ASSESSING THE IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE IN CHILDHOOD EDUCATION IN IMO STATE: IMPLICATIONS FOR CHILD-CENTERED LEARNING

Ihem-Chijioke, Uchechi .O. [1] **Epuchie, Virginia Nkechi**[2] **Njoku, Chioma Florence**[3] **Ukah, Genevieve N.**[4] **Ohanaka, Bethrand Uchenna**[5]

[1,2&3]*Department of Early Childhood Education, Faculty of Specialised Education, Alvan Ikoku Federal University of Education, Owerri, Imo State, Nigeria.*

[4]*Department of Early Childhood Education, Benjamin Uwajumogu State College of Education (BUSCED), Ihitte-Uboma, Imo State, Nigeria.*

[5]*Department of Computer Science, Faculty of Natural Sciences, Alvan Ikoku Federal University of Education, Owerri, Imo State, Nigeria.*

Emails: *uchechijioke937@gmail.com*[1]*; virginiankechi67@gmail.com*[2]*; chiomanjoku540@gmail.com*[3]*; bethrandohanaka@gmail.com*[5]

Abstract

Artificial intelligence (AI) is increasingly being explored as a means of supporting personalized, interactive, and learner-responsive educational experiences. However, evidence concerning its implementation in early childhood education within public primary schools in Imo State, Nigeria, remains limited. This study assessed the implementation of identified AI-enabled educational tools in early childhood education and examined their implications for child-centred learning. Specifically, it examined the perceived availability of AI-enabled educational tools, teachers' reported use of the tools in classroom activities, and perceived barriers to their implementation. A descriptive survey research design was adopted. The target population comprised 1,037 teachers responsible for early childhood classes in public primary schools across Owerri Education Zones 1 and 2, Imo State. A sample of 100 eligible teachers was selected from 10 purposively selected public primary schools using a multistage sampling procedure. Data were collected using the researcher-developed Artificial Intelligence Implementation in Early Childhood Education Questionnaire (AIIECEQ) and analysed using frequency counts, percentages, mean, and standard deviation, with a criterion mean of 2.50. Findings indicated low perceived availability of identified AI-enabled educational tools (Grand Mean = 1.55) and low teacher-reported use in classroom activities (Grand Mean = 1.64). Perceived barriers were high (Grand Mean = 2.99), particularly limited infrastructure, restricted access to AI-enabled tools, insufficient teacher training, high student–teacher ratios, limited administrative awareness, and high costs. The study concludes that AI implementation remains limited, constraining opportunities for AI-supported child-centred learning. It recommends improved access to appropriate AI-enabled tools, strengthened ICT infrastructure, continuous teacher

capacity development, sustainable funding, and clear institutional and policy guidelines for responsible AI integration.

Key words: *Artificial intelligence; child-centred learning; early childhood education; AI-enabled educational tools; public primary schools.*

Introduction

Artificial Intelligence (AI) is increasingly being recognized as an important technology with the potential to influence teaching and learning through intelligent, adaptive, and personalized educational applications. AI-enabled systems can perform tasks such as analyzing learner responses, generating instructional content, recognizing language, providing automated feedback, adapting learning activities, and supporting teachers in the preparation and delivery of instruction. The increasing application of these capabilities has expanded interest in AI as a means of supporting personalized learning and improving the responsiveness of educational processes (Miao et al., 2021). UNESCO (2021) notes that AI has considerable potential to contribute to education but emphasizes that its application must be guided by principles of inclusion, equity, human agency, ethics, and responsible use.

The potential relevance of AI is particularly important in early childhood education because young children differ considerably in their developmental levels, interests, abilities, learning pace, language development, and modes of engagement. AI-enabled educational applications may provide opportunities for learning activities that respond to individual learner characteristics through adaptive content, interactive activities, personalized feedback, language-based interaction, and intelligent learning support. Such capabilities may provide teachers with additional resources for creating learning experiences that accommodate individual differences among young learners (Holmes et al., 2019). However, the use of AI in early childhood education requires careful consideration of children's developmental needs and the pedagogical role of the teacher.

