

EMPOWERING EARLY CHILDHOOD TEACHERS IN NIGERIA THROUGH GOVERNMENT-SUPPORTED AI TRAINING AND DIGITAL LITERACY INITIATIVES

OLOFINNIKA, Adedayo Albert, Ph.D

Early Childhood Education Unit, Department of Guidance & Counselling,
Adekunle Ajasin University, Akungba-Akoko, Nigeria

Email: adedayoolofinnika@gmail.com

adedayo.olofinnika@aaua.edu.ng

Mobile: +2348067616770

&

OLWE, Peter Kayode Ph.D

Department of Early Childhood Education
Adeyemi Federal University of Education, Ondo, Nigeria

Email: olowepk@afued.edu.ng

Mobile: +2348068730546

Abstract

Early childhood education (ECE) in Nigeria faces persistent resource and skill gaps, with many teachers lacking digital competencies needed for 21st-century pedagogy. This study evaluated a government-supported AI and digital literacy training pilot programme for ECE teachers, examining its impact on technological skills and instructional quality. Using a case study design, the researchers assessed 824 trained early childhood teachers through pre/post surveys, interviews, and classroom observations across six southwestern states (Lagos, Ogun, Oyo, Osun, Ondo, and Ekiti). Quantitative data analysed using paired t-tests and multiple regression showed significant gains in digital competency (mean scores improved from 2.3 to 4.1, $p < 0.001$) and AI literacy. Qualitative thematic analysis revealed increased teacher confidence in technology integration and improved pupil engagement. Multiple regression analysis found that AI knowledge and tool usage significantly predicted teaching skills improvements. The findings demonstrate that government-led training can transform ECE by building teacher capacity aligned with Nigeria's digital learning goals, enabling personalised, engaging instruction that advances children's development. Recommendations include scaling such initiatives with sustained support and infrastructure development.

Keywords: Early Childhood Education, Digital Literacy, Artificial Intelligence, Teacher Training, Technology Integration, Professional Development

Introduction

Early childhood education (ECE) represents a critical foundation for lifelong learning and development, yet Nigeria's ECE sector continues to face significant challenges, including resource constraints, infrastructure deficits, and skill gaps among teachers (Bello & Ajao, 2024). The integration of Artificial Intelligence (AI) has emerged as a transformative strategy for addressing these systemic challenges, with recent interventions demonstrating that AI-assisted educational programs can achieve learning gains equivalent to nearly two years of typical learning in just six weeks in Nigerian contexts (World Bank, 2024).

The Nigerian government has demonstrated commitment to digital transformation through comprehensive policy frameworks. The National Information Technology Development Agency (NITDA), established in 2001, aims to achieve 70% digital literacy by 2027 through the Digital Literacy for All (DL4ALL) program (NITDA, 2023). Despite these initiatives, ECE teachers face significant digital literacy gaps, limited access to technology, inadequate training opportunities, and insufficient institutional support for digital integration (Bello & Ajao, 2024). AI literacy has become crucial in digital education research, with AI tools increasingly used in ECE to enhance learning and development (Ogunode *et al.*, 2024; Zhang *et al.*, 2024). In underserved regions, well-trained AI could provide access to high-quality educational resources and personalised learning experiences (World Bank, 2024). The Nigerian government's initiatives include free online courses for teachers, entrepreneurship and digital literacy subjects in the curriculum, and frameworks for licensing private organisations' digital literacy training (NITDA, 2023; Bello & Ajao, 2024).

While previous research has documented AI's potential in education and the importance of digital literacy training, gaps remain in understanding how these elements can be effectively integrated to support ECE teachers in Nigerian contexts (Ogunode *e. al.*, 2024; Zhang *et al.*, 2024). This study addresses this gap by examining a pilot government-supported AI training initiative specifically designed for early childhood teachers.

Theoretical framework

This study was grounded in two complementary theoretical frameworks: the Technology Acceptance Model (TAM) and Social Cognitive Theory (SCT), providing a comprehensive lens for understanding how early childhood teachers adopt and integrate AI technologies into their teaching practices.

Technology Acceptance Model (TAM)

The Technology Acceptance Model, developed by Davis (1989), posits that technology adoption is primarily determined by two key factors: perceived usefulness and perceived ease of use. Perceived usefulness refers to the degree to which an individual believes that using a particular technology would enhance their job performance, while perceived ease of use refers to the degree to which an individual believes that using the technology would be free of effort.

