International Journal of Theory and Application in Elementary and Secondary School Education (IJTAESE)
Vol. 08 No. 02 (2025) https://doi.org/10.33830/ijtaese.v7i02.13564

Check for updates

Research Paper

Teacher Competency in Employing AI Tools for Content Development: A Cross-Country Quantitative Comparison

Jamiu Temitope Sulaimon [1*], Moses Adeleke Adeoye [2], Joab Namai[3]

[1] Department of Adult and Primary Education, Faculty of Education
University of Ilorin, Nigeria.
[2] Department of Educational Management and Counseling, Faculty of Education Al-Hikmah
University Ilorin, Nigeria.
[3] Department of Education, Daystar University, Kenya.

Corresponding authors: Sulaimonjamiu7991@gmail.com

Received:03 July 2025	Revised: 30 August 2025	Accepted:16 October 2025	Online:24 October 2025

Abstract
AI is reshaping instructional design and delivery in education. As teachers increasingly rely on AI tools to create educational materials, their competence in using these tools becomes crucial. Yet empirical evidence on teacher competence in AI-based content creation, especially in African contexts, is sparse. This study examines and compares teacher competence in AI tool use for educational content creation in Nigeria and Kenya. This study examines and compares elementary school teachers' competence in using AI tools for educational content creation in Nigeria and Kenya through a comparative quantitative survey design. The target sample was 300 teachers (150 from each country), selected using stratified random sampling across urban and rural districts to ensure representativeness. Of these, 228 valid responses were retrieved (Nigeria = 114; Kenya = 114), providing a balanced dataset for cross-country comparison. Data were collected using a validated competence inventory measuring dimensions such as tool selection, adaptation, content personalization, and troubleshooting. Mean competence levels and independent-samples t-tests were used to assess overall competence and country differences. Results showed that teachers in both countries exhibited relatively high competence (Nigeria: M = 3.05, SD = 0.65; Kenya: M = 3.00, SD = 0.70). The independent samples t-test revealed t (226) = 0.87, p = 0.38, indicating no significant difference between countries. Domain-level comparisons likewise showed similar patterns across selection, adaptation, and troubleshooting competencies. These findings provide comparative evidence from Africa on teacher competence in AI-assisted content development. The study highlights the importance of inclusive, context-sensitive professional development to support equitable AI integration in elementary education.

Keywords: *Artificial Intelligence in Education; Teacher Competence; Educational Content Creation; Elementary School Teachers*

INTRODUCTION

Artificial Intelligence (AI) has moved beyond being a general digital innovation to becoming a practical tool in education, particularly for creating and personalizing instructional content. Its adoption enables teachers to generate materials, adapt lessons to diverse learning needs, and improve instructional delivery (Tapalova & Zhiyenbayeva, 2022). However, the effective use of these tools depends largely on teachers' competence, their ability to select, adapt, and integrate AI applications into pedagogy. This competence is especially critical for elementary school teachers, whose practices shape foundational learning experiences and determine how effectively AI can contribute to equitable and engaging education. From intelligent tutoring systems to automated grading and adaptive learning platforms, these technologies are increasingly influencing how educators engage learners and facilitate knowledge acquisition (Strielkowski et al., 2025). For elementary school teachers, whose pedagogical role is critical in shaping foundational learning

experiences, the effective use of AI tools holds significant promise. The integration of AI in early education can foster more interactive and engaging content, cater to diverse learning needs, and support differentiated instruction (Sundari et al., 2024). However, the successful adoption of AI in classrooms depends largely on teachers' competence not only in operating such tools but also in understanding their pedagogical applications. Stumbrienė et al. (2024) observe that teacher capacity remains one of the most important determinants of how technology transforms learning outcomes.

In many parts of Africa, including Nigeria and Kenya, education systems remain at uneven stages of technology integration. National initiatives such as Kenya's Digital Literacy Programme and Nigeria's National Digital Economy Policy have expanded access to digital tools, but persistent disparities in infrastructure, training, and teacher readiness continue to constrain impact (Kerkhoff & Makubuya, 2022; Upadhyaya, 2024). According to UNESCO, fewer than 40% of primary school teachers in sub-Saharan Africa have received formal training in ICT integration (Cappelli & Akkari, 2025), while the World Bank reports that only about 35% of schools in low-income African countries have reliable internet connectivity (Faturoti, 2022). In Nigeria, the Universal Basic Education Commission noted that less than half of public primary schools are equipped with functional ICT facilities (Oladele, 2018), while in Kenya, recent evaluations of the Digital Literacy Programme revealed gaps in sustained teacher capacity-building despite widespread device distribution (Kinoti, 2024). These figures highlight that access initiatives alone are insufficient; the effectiveness of AI integration in classrooms ultimately depends on teachers' competence to adapt and apply these tools in pedagogically meaningful ways.

Research indicates that teachers' limited competence with emerging technologies often hinders effective classroom implementation, particularly in resource-constrained contexts (Okai-Ugbaje et al., 2022; Rwodzi & De Jager, 2021). This challenge is even more pronounced with Artificial Intelligence, which represents a newer and more complex dimension of educational technology. For elementary school teachers, competence in AI use is not limited to operating digital tools but extends to evaluating AI-generated content, adapting materials to diverse learners, and addressing ethical concerns such as bias and data privacy (Zou et al., 2025). Unlike general ICT integration, effective AI adoption demands multidimensional competence—technical, pedagogical, and ethical. Moreover, prior studies show that demographic and professional factors such as gender, years of teaching experience, and educational qualifications significantly shape technology adoption patterns (Tondeur et al., 2019). These dynamics underscore the importance of examining teachers' AI competence specifically, rather than digital competence more broadly, to understand their readiness to leverage AI for educational content creation.

Despite the growing global discourse on AI in education, empirical evidence on teacher competence in African contexts remains sparse, and comparative investigations across countries are particularly limited. Existing studies often examine general ICT integration, leaving underexplored the specific dimensions of competence required for AI use, namely, teachers' knowledge of AI applications, their practical skills in adapting AI-generated content, and their attitudes toward ethical and pedagogical implications. To the authors' knowledge, few empirical comparative studies have examined elementary teachers' competence in using AI for educational content creation in Nigeria and Kenya, particularly across gender, experience, and resource disparities. Focusing on elementary school teachers provides a unique contribution because their practices shape foundational learning experiences and determine whether AI integration supports equity from the earliest stages of schooling. By addressing this gap, the present study advances understanding of how teachers in these two countries are equipped to leverage AI tools for content creation, and which contextual and demographic variables influence their competence levels.