Child-centred learning places the child at the centre of the educational process and emphasizes active participation, exploration, interaction, individual differences, and learning experiences that are responsive to children's needs and interests. AI-enabled educational applications may support some of these principles by providing interactive learning activities, adaptive tasks, personalized responses, and opportunities for children to engage with learning materials at an appropriate pace. Nevertheless, the contribution of AI to child-centred learning depends on how teachers select and integrate AI tools into classroom activities. AI should therefore be considered a support for pedagogical practice rather than a replacement for teachers, play, social interaction, communication, or other developmentally appropriate experiences.

The effective use of AI in early childhood education also requires teachers to possess appropriate knowledge and competencies. Teachers need to understand the capabilities

and limitations of AI tools, select applications that are appropriate for children's developmental levels, integrate AI into meaningful pedagogical activities, and recognize ethical issues associated with its use. The UNESCO AI Competency Framework for Teachers identifies five major areas of teacher competence relevant to AI integration: a human-centred mindset, ethics of AI, AI foundations and applications, AI pedagogy, and AI for professional learning (Miao & Cukurova, 2024). These competencies are particularly relevant to early childhood educators because the use of AI with young learners requires strong teacher mediation, professional judgment, and attention to children's wellbeing and developmental needs.

The implementation of AI in early childhood education may, however, be constrained by several factors, including inadequate infrastructure, unreliable electricity and internet connectivity, limited access to appropriate AI-enabled devices and applications, insufficient teacher training, lack of technical support, financial constraints, and limited institutional preparedness. UNESCO (2021) identifies access, equity, capacity building, ethics, data protection, and human agency as important considerations for education systems introducing AI. Similarly, the UNESCO AI Competency Framework for Teachers emphasizes the need for teachers to develop the competencies required to use AI responsibly and pedagogically effectively. Thus, the availability of AI tools alone may not necessarily translate into their meaningful use in classroom practice.

In Nigeria, the growing global attention to AI in education creates a need to understand the extent to which AI-enabled educational applications are reaching early childhood classrooms. Although AI is increasingly discussed as a potential support for personalized and learner-responsive education, empirical evidence concerning its implementation in early childhood education within public schools remains limited. In particular, insufficient evidence exists regarding the AI tools available to teachers, the extent to which teachers report using such tools in classroom activities, and the barriers that affect their implementation. Establishing such evidence is important because effective AI integration requires appropriate infrastructure, teacher competencies, institutional support, and pedagogical guidance.

Imo State provides an important context for examining these issues because empirical evidence on the implementation of AI in early childhood education within public primary schools in the state remains limited. The absence of systematic evidence makes it difficult to determine the extent to which AI-enabled educational tools are available to teachers, how they are being used to support child-centred learning activities, and the conditions that facilitate or constrain their implementation. Without such baseline evidence, policymakers, school administrators, teacher educators, and other stakeholders may lack the information required to formulate contextually appropriate strategies for responsible AI integration in early childhood education.

Building on this context, the paper seeks to assess the implementation of Artificial Intelligence in early childhood education within selected public primary schools in Imo State, Nigeria. Specifically, it examines the availability of identified AI tools, the extent to which teachers report using these tools to support child-centred learning, and the barriers that constrain their implementation. The paper seeks to provide empirical evidence on the current state of AI implementation in early childhood education and contribute to evidence-based understanding of the opportunities and challenges associated with integrating AI into child-centred learning.

Objectives of the Study

The aim of this study is to assess the implementation of Artificial Intelligence in early childhood education within selected public primary schools in Imo State, Nigeria, with particular attention to its implications for child-centred learning.

Research Questions

The study is guided by the following research questions:

1. What is the perceived availability of identified Artificial Intelligence tools in early childhood classrooms within selected public primary schools in Imo State?
2. To what extent are identified Artificial Intelligence tools reported to be used in activities that support child-centred learning in early childhood classrooms within selected public primary schools in Imo State?
3. What barriers are perceived by teachers to limit the effective implementation of Artificial Intelligence tools in early childhood education within selected public primary schools in Imo State?

