2 = 45.23$, $p < .001$) supports prior research showing that poor connectivity and outdated hardware constrain digital learning innovation (OECD, 2021; World Bank, 2022). In Nasarawa State, erratic electricity, limited internet bandwidth, and obsolete computers undermine attempts to modernize examinations. This explains the failure of previous ICT enhancement programmes such as the TETFund ICT Training Initiative and the Digital Teachers Programme, which, despite good intentions, lacked contextual adaptation, continuity, and reliable infrastructural foundations.

Another notable finding is the psychological and institutional resistance observed among educators. Fear of system malfunction, mistrust of AI-based decision systems, and lack of clarity about grievance redress mechanisms mirror global concerns about AI surveillance and privacy (Buolamwini & Gebru, 2018; Yin et al., 2022). The OECD (2021) AI Principles for Education underscore that algorithmic tools must operate with transparency, accountability, and user empowerment. However, such principles are yet to be fully domesticated in Nigeria's tertiary education policy frameworks. The preference for hands-on, contextualized training underscores that sustainable competence development cannot be achieved through short-term workshops or lectures. UNESCO (2022) advocates for competency-based professional development models that emphasize experiential learning, mentoring, and peer support. Participants' emphasis on simulation-based, collaborative learning reflects a readiness for transformation if systemic and policy support is provided.

Conclusion

The study concludes that while Nasarawa State Colleges of Education have initiated digital transformation efforts, digital competence gaps, infrastructural weaknesses, and ethical uncertainties threaten the sustainable adoption of AI proctoring systems. A strategic blend of capacity building, infrastructural investment, ethical governance, and contextual policy innovation can position Nigeria's teacher education sector to harness AI for transparent, inclusive, and high-quality assessments, aligning with SDG 4 and the UNESCO 2023 Education Transformation Agenda.

Recommendations

In view of the findings, the following recommendations are made:

1. The Nasarawa State Ministry of Education, in collaboration with TETFund and NCCE, should adopt a localized digital competence framework aligned with UNESCO's ICT Competency Framework for Teachers (ICT-CFT, 2018) and the EU DigCompEdu model. This framework should define progressive digital skills benchmarks, from basic

ICT literacy to advanced AI competence, tailored to the realities of Colleges of Education.

2. Periodic and practical Continuous Professional Development (CPD) programmes focusing on AI awareness, data privacy, algorithmic bias, and ethical assessment practices should be mandatory. Training should include hands-on laboratory sessions, simulation exercises, and guided system testing. Incentivizing certification in digital pedagogy (e.g., through salary advancement or promotion credits) will strengthen motivation and accountability.
3. Sustainable AI proctoring depends on reliable internet, stable electricity, and secure hardware systems. The study recommends that Colleges of Education in Nasarawa State partner with private technology providers and the Universal Service Provision Fund (USPF) to upgrade connectivity and establish dedicated ICT support units with AI expertise.
4. Each institution should develop clear AI usage policies, covering privacy, surveillance, consent, and redress mechanisms. This aligns with global standards such as the OECD AI Principles (2021) and the UNESCO Recommendation on the Ethics of Artificial Intelligence (2021). Transparent policy frameworks can mitigate mistrust and enhance staff and student confidence in AI-based systems.
5. The National Commission for Colleges of Education (NCCE) should revise the Minimum Standards for Teacher Education to include AI literacy, digital ethics, and data analytics as core components. Embedding these modules will ensure that future educators are prepared for the digital realities of assessment and instruction.

References

Abubakar, A., Muktar, M., & Olayemi, O. (2022). Challenges and opportunities of implementing digital tools in higher education: Perspectives from Northwest Nigeria. *Journal of Educational Technology, 14*(3), 215–228.

Mokhtar, M., Ali, S., & Ahmad, R. (2021). *AI-based remote proctoring in higher education: Ethics, challenges, and opportunities.* Computers & Education, 172, 104–250.

OECD. (2021). *Digital education outlook 2021: Teaching, learning, and assessment.* OECD Publishing.

UNESCO. (2022). *Digital learning strategy 2022–2025.* Paris: UNESCO.

Abubakar, M. A., Yusuf, M., & Umar, S. (2022). Teachers' digital skills and technology adoption in Nigerian higher education institutions. *Journal of Education and e-Learning Research,* 9(2), 123–132.

Adebayo, F., & Fadeyibi, O. (2022). *ICT integration and teacher competency development in Nigerian colleges of education.* African Journal of Teacher Education, 11(1), 45–60.

Ali, A. F., Mokhtar, A. A., & Ahmad, F. (2022). AI in proctoring online examinations: An analysis of effectiveness and challenges. *Journal of Educational Computing Research, 60*(1), 58–73. https://doi.org/10.1177/07356331211019395

Aliyu, M. T., & Musa, I. (2023). *Institutional readiness for AI-based assessment systems in Colleges of Education in Northern Nigeria.* Nigerian Journal of ICT and Education, 7(1),77–94.