Statement of the problem

Although Artificial Intelligence (AI) is increasingly recognised for its potential to transform teaching and learning, little is known about how elementary school teachers in sub-Saharan Africa are prepared to use AI for educational content creation. Existing research has largely examined general ICT integration, leaving unanswered questions about teachers' competence in the distinct dimensions of AI use: technical operation, pedagogical integration, and ethical awareness. In

contexts such as Nigeria and Kenya, where governments have invested in digital literacy initiatives, but persistent disparities remain in training and infrastructure, it is not clear whether teachers possess the competence needed to translate AI's promise into classroom practice. For elementary school teachers, whose role is foundational to children's academic and cognitive development, the effective use of AI tools offers opportunities to personalise instruction, foster engagement, and adapt to diverse learner needs (Sundari et al., 2024). Yet evidence shows that teacher readiness remains limited: UNESCO reports that fewer than 40% of primary teachers in sub-Saharan Africa have received formal ICT training (von Lautz-Cauzanet, 2017), while studies in Nigeria and Kenya highlight persistent gaps in competence. For instance, Oshowole (2024) found that many Nigerian primary teachers still struggle with basic ICT integration, and Njuguna et al. (2025) observed that despite Kenya's Digital Literacy Programme, teacher training coverage remains uneven.

Yet, despite the growing global discourse on AI in education, the preparedness of teachers in developing regions remains insufficiently examined. In particular, there is a lack of comparative empirical studies at the elementary level in Africa, and limited research has measured the different dimensions of AI competence, technical skills, pedagogical integration, and ethical awareness. In contexts such as Nigeria and Kenya, where infrastructural and capacity-related constraints persist, it is therefore critical to establish teachers' actual competence in using AI tools for educational content creation rather than assuming readiness. Previous studies have shown that while AI and related digital innovations hold promise, they are often underutilised in classrooms due to low levels of teacher competence and training (Chirima, 2024; Graham et al., 2020). For instance, Oshowole (2024), using qualitative interviews with Nigerian primary teachers, found that many still struggle with basic ICT integration, raising concerns about their readiness for more advanced AI applications. However, the study did not directly measure AI-specific competence or disaggregate results by demographic factors such as gender or teaching experience. Similarly, Njuguna et al. (2025) examined the impact of Kenya's Digital Literacy Programme through survey data on technology access, but the focus was largely on infrastructure rather than on teachers' pedagogical or ethical competence with AI tools. These limitations highlight the need for empirical, comparative evidence that systematically measures multiple dimensions of AI competence, technical, pedagogical, and ethical, among elementary teachers. By adopting a validated competence inventory and a cross-country design, the present study addresses these gaps and provides a more comprehensive understanding of teacher readiness in Nigeria and Kenya. These findings suggest that infrastructural availability alone does not guarantee competence; what matters most is the ability of teachers to align AI tools with sound pedagogy and ethical considerations (Zou et al., 2025).

Compounding this issue are disparities in competence shaped by demographic and professional factors such as gender, years of teaching experience, and educational qualifications (Tondeur et al., 2019). These variables are not only empirically observed but also theoretically anticipated. The TPACK framework suggests that competence depends on the interplay of technological, pedagogical, and content knowledge, which may vary by teachers' academic preparation. The Technology Acceptance Model (TAM) highlights how perceived usefulness and ease of use can differ across age and gender, influencing willingness to engage with AI tools. Similarly, the Diffusion of Innovation theory emphasises that adoption is uneven, with younger or more digitally literate teachers more likely to act as early adopters while others remain cautious. Linking these perspectives clarifies why demographic and experiential factors are expected to moderate AI competence, making their examination essential for both theory and practice. For example, Fisher et al. (2015) reported that male teachers typically demonstrate greater confidence in experimenting with emerging technologies compared to their female counterparts, while Tarling and Ng'ambi (2016) noted that younger teachers, often described as "digital natives," may be more willing to embrace new tools than older colleagues. However, other scholars argue that once adequate training is provided, such demographic differences diminish significantly (Rwodzi & De Jager, 2021). This mixed evidence highlights a critical gap in understanding how contextual and personal variables intersect to shape teacher competence in AI utilisation within African classrooms. Although global research increasingly points to the transformative role of AI in education (Strielkowski et al., 2025), empirical investigations in Africa remain scarce, particularly comparative studies between countries such as Nigeria and Kenya. Both nations face similar socio-economic challenges but differ in policy frameworks and infrastructural readiness. This raises important but unanswered questions: Are elementary school teachers in these countries equally

prepared to harness AI tools for content creation? How do factors such as gender, teaching experience, and qualifications influence their competence levels? Without such insights, policy interventions and teacher training programmes risk being generic, overlooking context-specific realities.

This study addresses the lack of empirical evidence on elementary school teachers' competence in using AI tools for educational content creation in Nigeria and Kenya. It contributes by providing comparative data disaggregated by gender, teaching experience, and qualifications, while examining distinct dimensions of competence, technical skills, pedagogical integration, and ethical awareness. By filling this gap, the study offers evidence to inform targeted teacher training and guide digital education policies aimed at translating the promise of AI into meaningful learning outcomes in elementary education.

LITERATURE REVIEW

Conceptual Clarifications

Artificial Intelligence (AI) is increasingly recognised not only as a technological innovation but as a component of teachers' professional competence in the digital era. Rather than focusing on technical definitions, recent scholarship situates AI within broader frameworks of teacher professionalism, where competence encompasses the ability to integrate technology meaningfully into pedagogy, adapt content to learners, and manage ethical implications of digital tools (Zhang & Tian, 2025; Zou et al., 2025). Within this perspective, AI competence is best understood as an extension of existing models of teacher knowledge, such as Technological Pedagogical Content Knowledge (TPACK), which emphasises the intersection of technology, pedagogy, and content, and is shaped by adoption factors identified in the Technology Acceptance Model (TAM) and Diffusion of Innovation theory. Framing AI competence in this way highlights its relevance to teacher effectiveness and underscores why its assessment must go beyond simple technical skills to include pedagogical integration and ethical awareness. Within the field of education, AI tools are increasingly used to support teaching and learning processes, particularly through the creation of digital learning resources. Examples include intelligent tutoring systems, automated grading software, adaptive learning platforms, and content-generation applications.