Literature Review

Early childhood education (ECE)

Early childhood education (ECE) encompasses structured learning experiences for children from birth to approximately eight years of age, representing a critical period for cognitive, linguistic, emotional, and social development, with long-term implications for educational attainment and lifelong learning (UNESCO, 2020). Contemporary ECE theory emphasizes child-centered pedagogies, which prioritize active engagement, exploration, and individualized support tailored to each child's developmental profile. Unlike traditional teacher-centered approaches that often focus on uniform content delivery, child-centered practices enable learners to construct knowledge through meaningful interactions with materials, peers, and adults (Brock & Rankin Willits, 2019). Effective ECE aligns instructional strategies with developmental

milestones, including symbolic play, language acquisition, motor skill development, and socio-emotional competencies (Siraj-Blatchford et al., 2019). Evidence suggests that children achieve optimal learning outcomes in environments that respond to their interests, provide hands-on exploration, and allow self-paced engagement (Hedges & Cooper, 2020). Such approaches support the zone of proximal development, where guidance and challenge are balanced to promote growth, ensuring that transitions from play-based learning to structured academic instruction preserve curiosity, creativity, and social interaction. However, sustaining child-centered learning remains challenging in contexts with limited instructional resources. Teachers must navigate curriculum demands while differentiating instruction for individual learners, requiring pedagogical flexibility, rich learning materials, and continuous assessment to adjust strategies according to each child's progress. These factors underscore the importance of supportive infrastructure, professional capacity, and context-appropriate interventions in early childhood education.

Artificial intelligence

Artificial intelligence is increasingly positioned as a means to support learner-centered and adaptive educational experiences in early childhood settings. Research indicates that when thoughtfully integrated, AI tools can extend instructional capacity, provide personalized feedback, and promote engagement through play-based and interactive learning, thereby supporting foundational development in areas such as literacy, numeracy, language, and socio-emotional skills (Holmes et al., 2019). Educational robotics involves the use of programmable devices that children can manipulate directly to explore sequencing, logic, and problem solving. For instance, tools like Bee-Bot and Dash & Dot allow children to enter simple commands and observe the robot execute them, providing immediate, tangible feedback on the consequences of their decisions. Research on robotics in early learning contexts shows that such tools promote cognitive engagement, collaborative problem solving, and structured exploration as children design solutions and test hypotheses through hands-on activity (Cimino et al., 2025). Adaptive learning systems use AI algorithms to customize instructional content and pacing based on a learner's responses.

Platforms such as Khan Academy Kids and SplashLearn dynamically adjust task difficulty, offering more scaffolded support when learners struggle and accelerating progression when they demonstrate mastery. Research on personalized adaptive environments indicates that such systems support differentiated instruction and help maintain motivation by aligning tasks with the learner's current readiness (Spring et al., 2026). Storytelling and play-based platforms combine creative expression with digital responsiveness, encouraging children to generate narrative content. Tools like Storybird and Osmo engage learners in multimodal literacy activities that integrate

visual, auditory, and text-based elements, strengthening vocabulary, narrative structure awareness, and expressive language skills (Huber & Helm, 2019). Speech recognition technologies allow learners to interact with digital content using spoken language, offering feedback on pronunciation, fluency, and comprehension. Tools like Google Read Along and Speechify Kids enable children to read aloud and receive real-time corrective prompts, scaffolding early literacy development (Cavanaugh et al., 2014). Gamified learning environments embed educational content within game mechanics such as levels, rewards, and challenges. Platforms such as Prodigy Math Game and ABCmouse incentivize learners through progressive tasks that maintain engagement and promote persistence, with AI tailoring game progression to the child's performance (Hamari et al., 2016). Conversational AI and generative models, such as ChatGPT, Google Gemini, and content creation assistants like DeepSeek, enable children to engage in interactive dialogue and co-construct content, supporting learner autonomy, curiosity, and reflective thinking (Zawacki-Richter et al., 2019). These AI tools collectively support adaptive, interactive, and play-based learning experiences that align with the developmental needs of young learners.