In the context of this study, TAM provides a framework for understanding how early childhood teachers' perceptions of AI tools' usefulness and ease of use influence their intentions to integrate these technologies into their teaching practices. The government-supported training programme aimed to enhance both dimensions, demonstrating AI's practical benefits for ECE (perceived usefulness) while building technical competencies that reduce implementation barriers (perceived ease of use).

Social Cognitive Theory (SCT)

Social Cognitive Theory, developed by Bandura (1986), emphasises the role of observational learning, self-efficacy, and reciprocal determinism in human behaviour. Central to SCT is the concept of self-efficacy, which is an individual's belief in their capability to execute behaviours necessary to produce specific performance attainments. Self-efficacy influences the choices people make, the effort they expend, and their persistence in facing challenges.

For this study, SCT provides insight into how professional development experiences shaped teachers' confidence in technological integration. The training program incorporated modelling, guided practice, and feedback mechanisms designed to build teacher self-efficacy in the AI tool. The theory suggests that as teachers develop confidence through successful experiences with AI technologies, they become more likely to persist in implementation despite challenges.

Theoretical Integration

The integration of TAM and SCT creates a comprehensive framework for understanding AI adoption in ECE contexts. While TAM focuses on cognitive perceptions of technology characteristics, SCT emphasises psychological factors, including confidence and self-efficacy. Together, these theories suggest that effective professional development must address both technical competencies (ease of use) and pedagogical relevance (usefulness), while building educator confidence through structured, supportive learning experiences.

This theoretical framework guided the study's design, particularly the selection of outcome variables (competency, confidence, practice change) and the development of training program components aimed at influencing these factors.

Statement of the Problem

Despite Nigeria's ambitious digital transformation agenda and the recognised potential of AI in education, early childhood teachers continue to face substantial barriers to effective technology integration. Many ECE teachers lack basic digital competencies required for 21st-century pedagogy, which limits their ability to provide engaging personalised learning experiences. While government initiatives like DL4ALL aim to improve digital literacy, limited research exists on the effectiveness of AI-specific training for ECE teachers or its impact on teaching practices and student outcomes. This knowledge gap hinders evidence-based policy decisions and program scaling efforts needed to transform early childhood education in Nigeria.

Purpose of the Study

This study evaluated the impact of a government-supported AI training and digital literacy initiative on early childhood teachers in Nigeria. Specifically, it examined how participation influenced teachers' technological competencies, pedagogical practices, confidence in integrating AI tools, its implications for educational quality and equity aligned with Nigeria's digital transformation goals. The specific objectives are to:

1. Assess changes in early childhood teachers' digital competency and AI literacy levels following participation in government-supported AI training programmes.
2. Examine the influence of AI training on the early childhood teachers' pedagogical practices and teaching confidence.
3. Identify challenges and implementation barriers affecting the integration of AI tools in early childhood education contexts.
4. Determine factors that predict improvements in teaching skills among trained early childhood teachers.
5. Explore implications of government-supported AI training for educational quality, equity, and alignment with Nigeria's digital transformation goals.

Research Questions

The following research questions guided this study:

1. What is the effect of government-supported AI training on early childhood teachers' digital competency and AI literacy levels?
2. How does AI training influence early childhood teachers' pedagogical practices and teaching confidence?
3. What challenges and barriers do early childhood teachers face in implementing AI tools following training?
4. What factors predict improvements in teaching skills following AI training participation?

Hypotheses

The following null hypotheses were tested at a 0.05 level of significance:

H01: There is no significant difference in digital competency scores of early childhood teachers before and after AI training.

H02: There is no significant difference in teaching confidence levels of early childhood teachers before and after AI training.

H03: AI knowledge and tool usage do not significantly predict improvements in teaching skills among trained early childhood teachers.

Methodology

This study employed a case study research design to evaluate the impact of government-supported AI training on early childhood teachers in Nigeria. The case study approach provided an in-depth, contextual understanding of how the training program influenced educator practices within specific Nigerian ECE settings (Yin, 2024). The design incorporated both explanatory and exploratory elements, examining not only training outcomes but also underlying mechanisms contributing to observed changes. The population comprised all early childhood teachers in six southwestern Nigerian states (Lagos, Ogun, Oyo, Osun, Ondo, and Ekiti) who participated in government-supported AI training programs. Using purposive sampling, education centres with basic technological infrastructure, administrative support for digital transformation, and willingness to participate were selected. The final sample consisted of 824 early childhood teachers who completed the AI training program (Federal Government AI Training for School Teachers and AI Academy by the Federal Ministry of Innovation, Science and Technology in partnership with THE COMMONWEALTH and Intel Corporation). For qualitative data collection, purposive sampling was used to select key informants, including 12 PHC facility managers, 12 healthcare providers, and 6 officials from education boards, totalling 30 participants for in-depth

interviews. A structured questionnaire adapted from validated scales used in educational technology research (Burdett et al., 2024) was employed, with modifications for early childhood education and African contexts. The instrument comprised five sections:

1. Section A: Demographic information (age, gender, teaching experience, educational qualification)
2. Section B: Digital Competency Scale (15 items, 5-point Likert scale)
3. Section C: AI Literacy Assessment (20 items, 5-point Likert scale)
4. Section D: Teaching Confidence Scale (12 items, 5-point Likert scale)
5. Section E: Pedagogical Practice Changes (10 items, 5-point Likert scale)

The instrument demonstrated high reliability with Cronbach's alpha coefficients of 0.89 for digital competency, 0.92 for AI literacy, 0.87 for teaching confidence, and 0.85 for pedagogical practices scales.

Semi-structured interview protocols were developed covering:

1. Perceived changes in pedagogical approaches
2. Challenges and barriers to AI integration
3. Impact on student engagement
4. Institutional factors influencing implementation
5. Recommendations for program improvement

A systematic observation checklist was developed to document AI tool usage, digital literacy demonstration, and pedagogical transformation in early childhood settings. Content validity was established through expert review by three professors in early childhood education and educational technology. The instruments were pilot-tested with 40 teachers not included in the main study. Test-retest reliability was assessed with a two-week interval, yielding correlation coefficients ranging from 0.82 to 0.91 for the various scales, indicating strong reliability.

Data collection followed a three-phase approach over six months:

Phase 1 (Pre-training): Baseline surveys administered two weeks before training; demographic data and pre-training competency levels collected.

Phase 2 (During training): Ongoing documentation of training activities; classroom observations initiated; informal interviews with participants.

Phase 3 (Post-training): Post-training surveys administered immediately after training completion; follow-up surveys at one and three months; in-depth interviews with selected participants; systematic classroom observations; document analysis of training materials and institutional reports.

All procedures adhered to ethical guidelines with informed consent obtained from all participants. Confidentiality and anonymity were maintained throughout.

Data were analysed using SPSS version 29. Descriptive statistics (frequencies, percentages, means, and standard deviations) summarised participant characteristics and competency levels. Paired samples t-tests assessed significant differences between pre- and post-training scores for digital competency, AI literacy, and teaching confidence, testing hypotheses H01 and H02 at a 0.05 significance level. Multiple regression analysis examined predictors of teaching skill improvements, testing hypothesis H03, with AI knowledge and tool usage as predictor variables.

Interview transcripts underwent thematic analysis following Braun and Clarke's (2024) procedures. Data were coded using both deductive (theory-based) and inductive (emergent) approaches. Key analytical steps included familiarisation, systematic coding, theme development, and member checking for authenticity. Observation notes were analysed to identify patterns in classroom practice changes. Quantitative and qualitative findings were integrated through triangulation to provide a comprehensive understanding of the training programme's impact.

Results

The sample of 824 participants comprised 89.3% females and 10.7% males, reflecting the gender distribution typical in early childhood education. Age distribution showed 34.2% aged 25-30 years, 41.5% aged 31-40 years,

and 24.3% above 40 years. Educational qualifications included 45.6% with NCE, 38.9% with bachelor's degrees, and 15.5% with postgraduate qualifications. Teaching experience ranged from less than 5 years (28.4%) to over 15 years (18.3%).

Research Question 1: Effect of AI Training on Digital Competency and AI Literacy

Table 1: Paired Samples t-test Results for Digital Competency and AI Literacy

Variable	Pre-training Mean (SD)	Post-training Mean (SD)	Mean Difference	t-value	df	p-value
Digital Competency	2.34 (0.68)	4.12 (0.57)	1.78	42.16	823	<0.001*
AI Literacy	2.28 (0.71)	4.05 (0.62)	1.77	39.84	823	<0.001*

*Significant at $p < 0.05$

The results show statistically significant improvements in both digital competency and AI literacy scores following the training intervention. Digital competency mean scores increased from 2.34 to 4.12 ($t = 42.16$, $p < 0.001$), while AI literacy scores improved from 2.28 to 4.05 ($t = 39.84$, $p < 0.001$). These substantial gains were maintained at three-month follow-up assessments, indicating lasting impact. Therefore, hypothesis H_{01} was rejected, confirming significant differences in digital competency after training.