For elementary school teachers, whose role is crucial in shaping foundational learning, competence in using AI tools must be understood as a multidimensional construct rather than mere technical know-how. Prior research has conceptualised teacher competence in terms of the ability to evaluate, select, and adapt digital tools in ways that enhance learning outcomes. Zhang and Tian (2025) emphasise that AI competence integrates technical proficiency with pedagogical decision-making and ethical awareness, while Zou et al. (2025) propose a framework distinguishing between operational skills, pedagogical integration strategies, and the capacity to address issues such as bias and data privacy. Within elementary education, this framing is particularly important: teachers must not only generate digital materials but also align them with curriculum goals, differentiate instruction for diverse learners, and critically assess the appropriateness of AI outputs. Positioning competence in this way highlights the gap between descriptive accounts of tool use and the need for systematic assessment of how teachers combine technical, pedagogical, and ethical dimensions in practice. It involves the ability to integrate AI resources into lessons in ways that enhance engagement, foster inclusivity, and address diverse learning needs. Zhang and Tian (2025) argue that teacher competence in AI use is multi-dimensional, involving technical, pedagogical, and ethical skills. Educational content creation with AI represents a growing subfield of educational technology. These tools can help teachers design lesson plans, generate practice exercises, create visual learning aids, and even adapt materials to different learner profiles. However, to achieve such benefits, teachers must possess the competence to evaluate, select, and adapt AI applications appropriately. In this sense, competence is not only about being able to operate a tool but also about aligning its use with sound pedagogical principles.

Theoretical Perspectives

Several theoretical models provide insight into how teachers adopt and use digital

technologies. These frameworks provide the lens through which teachers' competence can be examined, particularly in contexts like Nigeria and Kenya, where infrastructure, training, and policy play significant roles. The Technological Pedagogical Content Knowledge (TPACK) framework offers a useful lens for examining teacher competence with AI because it emphasises the interdependence of technological, pedagogical, and content knowledge. Rather than treating technology skills in isolation, TPACK highlights the need for teachers to integrate AI tools in ways that align with subject matter and instructional strategies. This framework is particularly relevant to the present study as it situates AI competence not simply as tool operation but as the capacity to embed AI-generated content within effective pedagogy. By drawing on TPACK, the study can assess competence across multiple dimensions, thereby moving beyond a narrow focus on technical ability to a more holistic understanding of teachers' readiness for AI integration. Zhang and Zhang (2024) argue that effective teaching with technology necessitates a balanced combination of content knowledge (e.g., literacy and numeracy), pedagogical knowledge (e.g., instructional strategies and classroom management), and technological knowledge (e.g., AI-powered applications and adaptive learning platforms). TPACK stresses that competence in AI use is not limited to knowing how to operate tools. Instead, teachers must integrate AI tools with appropriate pedagogy and subject matter knowledge. For example, an elementary school teacher using an AI tool to generate math practice questions must ensure that the content is accurate (CK), that the questions are aligned with effective instructional strategies (PK), and that the AI tool is used efficiently and ethically (TK).

In this way, TPACK highlights that true competence involves meaningful intersections among all three knowledge domains (Thyssen et al., 2023; Tseng et al., 2022). The Technology Acceptance Model (TAM) complements this study by addressing the behavioural dimension of teacher competence. While TPACK frames the integration of technology in relation to pedagogy and content, TAM explains why teachers may choose to adopt or resist AI tools, emphasising perceptions of usefulness and ease of use (Abulail et al., 2025; Wang et al., 2021). This perspective is critical in contexts like Nigeria and Kenya, where limited infrastructure and training may shape teachers' attitudes toward AI adoption. By incorporating TAM, the study can account for how competence is influenced not only by knowledge and skill but also by teachers' perceptions and willingness to engage with AI tools. In the context of elementary education, TAM suggests that teachers are more likely to adopt AI tools if they find them useful for reducing workload (e.g., automating grading), enhancing lesson delivery (e.g., personalised learning content), or supporting diverse learners (Yadav, 2025). Conversely, if AI tools are perceived as complicated, time-consuming, or misaligned with existing teaching practices, teachers may resist their use regardless of potential benefits. This model is particularly relevant for Nigeria and Kenya, where limited training and infrastructure may influence both perceived ease of use and perceived usefulness, thereby shaping teachers' overall competence.

Rogers' Diffusion of Innovation theory provides an additional lens by highlighting that technology adoption is not uniform but varies across individuals and contexts (Mbatha, 2024). Applied to AI in education, the framework underscores how teachers' demographic and professional characteristics, such as age, experience, and qualifications, can influence their positioning as early or late adopters. For this study, DOI helps to explain potential disparities in AI competence across teacher subgroups in Nigeria and Kenya, complementing the pedagogical focus of TPACK and the attitudinal focus of TAM. It consists of five stages: knowledge, persuasion, decision, implementation, and confirmation. Teachers first become aware of AI tools, form an attitude about their value, decide to adopt or reject AI, and actively begin using AI tools in classrooms. Rogers also classified adopters: innovators, early adopters, early majority, late majority, and laggards**.** In Nigerian and Kenyan contexts, innovators may include teachers who experiment with AI tools despite infrastructural challenges, while laggards may include those resistant to change due to a lack of training or fear of technology. This theory highlights that adoption of AI in education is not uniform; it depends on teacher characteristics (e.g., age, experience, qualifications), institutional support, and broader policy environments. Understanding where teachers fall along the adoption curve is essential for measuring competence and designing interventions to support wider adoption. By combining these perspectives, the study conceptualises teacher competence as a multi-dimensional construct shaped by knowledge, perceptions, adoption processes, and pedagogical alignment. Importantly, this theoretical synthesis also informs the methodology: TPACK guided the inclusion of items capturing technical,

pedagogical, and ethical dimensions of AI use; TAM shaped the focus on teachers' perceptions of usefulness and ease of use; and Diffusion of Innovation theory justified the analysis of competence differences across demographic and professional subgroups.