Angeli, C., & Valanides, N. (2020). TPACK in teacher education: Insights from a systematic review. *Education and Information Technologies, 25*(3), 1207–1231. https://doi.org/10.1007/s10639-019-09914-8

Bennett, S., Maton, K., & Kervin, L. (2022). The 'digital natives' debate in education: A critical review of the evidence. *British Journal of Educational Technology, 53*(1), 18–30. https://doi.org/10.1111/bjet.13053

Buchanan, E. A., Ess, C., & Finn, R. (2022). Data ethics in the age of artificial intelligence: A critical overview. *Ethics and Information Technology, 24*(3), 321–332. https://doi.org/10.1007/s10676-022-09616-2

Buolamwini, J., & Gebru, T. (2018). Gender shades: Intersectional accuracy disparities in commercial gender classification. In *Proceedings of the 1st Conference on Fairness, Accountability, and Transparency* (pp. 81–93). https://doi.org/10.1145/3287560.3287598

Carretero, S., Vuorikari, R., & Punie, Y. (2017). *DigComp 2.1: The Digital Competence Framework for Citizens*. European Commission. https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research reports/digcomp-21-digital-competence-framework-citizens-update-policies

Chai, C. S., Koh, J. H. L., & Tsai, C. C. (2019). A review of technological pedagogical content knowledge (TPACK) research in the field of education: Trends and future directions. *Educational Technology & Society, 22*(1), 7–17.

Cohen, L., Manion, L., & Morrison, K. (2021). *Research Methods in Education* (8th ed.). Routledge.

Eze, S. C. (2020). *Digital literacy and instructional delivery in tertiary institutions in Nigeria.* Nigerian Journal of Educational Technology, 6(2), 89–103.

Ferrari, A. (2012). Digital competence in the 21st century: A new approach. European Commission. https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research reports/digital-competence-21st-century-new-approach

Ibrahim, S. (2022). *Assessing the impact of ICT enhancement programs in teacher education in Nasarawa State.* International Journal of Digital Education, 5(2), 33–48.

Iloanusi, C. (2022). *Bridging the digital divide: Infrastructure and teacher readiness in Northern Nigeria.* International Journal of Digital Learning, 3(4), 56–70.

Koehler, M. J., & Mishra, P. (2017). What Is technological pedagogical content knowledge (TPACK)? In *The Cambridge Handbook of Computing Education Research* (pp. 51–66). Cambridge University Press. https://doi.org/10.1017/9781316821830.005

Mishra, P., & Koehler, M. J. (2006). *Technological pedagogical content knowledge: A framework for integrating technology in teacher knowledge.* Teachers College Record, 108(6), 1017 1054.

Mokhtar, A. A., Ali, A. F., & Ahmad, F. (2021). AI-based proctoring systems for online examinations: A review of challenges and future directions. *Journal of Educational Computing Research, 59*(4), 642–661. https://doi.org/10.1177/07356331211031610

Nwankwo, P. A., & Akintola, A. (2021). *Challenges of ICT infrastructure in Nigerian tertiary institutions: A regional analysis.* Journal of Education and Development Studies, 4(3), 22–35.

OECD. (2019). *Teaching and learning international survey (TALIS) 2018 results: Teachers and school leaders as lifelong learners (Vol. 1).* OECD Publishing. https://doi.org/10.1787/1d0bc92a-en

OECD. (2021). *OECD principles on artificial intelligence.* OECD Publishing. https://doi.org/10.1787/620f437d-en

Okebukola, P. (2021). *Reinventing teacher education in Africa through ICT-driven pedagogy.* University of Lagos Press.

Okeke, C., & Ofoha, D. (2021). *Teacher professional development and ICT utilization in colleges of education in Nigeria.* International Review of Education, 67(5), 601–620. https://doi.org/10.1007/s11159-021-09912-3

Omodan, B. I., & Dube, B. (2021). *Digitizing higher education in post-COVID Nigeria: The realities of lecturers' competencies and institutional readiness.* Journal of Learning for Development, 8(3), 490–503.

Rao, S., Singh, S., & Yadav, R. (2021). Examining the role of AI in online examination proctoring: Issues and future perspectives. *International Journal of Educational Technology in Higher Education, 18*(1), Article 12. https://doi.org/10.1186/s41239-021 00245-5

Santos, A., Ferreira, M. M., & Da Silva, C. (2020). The role of digital competencies in the implementation of AI tools in education: A systematic review. *Education and Information Technologies, 25*(4), 3261–3282. https://doi.org/10.1007/s10639-020-10392-8

UNESCO. (2018). *ICT competency framework for teachers (Version 3).* UNESCO.

UNESCO. (2022). *Reimagining our futures together: A new social contract for education.* UNESCO Publishing.

UNESCO. (2023). *Global education monitoring report 2023: Technology in education – A tool on whose terms?* UNESCO Publishing.

Voogt, J., Fisser, P., Pareja Roblin, N., Tondeur, J., & van Braak, J. (2015). *Technological pedagogical content knowledge—a review of the literature.* Journal of Computer Assisted Learning, 31(4), 401–417.

World Bank. (2022). *Reimagining digital education in Africa.* Washington, DC: World Bank.

Yin, J., Zhang, Z., & Chen, Y. (2022). The impact of AI technology on educational assessment: A review and future directions. *Journal of Computer Assisted Learning, 38*(1),

57–72. https://doi.org/10.1111/jcal.12610

Zhou, W., Yang, Y., & Sun, Q. (2023). Challenges and opportunities of AI proctoring in high stakes examinations: A systematic review. *Education and Information Technologies, 28*(3), 355–370. https://doi.org/10.1007/s10639-023-11115-7