Research Question 2: Influence on Pedagogical Practices and Teaching Confidence

Table 2: Paired Samples t-test Results for Teaching Confidence

Variable	Pre-training Mean (SD)	Post-training Mean (SD)	Mean Difference	t-value	df	p-value
Teaching Confidence	2.56 (0.74)	4.21 (0.59)	1.65	38.92	823	<0.001*
Technology Integration	2.41 (0.79)	4.08 (0.64)	1.67	37.45	823	<0.001*

*Significant at $p < 0.05$

Teaching confidence showed significant improvement, with mean scores increasing from 2.56 to 4.21 ($t = 38.92$, $p < 0.001$). Technology integration confidence similarly increased from 2.41 to 4.08 ($t = 37.45$, $p < 0.001$). Therefore, hypothesis H_{02} was rejected, confirming significant improvements in teaching confidence following AI training.

Thematic analysis revealed three major themes:

Theme 1: Enhanced Confidence and Self-Efficacy

Teachers consistently reported increased confidence in technology use. One participant stated: *"Before this training, I was afraid of technology. Now I see it as a tool that can help me be a better teacher for my children."*

Theme 2: Personalized Learning Approaches

Participants described using AI tools to create individualized learning experiences. An educator explained: *"I can now use AI to help me understand each child's learning style and create activities that match their needs. It's like having a teaching assistant that knows every child individually."*

Theme 3: Improved Student Engagement

Classroom observations documented increased student participation, enthusiasm, and sustained attention during AI-enhanced learning activities. Teachers reported better material retention and improved problem-solving abilities among students.

Research Question 3: Challenges and Barriers to AI Implementation

Qualitative analysis identified four major challenges:

1. **Infrastructure Limitations:** Inconsistent internet connectivity (mentioned by 67% of interviewees) and limited device availability (54%)
2. **Resource Constraints:** Insufficient digital devices for all students and inadequate technical support
3. **Administrative Support Variability:** Teachers with strong administrative support showed better long-term AI integration than those in less supportive environments
4. **Adaptation Requirements:** Need for creative problem-solving to apply AI skills in resource-constrained environments

Research Question 4: Predictors of Teaching Skill Improvements

Table 3: Multiple Regression Analysis - Predictors of Teaching Skill Improvement

Predictor Variable	B	SE B		T	p-value
(Constant)	1.24	0.18	-	6.89	<0.001
AI Knowledge	0.42	0.06	0.38	7.12	<0.001*
AI Tool Usage	0.35	0.05	0.32	6.87	<0.001*
Digital Competency	0.21	0.07	0.18	3.04	0.002*
Teaching Experience	0.08	0.04	0.09	1.98	0.048*

*Significant at $p < 0.05$

$R^2 = 0.64$, Adjusted $R^2 = 0.63$, $F(4, 819) = 365.72$, $p < 0.001$

The regression model was statistically significant ($F = 365.72$, $p < 0.001$), explaining 64% of variance in teaching skill improvements. AI knowledge ($\beta = 0.38$, $p < 0.001$) and AI tool usage ($\beta = 0.32$, $p < 0.001$) emerged as the strongest predictors, followed by digital competency ($\beta = 0.18$, $p = 0.002$) and teaching experience ($\beta = 0.09$, $p = 0.048$). Therefore, hypothesis H_{03} was rejected, confirming that AI knowledge and tool usage significantly predict teaching skill improvements.

Discussion of Findings

The significant improvements in digital competency and AI literacy (Research Question 1, Hypothesis [H01](#)) align with recent evidence showing that AI-assisted educational programs can achieve substantial learning gains in Nigerian contexts (World Bank, 2024). The magnitude of improvement from mean scores of 2.3 to 4.1 demonstrates the training program's effectiveness in transforming educator competencies. This finding supports Patel *et al.* (2024), who found that profound understanding of AI significantly predicts positive outcomes in AI use, ethics, and problem-solving.

The sustained improvements at three-month follow-up indicate lasting impact, suggesting that the training successfully built foundational competencies rather than superficial awareness. This sustainability is particularly important given Nigeria's goal of achieving 70% digital literacy by 2027 (NITDA, 2023). The findings suggest that targeted, government-supported training can effectively address digital literacy gaps among ECE teachers.

The substantial improvements in teaching confidence and technology integration (Research Question 2, Hypothesis [H02](#)) reflect the theoretical predictions of Social Cognitive Theory regarding self-efficacy development. The training program's emphasis on practical application and guided practice appeared to build educator confidence effectively, consistent with UNESCO (2024) findings that training and support empower teachers to integrate technology confidently.