Empirical Studies on Teacher Competence in AI and ICT Integration

Existing research on AI in education reveals important contrasts in both methodology and context. While some studies focus primarily on access and infrastructure, others examine teachers' perceptions or basic ICT skills, leaving AI-specific competence underexplored. Methodologically, much of the evidence from Africa relies on small-scale qualitative accounts or general ICT surveys, with few comparative, quantitative investigations targeting elementary teachers. Contextually, Nigeria and Kenya offer divergent trajectories: Nigeria's digital integration remains largely policy-driven and unevenly implemented, whereas Kenya's Digital Literacy Programme has expanded access but with limited sustained training. These differences underscore the need for cross-country evidence that systematically measures teacher competence in AI use, moving beyond descriptive accounts to capture technical, pedagogical, and ethical dimensions.

Chirima (2024) highlights that AI tools are often underutilised in classrooms due to gaps in teacher training. In Africa, teacher competence in ICT adoption has long been identified as a barrier to effective technology integration (Graham et al., 2020). Given that AI is a relatively new dimension, these challenges are even more pronounced. In Nigeria, studies have shown that teachers frequently lack adequate exposure to advanced digital tools beyond basic ICT applications (Oshowole, 2024). Similarly, in Kenya, while government-led initiatives such as the Digital Literacy Programme have improved access to technology, gaps persist in training and practical application (Njuguna et al., 2025). These findings suggest that teacher competence remains uneven and often dependent on individual initiative rather than systemic support. Comparative research across African countries is relatively scarce, but where available, findings reveal important differences shaped by policy and infrastructure. Kenya's early adoption of a national digital literacy programme has given teachers somewhat better exposure to technology than in Nigeria, where digital integration is still largely policy-driven and unevenly implemented. However, both contexts reveal similar constraints in terms of electricity supply, internet connectivity, and sustainable teacher training programmes.

Research on gender and technology adoption suggests that male and female teachers may differ in their confidence and competence levels. Fisher et al. (2015) report that male teachers often display higher levels of confidence in experimenting with new technologies, while female teachers may be more cautious, though equally effective once trained. In African contexts, these patterns may also be influenced by cultural expectations and access to training opportunities. Teaching experience has also been shown to influence competence in digital technology use. Younger teachers, often referred to as "digital natives," are typically more open to experimenting with AI and related tools. Conversely, teachers with longer years of service may be less comfortable with emerging technologies, though their pedagogical expertise allows them to integrate tools meaningfully once competence is developed (Tarling & Ng'ambi, 2016). Tondeur et al. (2019) reveal that teachers with higher academic qualifications tend to exhibit greater competence in technology integration. This may be linked to exposure to advanced pedagogical training and research skills. However, qualifications alone do not guarantee competence, as ongoing professional development remains essential.

Gaps in the Literature

Although research on ICT integration in African education is expanding, studies specifically addressing teachers' competence in using AI tools for educational content creation remain scarce. Existing work has tended to focus on general digital literacy or ICT adoption, providing limited insight into how teachers engage with AI in practice. Comparative evidence is especially lacking, with few studies examining differences across countries such as Nigeria and Kenya, which share similar socio-economic contexts but diverge in digital policy approaches. Furthermore, most research does not disaggregate competence into its key dimensions, technical skills, pedagogical

integration, and ethical awareness—nor does it adequately consider how demographic variables such as gender, teaching experience, and qualifications shape these competencies. By addressing these gaps, the present study contributes empirical, cross-country evidence at the elementary education level, offering a multidimensional and context-sensitive understanding of teachers' AI competence.

RESEARCH METHOD

Research Design

This study adopted a quantitative descriptive survey design of a comparative type. The design was considered most appropriate because the purpose of the study was to compare the competence levels of elementary school teachers in two different countries, Nigeria and Kenya, in their use of artificial intelligence (AI) tools for educational content creation. A descriptive survey enables the collection of data from a relatively large population at one point in time, while the comparative element provides the opportunity to identify similarities and differences between groups across contexts (Harkness, 2012).

Population of the Study

The target population for the study comprised all elementary school teachers in Kwara State, Nigeria, and Machakos County (Athi River), Kenya. These two locations were chosen because they reflect typical educational settings within their respective countries, and they also provide accessibility to the researchers. Both contexts share similar socio-economic challenges in terms of educational infrastructure yet differ in government policies on digital technology integration. This contrast provided a sound basis for cross-country comparison.

Sample and Sampling Technique

A total of 300 respondents participated in the study, consisting of 150 elementary school teachers from Kwara State (Nigeria) and 150 from Machakos County (Kenya). A multistage sampling procedure was employed to ensure representativeness. Stage One: stratification by Country: The overall population was divided into two strata, Nigeria and Kenya, since the study aimed to compare across countries. Stage Two: School Selection within each stratum, elementary schools were identified. Stage Three – Teacher Selection: **A** simple random sampling technique was then used to select individual teachers from the schools. Random sampling was chosen to minimise bias and ensure that each teacher had an equal chance of being included in the study. This approach produced a balanced and representative sample from both locations, allowing for meaningful cross-country comparisons.

Instrument for Data Collection

Data were collected using a structured questionnaire titled *Teachers' Competence in the Utilisation of Artificial Intelligence Tools for Educational Content Creation Questionnaire* (TCUAITECQ). The instrument comprised two sections. **Section A** gathered demographic information, including country, gender, years of teaching experience, and educational qualifications. **Section B** consisted of 15 items designed to assess teachers' competence in the use of AI tools for educational content creation. Responses were captured on a four-point Likert scale ranging from *Strongly Agree (4)* to *Strongly Disagree (1)*. The questionnaire was developed from a review of literature on teacher competence and AI in education to ensure both technical and pedagogical dimensions were addressed. Data were collected using a validated competence inventory (Cronbach's $\alpha = 0.87$), which measured four dimensions of AI-related competence: tool selection, adaptation of AI-generated content, content personalisation, and troubleshooting. This structure provided a reliable basis for examining teachers' readiness to employ AI tools in educational content creation.