The qualitative findings revealing enhanced personalised learning approaches and improved student engagement demonstrate that confidence gains translated into meaningful pedagogical changes. This transformation aligns with Bello and Ajao (2024), who found that technology integration improves student motivation, collaboration, and engagement. The ability of trained teachers to create differentiated learning

materials and adaptive assessments suggests that AI training enabled them to address diverse learning needs more effectively.

The identified challenges (Research Question 3), particularly infrastructure limitations and inconsistent internet connectivity, reflect broader systemic issues in Nigeria's educational technology landscape. These findings underscore that professional development alone is insufficient without addressing underlying infrastructure constraints. The variability in administrative support highlights the importance of institutional commitment to technology integration, consistent with research on transformational leadership in educational technology implementation.

Despite these challenges, teachers demonstrated creativity in adapting AI tools to resource-constrained environments, suggesting resilience and commitment to implementation. This finding has important implications for scaling initiatives, indicating the need for comprehensive support systems addressing both professional development and infrastructure simultaneously.

The regression analysis (Research Question 4, Hypothesis H03), revealing AI knowledge and tool usage as the strongest predictors of teaching skill improvements, provides empirical support for the Technology Acceptance Model. These findings suggest that both conceptual understanding (knowledge) and practical application (usage) are essential for effective technology integration. The significant but smaller contribution of teaching experience suggests that while experience matters, it does not compensate for a lack of AI-specific training.

The model's high explanatory power (64% variance explained) indicates that the training program successfully targeted key factors influencing teaching improvement. This finding has important implications for future program design, suggesting the importance of balancing theoretical knowledge development with practical application opportunities.

Implications for Policy and Practice (Addressing Objective 5)

The positive outcomes support scaling government-supported AI training initiatives across Nigeria's ECE sector. The evidence suggests that comprehensive professional development can effectively transform educator practice when grounded in appropriate theoretical foundations with practical implementation support. However, successful scaling requires addressing infrastructure challenges and ensuring sustained institutional support.

The findings align with Nigeria's broader digital transformation goals and the World Economic Forum (2025) projection that nearly 40% of required workforce skills will change within five years. The demonstrated effectiveness of this pilot program provides an empirical basis for embedding AI literacy into ECE policy frameworks and professional development standards.

Conclusion

Government-supported AI training significantly enhanced early childhood teachers' digital competencies, AI literacy, and teaching confidence in Nigeria, with improvements sustained over three months. The training successfully transformed pedagogical practices, enabling teachers to create personalised learning experiences and increase student engagement despite infrastructure challenges. AI knowledge and tool usage emerged as critical predictors of teaching improvement, explaining 64% of the variance in skill enhancement. The findings confirm that comprehensive professional development addressing both conceptual understanding and practical application can effectively build teacher capacity in resource-constrained contexts. Teachers demonstrated resilience and creativity in adapting AI tools to challenging environments, though sustained success requires simultaneous investment in infrastructure and institutional support systems. The program's effectiveness validates the theoretical integration of the Technology Acceptance Model and Social Cognitive Theory in understanding technology adoption among educators. These results provide empirical support for scaling AI training initiatives as a viable pathway to achieving Nigeria's 70% digital literacy goal by 2027 while enhancing educational quality and equity in early childhood settings.

Recommendations

Based on the findings, the following recommendations are made:

1. **Scale AI Training Nationally:** The Federal Ministry of Education should scale this pilot program to all states, prioritising ECE teachers to maximise impact on foundational learning.

2. Address Infrastructure Challenges: The government should simultaneously invest in educational infrastructure, including reliable internet connectivity and digital devices, to enable effective AI tool implementation.
3. Establish Sustained Support Systems: Create ongoing support mechanisms, including mentorship programs, communities of practice, and refresher training to sustain and deepen initial competency gains.
4. Integrate AI Literacy into Pre-Service Training: Teacher education institutions should incorporate AI literacy and digital competency development into pre-service curricula to prepare future teachers.
5. Strengthen Institutional Leadership: Provide training for school administrators on supporting technology integration to ensure teachers receive the necessary institutional backing.
6. Develop Context-Specific Resources: Create AI tools and educational resources adapted to Nigerian contexts, languages, and cultural considerations.
7. Establish Monitoring and Evaluation Systems: Implement robust systems to track long-term impacts of AI training on educator practice and student outcomes.
8. Foster Public-Private Partnerships: Leverage partnerships with technology companies and development organisations to supplement government resources and expertise.
9. Prioritise Equity: Ensure AI training reaches teachers in rural and underserved areas to prevent widening digital divides.
10. Conduct Longitudinal Research: Support ongoing research examining the long-term sustainability of training impacts and factors influencing successful AI integration in diverse contexts.

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