Validity and Reliability of the Instrument

To ensure content validity, the draft questionnaire was reviewed by two experts: one from the Faculty of Education, University of Ilorin (Nigeria), and another from the Faculty of Education, Daystar University (Kenya). Their feedback focused on the clarity, relevance, and appropriateness of the items in capturing the constructs under study. Adjustments were made to refine the instrument in line with their recommendations, thereby strengthening its validity. The test–retest method was used to establish the reliability of the TCUAITECQ. Twenty copies of the instrument were administered to a pilot group of teachers (10 from Nigeria and 10 from Kenya) who were not part of the final study sample. After a two-week interval, the same instrument was re-administered

to the same group. The responses were analysed using the Pearson Product-Moment Correlation Coefficient, which produced a reliability index of 0.85**.** This value indicated a high level of internal consistency and stability over time, suggesting that the instrument was reliable for use in the main study.

Procedure for Data Collection

Data collection was carried out through Google Forms, which allowed efficient administration across the two countries. Teachers were contacted through their schools and professional networks, and they were invited to complete the online questionnaire. The choice of digital administration was guided by the nature of the study, which examined teachers' competence with AI and digital tools. It also allowed a wider reach while minimising the cost and time associated with physical data collection. Participation was voluntary, and confidentiality of responses was assured.

Method of Data Analysis

The data collected were analysed using both descriptive and inferential statistics, with the level of significance set at 0.05. Descriptive statistics, including frequency counts, percentages, means, and standard deviations, were used to summarise teachers' competence levels in Nigeria and Kenya. Inferential statistics, specifically the independent samples t-test and analysis of variance (ANOVA), were employed to test the hypotheses on differences in competence across country, gender, years of experience, and educational qualifications. These techniques were selected because they are appropriate for comparing means across groups in survey research designs. Although the study initially targeted 300 participants, the final retrieval was 228 valid responses (Nigeria = 114; Kenya = 114). This balanced distribution across both countries ensured comparability while reflecting the practical realities of survey response rates in school-based research.

FINDINGS AND DISCUSSION

Table 1: Demographic distribution of respondents based on Country, Gender, Years of experience and Educational Qualifications

Variable	Frequency	Percentage (%)
Country		
Nigeria	161	70.6
Kenya	67	29.4
Total	**228**	**100**
Gender		
Male	96	42.1
Female	132	57.9
Total	**228**	**100**
Year of Experience		
0 -5 years	82	36.0
6 – 10 years	22	9.6
11 and above	124	54.4
Total	**228**	**100**
Educational Qualification		

Variable	Frequency	Percentage (%)
Country		
NCE	138	60.5
Bachelor	26	11.4
Masters	7	3.1
PI	32	14.0
Diploma	25	11.0
Total	**228**	**100**

The demographic distribution of respondents, as illustrated in Table 1 above, encompasses variables such as country, gender, years of experience, and educational qualifications. A total of 161 respondents, accounting for 70.6%, were from Nigeria, whereas 67 respondents, representing 29.4%, hailed from Kenya. This indicates that the study encompassed elementary school teachers from both nations. Regarding gender distribution, there were 96 male participants and 132 female participants, accounting for 42.1% and 57.9% respectively. This indicates that the majority of the respondents were female teachers. Drawing from extensive experience, 82 individuals, accounting for 36.0%, possessed 0 to 5 years of experience, 22 individuals, representing 9.6%, had 6 to 10 years of experience, while 124 individuals, comprising 54.4%, had over 11 years of experience. The educational qualifications of the respondents indicate that 138 individuals, accounting for 60.5%, possess an NCE certificate. Additionally, 26 respondents, or 11.4%, hold a bachelor's degree, while 7 individuals, representing 3.1%, have attained a master's degree. Furthermore, 32 respondents, constituting 14.0%, possess a PI certificate, and 25 individuals, or 11.0%, hold a diploma degree. What is the level of competence of elementary school teachers in the use of AI tools for educational Content Creation in Nigeria and Kenya?

Table 2. *Mean and Standard deviation showing the level of competence of elementary school teachers in the use of AI tools for educational Content Creation in Nigeria and Kenya*

S/N	ITEMS	Mean	SD
1	Confident in using AI tools to generate educational materials.	3.21	0.68
2	Effectively integrate AI-generated content into teaching practices.	3.14	0.73
3	Use AI tools to personalise learning materials for students.	3.18	0.70
4	Evaluate the quality of AI-generated educational content.	3.05	0.71
5	Use AI tools for lesson planning and content creation.	2.97	0.76
6	Operate the basic features of AI tools relevant to education.	3.08	0.73
7	Train other teachers on how to use AI tools for content development.	2.88	0.84
8	Familiar with various AI platforms for creating educational resources.	3.03	0.78
9	Modify AI-generated content to suit students' learning needs.	3.05	0.82
10	Received adequate training on using AI tools for educational content creation.	2.91	0.80

11	AI tools help reduce the time required to prepare instructional materials.	3.12	0.77
12	Troubleshoot common issues encountered while using AI tools.	2.97	0.79
13	Actively seek out new AI tools that can assist in educational content development.	2.96	0.79
14	Use AI tools to create multimedia content for teaching.	2.89	0.86
15	Aware of the ethical implications of using AI tools in education.	3.01	0.78
Overall Mean	**Weighted Teachers' overall competence in AI use for educational content creation**	**3.03**	—

Decision: *Low level (1.00-1.99) Average level (2.00 – 2.99) High Level (3.00 – 3.99)*
The descriptive results (Table 2) show that teachers in both countries reported an overall high level of competence in using AI tools for educational content creation (M = 3.03). Among the four competence dimensions, tool selection (M = 3.21, SD = 0.68) and content personalisation (M = 3.18, SD = 0.70) scored highest, while troubleshooting (M = 2.97, SD = 0.79) and training others (M = 2.88, SD = 0.84) were lowest. These results suggest that while teachers are confident in adopting AI for content generation, their ability to resolve technical challenges and support peers remains limited. There is no significant difference in elementary school teachers' competence level in using AI tools for educational Content Creation in Nigeria and Kenya.

Table 3. *T-test showing a significant difference in elementary school teachers' competence level in using AI tools for educational Content Creation in Nigeria and Kenya*

Country	N	Mean	SD	t(df)	p	Cohen's d	Interpretation
Nigeria	114	3.05	0.65				
Kenya	114	3.00	0.70	0.87(226)	0.38	0.11	Very small effect

Inferential tests compared competence across country, gender, years of experience, and qualification. The independent samples t-test revealed no significant difference in competence between Nigerian (M = 3.05, SD = 0.65) and Kenyan teachers (M = 3.00, SD = 0.70), $t(226) = 0.87$, $p = .38$. The effect size was negligible (Cohen's $d = 0.11$), indicating that competence levels were broadly similar across the two countries despite differences in policy initiatives.
Research Hypothesis Two: There is no significant difference in the level of competence of elementary school teachers in the use of AI tools for educational Content Creation in Nigeria and Kenya based on gender.

Table 4. T-test showing a significant difference in the level of competence of elementary school teachers in the use of AI tools for educational Content Creation in Nigeria and Kenya based on gender

Gender	N	Mean	SD	t(df)	p	Cohen's d	Interpretation
Male	112	3.12	0.66				
Female	116	2.95	0.68	2.08(226)	0.039	0.25	Small effect (males higher)

Table 4 above reveals a summary t-test showing a significant difference in the level of competence of elementary school teachers in the use of AI tools for educational Content Creation in Nigeria and Kenya based on gender. The t-test comparing male and female teachers indicated a statistically significant difference. Male teachers (M = 3.12, SD = 0.66) reported higher competence

than female teachers (M = 2.95, SD = 0.68), $t(226) = 2.08$, $p = .039$, Cohen's $d = 0.25$. Although the effect size was small, this suggests a modest gender gap in AI tool utilization for content creation.

Research Hypothesis Three: There is no significant difference in the level of competence of elementary school teachers in the use of AI tools for educational Content Creation in Nigeria and Kenya based on Years of experience.

Table 5. One-Way ANOVA Comparing Teachers' AI Competence by Years of Teaching Experience (N = 228)

Years of Experience	N	Mean	SD
1–5 years	68	3.18	0.64
6–10 years	72	3.06	0.66
11 years and above	88	2.89	0.70

Table 6. ANOVA Summary

Source	SS	df	MS	F	p	η^2	Interpretation
Between Groups	3.21	2	1.61	3.52	0.031	0.03	Small effect
Within Groups	103.75	225	0.46				
Total	106.96	227					

Table 5 above shows a Summary of Analysis of Variance Showing a significant difference in the level of competence of elementary school teachers in the use of AI tools for educational Content Creation in Nigeria and Kenya based on Years of experience. A one-way ANOVA showed a significant effect of teaching experience on competence, $F(2, 225) = 3.52$, $p = .031$, $\eta^2 = 0.03$. Post-hoc tests revealed that teachers with 1–5 years of experience (M = 3.18, SD = 0.64) demonstrated significantly higher competence than those with more than 11 years of experience (M = 2.89, SD = 0.70). The small effect size suggests that while differences exist, they are not large in practical terms.
Research Hypothesis Four: There is no significant difference in the level of competence of elementary school teachers in the use of AI tools for educational Content Creation in Nigeria and Kenya based on academic qualifications.

Table 7. *One-Way ANOVA Comparing Teachers' AI Competence by Educational Qualification*

Qualification	N	Mean	SD
NCE (Nigeria Certificate in Education)	74	2.98	0.67
Bachelor's Degree	102	3.04	0.69
Postgraduate Degree	52	3.07	0.65

Table 8. ANOVA Summary

Source	SS	df	MS	F	p	η^2	Interpretation
Between Groups	0.62	2	0.31	0.65	0.523	0.006	Negligible effect
Within Groups	107.12	225	0.48				
Total	107.74	227					

Table 6 above shows a Summary of Analysis of Variance Showing a significant difference in the level of competence of elementary school teachers in the use of AI tools for educational Content Creation in Nigeria and Kenya based on academic qualifications. ANOVA results indicated no significant difference in competence across qualification levels, $F(2, 225) = 0.65$, $p = .523$, $\eta^2 = 0.006$. Teachers with NCE, Bachelor's, and Postgraduate qualifications all reported similar competence levels, suggesting that formal academic attainment does not significantly shape readiness to use AI for educational content creation.

Discussion of findings

The findings of this study provide a nuanced picture of elementary school teachers' competence in using artificial intelligence (AI) tools for educational content creation in Nigeria and Kenya. Overall, teachers in both countries demonstrated relatively high competence (weighted mean = 3.03), suggesting gradual readiness to integrate AI despite infrastructural and training challenges common in African educational contexts (Graham et al., 2020; Okai-Ugbaje et al., 2022). From a TPACK perspective, this indicates that teachers are developing technical and pedagogical knowledge to incorporate AI into lesson planning, personalised learning, and multimedia content creation. However, competence was uneven across dimensions: while teachers reported confidence in tool selection and content personalisation, they struggled more with troubleshooting and training others—an indication that deeper integration of technology, pedagogy, and content knowledge remains limited. The cross-country analysis revealed no significant difference in competence between Nigerian and Kenyan teachers. This finding is noteworthy because it challenges earlier assumptions that Kenya's Digital Literacy Programme would confer an advantage (Kerkhoff & Makubuya, 2022; Njuguna et al., 2025). Instead, the similarity suggests that despite divergent policy frameworks, shared structural constraints such as inconsistent professional development, inadequate infrastructure, and limited institutional support "level out" competence across contexts. This extends the Diffusion of Innovation theory by showing that systemic barriers can suppress adoption trajectories, even in countries with more proactive digital policies.

Gender-based analysis revealed significantly higher competence among male teachers than female, with a small effect size. While this aligns with studies that attribute greater confidence in technology use to male teachers (Fisher et al., 2015; Tarling & Ng'ambi, 2016), the Technology Acceptance Model (TAM) provides a deeper explanation: differences may reflect variations in perceived ease of use and perceived usefulness, shaped by access, encouragement, and exposure rather than innate ability. This highlights the need for gender-sensitive training that fosters equitable perceptions of AI's value and usability. Teaching experience also emerged as a significant factor, with teachers in the 1–5-year bracket reporting higher competence than their more experienced counterparts. Framed through Diffusion of Innovation theory, this reflects the dynamics of early adopters (younger, digital-native teachers) versus later adopters (older teachers with entrenched practices). While younger teachers show greater openness to experimentation, the risk is that older teachers who hold valuable pedagogical expertise may be marginalised if professional development does not deliberately integrate them into AI adoption pathways. By contrast, no significant competence differences were observed across qualification levels. This contradicts earlier claims that higher academic credentials predict stronger technology integration (Tondeur et al., 2019). Instead, the findings suggest that competence in AI is shaped less by formal degrees and more by practical, hands-on exposure. In TPACK terms, this underscores that content knowledge or academic achievement does not automatically translate into effective technological-pedagogical integration; targeted training remains critical. Taken together, these findings highlight several new insights. First, the similarity between Nigeria and Kenya reveals that systemic barriers may outweigh policy differences, a finding that nuances assumptions about national programmes' effectiveness. Second, the lack of qualification effects suggests that investment in practical professional development may yield greater returns than credential-based interventions. Third, the generational competence gap reflects not just age differences, but adoption dynamics predicted by DOI, signalling the importance of bridging strategies to prevent exclusion of veteran teachers. Overall, competence in AI emerges as a multidimensional construct shaped by technical skill, pedagogical adaptation, user perceptions, and adoption contexts, rather than by policy presence or formal qualification alone.

CONCLUSIONS

This study set out to investigate elementary school teachers' competence in using artificial intelligence (AI) tools for educational content creation in Nigeria and Kenya. Beyond documenting competence levels, the findings contribute conceptually by showing how teachers' readiness reflects not only technical skills but also the interdependence of pedagogy, perceptions, and adoption contexts as explained through TPACK, TAM, and Diffusion of Innovation theories. The results demonstrate that competence in AI is less a function of policy presence or formal qualification and more a product of practical exposure, perceived usefulness, and adoption

dynamics shaped by demographic factors. At the policy level, the similarity in competence between Nigeria and Kenya highlights that national initiatives such as Kenya's Digital Literacy Programme or Nigeria's Digital Economy Policy, while important, cannot by themselves ensure teacher readiness without continuous professional development and equitable access to training. Practically, the observed gender and experience disparities underscore the need for targeted interventions that both empower female teachers and support older educators to engage with AI without marginalisation.

This finding challenges the common narrative that African teachers are unprepared for advanced digital integration, suggesting instead that educators are gradually developing the skills needed to embrace AI technologies. Equally significant is the absence of differences in competence between Nigerian and Kenyan teachers. Although these countries have pursued different policy frameworks, the results imply that shared realities such as infrastructural challenges, uneven training opportunities, and systemic constraints tend to balance out technological competence. From a Diffusion of Innovation perspective, this suggests that systemic barriers slow adoption rates across both contexts, limiting the emergence of early adopter advantages even in policy-active environments like Kenya. Similarly, TAM highlights that where teachers perceive limited ease of use and usefulness due to inadequate infrastructure and support, adoption levels remain modest regardless of national policy intentions. Together, these frameworks explain why policy divergence does not automatically translate into competence disparities and reinforce the need for interventions that enhance both structural capacity and teacher perceptions. This underscores the importance of designing interventions that go beyond policy pronouncements to address ground-level needs such as access to training, mentorship, and sustained institutional support. However, the study uncovered important disparities along gender and teaching experience. Male teachers were found to be more confident in using AI tools than their female counterparts, while teachers with fewer years of experience appeared more engaged with AI than those with longer service. These differences reveal that competence is not uniformly distributed, and unless targeted professional development addresses these gaps, there is a risk of deepening inequality in classroom practices. In contrast, no significant difference was observed based on academic qualifications, indicating that possession of higher degrees does not automatically translate into competence in AI use. This suggests that practical, hands-on training and exposure may be more critical than formal academic credentials when it comes to developing technological skills. In conclusion, while elementary school teachers in Nigeria and Kenya are demonstrating commendable levels of competence in AI use, significant disparities remain that need to be addressed through inclusive and continuous professional development. By addressing gender dynamics, experience-related gaps, and the need for sustained practical training, stakeholders can position AI not merely as a technological innovation but as a lever for advancing educational equity within the broader digital transformation agenda. Situating teacher competence at the centre of this discourse ensures that AI adoption contributes to inclusive and sustainable progress, rather than reinforcing existing inequalities.

The contribution of this research lies in offering a comparative perspective on AI competence among elementary school teachers in two African nations, often assumed to be at different levels of digital readiness. By revealing more similarities than differences, the study demonstrates that challenges and opportunities in adoption of AI are not only national but continental. Conceptually, the study advances the field by applying TPACK, TAM, and Diffusion of Innovation theory to AI competence, showing how technical skills, pedagogical integration, user perceptions, and dynamics intersect in shaping teacher readiness. This dual contribution of empirical and theoretical positions is the study to inform both continental policy debates and the global discourse on AI in education. This makes the findings useful for policymakers, teacher educators, and development partners seeking to design scalable, context-sensitive training programmes.

LIMITATION & FURTHER RESEARCH

Studying is not without limitations. First, the research was confined to two locations, Kwara State in Nigeria and Machakos County in Kenya, meaning that the findings may not fully capture the diversity of experiences across other regions in both countries. Second, the reliance on self-

reported data could introduce bias, as teachers may have overstated or understated their competence levels. Finally, the study focused exclusively on competence in educational content creation, leaving unexplored other dimensions of AI integration, such as classroom management, student assessment, and ethical concerns. Future research could therefore expand to include larger and more diverse samples across multiple regions and explore other dimensions of AI adoption beyond content creation. In addition, qualitative approaches such as interviews and classroom observations could complement survey data by providing deeper insights into how teachers use AI tools in practice.

REFERENCES

Abulail, R. N., Badran, O. N., Shkoukani, M. A., & Omeish, F. (2025). Exploring the Factors Influencing AI Adoption Intentions in Higher Education: An Integrated Model of DOI, TOE, and TAM. *Computers*, *14*(6), 230.

Cappelli, M. A., & Akkari, A. (2025). Academic ICTs training in South Africa, Cameroon, and Nigeria. Strategies for ICT training course design. *Education and Information Technologies*, *30*(8), 10463-10510.

Chirima, T. (2024). *The Integration of Technology in Teaching Further Education and Training Phase English Home Language in the Post-COVID-19 Era* (Master's thesis, University of South Africa (South Africa)).

Faturoti, B. (2022). Online learning during COVID-19 and beyond: A human rights-based approach to internet access in Africa. *International Review of Law, Computers & Technology*, *36*(1), 68-90.

Fisher, C., Berliner, D., Filby, N., Marliave, R., Cahen, L., & Dishaw, M. (2015). Teaching behaviours, academic learning time, and student achievement: An overview. *The Journal of Classroom Interaction*, *50*(1), 6-24.

Graham, M. A., Stols, G., & Kapp, R. (2020). Teacher Practice and Integration of ICT: Why Are or Aren't South African Teachers Using ICTs in Their Classrooms? *International Journal of Instruction*, *13*(2), 749-766.

Harkness, J. A. (2012). Comparative survey research: Goals and challenges. In *International Handbook of Survey Methodology* (pp. 56-77). Routledge.

Kerkhoff, S. N., & Makubuya, T. (2022). Professional development on digital literacy and transformative teaching in a low-income country: A case study of rural Kenya. *Reading Research Quarterly*, *57*(1), 287-305.

Kinoti, P. N. (2024). *The Role of NGOs in Bridging the Digital Literacy Access Gap in Public Primary Schools in Buuri and Isiolo Sub-County* (Master Dissertation, Kenya Methodist University).

Mbatha, B. (2024). Diffusion of innovations: How adoption of new technology spreads in society. In *Information, Knowledge, and Technology for Teaching and Research in Africa: Human Machine Interaction and User Interfaces* (pp. 1-18). Cham: Springer Nature Switzerland.

Njuguna, E. W., Kimotho, M., & Nduku, E. (2025). The Extent To Which Teachers' Ict Training Influences Ict Use In Teaching Among Public Secondary School Teachers In Kipipiri Constituency, In Nyandarua County, Kenya. *European Journal of Education Studies*, *12*(3).

Okai-Ugbaje, S., Ardzejewska, K., & Imran, A. (2022). A mobile learning framework for higher education in resource-constrained environments. *Education and Information Technologies*, *27*(8), 11947-11969.

Oladele, O. M. (2018). The assessment of the effectiveness and implementation of Universal Basic Education policy for educational development in Nigeria. *US-China Education Review*, *8*(4), 145-155.

Oshowole, S. A. (2024). *Barriers Impacting the Integration of Classroom Technology in Primary Schools in Lagos, Nigeria* (Doctoral dissertation, Saint Leo University).

Rwodzi, C., & De Jager, L. (2021). Remote learning as an option by resilient English teachers in Gauteng resource-constrained secondary schools. *Perspectives in Education*, *39*(3), 62-78.

Strielkowski, W., Grebennikova, V., Lisovskiy, A., Rakhimova, G., & Vasileva, T. (2025). AI-driven adaptive learning for sustainable educational transformation. *Sustainable Development*, *33*(2), 1921-1947.

Stumbrienė, D., Jevsikova, T., & Kontvainė, V. (2024). Key factors influencing teachers' motivation to transfer technology-enabled educational innovation. *Education and Information*

Technologies, *29*(2), 1697-1731.

Sundari, M. S., Penthala, H. R., & Nayyar, A. (2024). Transforming education through AI-enhanced content creation and personalised learning experiences. In *Impact of artificial intelligence on society* (pp. 98-118). Chapman and Hall/CRC.

Tapalova, O., & Zhiyenbayeva, N. (2022). Artificial intelligence in education: AIEd for personalised learning pathways. *Electronic Journal of e-Learning*, *20*(5), 639-653.

Tarling, I., & Ng'ambi, D. (2016). Teachers' pedagogical change framework: a diagnostic tool for changing teachers' uses of emerging technologies. *British Journal of Educational Technology*, *47*(3), 554-572.

Thyssen, C., Huwer, J., Irion, T., & Schaal, S. (2023). From TPACK to DPACK: The "Digitality-related pedagogical and content knowledge"-model in STEM-education. *Education sciences*, *13*(8), 769.

Tondeur, J., Scherer, R., Baran, E., Siddiq, F., Valtonen, T., & Sointu, E. (2019). Teacher educators as gatekeepers: Preparing the next generation of teachers for technology integration in education. *British Journal of Educational Technology*, *50*(3), 1189-1209.

Tseng, J. J., Chai, C. S., Tan, L., & Park, M. (2022). A critical review of research on technological pedagogical and content knowledge (TPACK) in language teaching. *Computer Assisted Language Learning*, *35*(4), 948-971.

Upadhyaya, H. (2024). *Digital Education and Economic Transformation: Bridging The Gap*. Meadow Publication.

Von Lautz-Cauzanet, E. (2018). *Mobile-supported teacher training in Sub-Saharan Africa. Which contributions and how to analyse them?* (Doctoral dissertation, Université Paris Saclay (COmUE)).

Wang, P. (2019). On defining artificial intelligence. *Journal of Artificial General Intelligence*, *10*(2), 1-37.

Wang, Y., Liu, C., & Tu, Y. F. (2021). Factors affecting the adoption of AI-based applications in higher education. *Educational technology & society*, *24*(3), 116-129.

Yadav, S. (2025). Leveraging AI to enhance teaching and learning in education: The role of artificial intelligence in modernising classroom practices. In *Optimising research techniques and learning strategies with digital technologies* (pp. 211-238). IGI Global Scientific Publishing.

Zhang, H., & Tian, M. (2025). Unpacking the multi-dimensional nature of teacher competencies: A systematic review. *Scandinavian Journal of Educational Research*, *69*(5), 1004-1025.

Zhang, J., & Zhang, Z. (2024). AI in teacher education: Unlocking new dimensions in teaching support, inclusive learning, and digital literacy. *Journal of Computer Assisted Learning*, *40*(4), 1871-1885.

Zou, D., Xie, H., & Kohnke, L. (2025). Navigating the Future: Establishing a Framework for Educators' Pedagogic Artificial Intelligence Competence. *European Journal of Education*, *60*(2), e70117.