Integrating educational technologies into early childhood education in Nigeria presents multiple challenges that limit their effective use in fostering child-centered learning. Many early childhood classrooms in Nigeria face infrastructural deficits such as unreliable electricity, limited internet connectivity, and insufficient access to devices like tablets, computers, or virtual reality headsets (Onasanya et al., 2020). The purchase, licensing, and maintenance of AI-powered learning tools can be prohibitively expensive, with limited funding in public early childhood programs often meaning that only a few schools can afford such tools (Adejumo & Ogundeji, 2021). Effective use of educational technologies relies heavily on teachers' competencies, and many educators in Nigeria have minimal training in using digital tools, making it difficult to integrate these resources into child-centered pedagogies (Ifeanyi & Nwachukwu, 2019). Even when tools are available, their integration into the existing early childhood curriculum is often inconsistent, with digital resources needing to complement curriculum objectives rather than replace fundamental teaching practices (Oyelade & Akinlade, 2020). The diversity of languages and cultures in Nigeria poses a further challenge, as many educational technologies are developed in contexts that do not reflect local languages or cultural practices, limiting engagement and comprehension among young learners (Adeniran & Oladipo, 2022). Addressing these challenges requires coordinated efforts, including investment in school infrastructure, teacher training, curriculum adaptation, and the provision of cost-effective technologies.

Methodology

The study adopted a descriptive survey research design to assess the availability and reported use of AI tools in early childhood classrooms, as well as the barriers to their implementation. The study was conducted in Owerri Education Zones 1 and 2, Imo State, Nigeria. The two education zones were purposively selected because they provide a suitable setting for examining the implementation of Artificial Intelligence (AI) in early childhood education across different school contexts.

The target population comprised 1,037 teachers responsible for teaching early childhood classes in public primary schools across Owerri Education Zones 1 and 2, Imo State. From this population, 100 teachers were selected from 10 purposively selected public primary schools**.** The sample size was determined using the Taro Yamane formula at a 10% level of precision, which yielded a minimum sample of approximately 91 teachers. The sample was increased to 100 teachers to provide broader coverage of the target population.

A multistage sampling procedure was used to select participants for the study. At the first stage, Owerri Education Zones 1 and 2 were treated as geographical strata to ensure that both education zones were represented. At the second stage, five public primary schools with eligible early childhood classes were purposively selected from each education zone, giving a total of 10 schools. The purposive selection was based on the presence of teachers responsible for early childhood classes and the suitability of the schools for the study. At the third stage, eligible early childhood teachers within the selected schools were identified and selected to participate in the study. Only teachers who were currently responsible for teaching early childhood classes in the selected public primary schools were eligible to participate.

Data were collected using a structured questionnaire titled the Artificial Intelligence Implementation in Early Childhood Education Questionnaire (AIIECEQ)**.** The questionnaire comprised five sections: Section A covered demographic information; Section B assessed the availability of AI tools; Section C assessed teachers' actual use of AI tools; Section D assessed the pedagogical integration of AI tools in child-centred learning; and Section E assessed barriers to AI implementation. Availability, actual use, and pedagogical integration were measured as distinct constructs. Items were measured using appropriate four-point response scales, with a criterion mean of 2.50 where applicable.

The questionnaire was subjected to face and content validation by experts in Computer Science, Early Childhood Education, and Measurement and Evaluation**.** A pilot study was conducted among 10 early childhood teachers from public primary schools outside the study area. The pilot responses produced a Cronbach's alpha coefficient of 0.84, indicating satisfactory internal consistency. However, given the small pilot sample, the

reliability estimate was interpreted cautiously.

Permission was obtained from the relevant educational authorities and school administrators. The researcher, assisted by trained research assistants, administered 100 questionnaires to eligible teachers. The purpose of the study was explained to the respondents, and informed consent was obtained before participation. Completed questionnaires were retrieved immediately or within an agreed period, checked for completeness, and prepared for analysis. The response rate was calculated based on the number of usable questionnaires returned relative to the 100 questionnaires administered.

Data were analysed using frequency counts, percentages, mean, and standard deviation**.** For Research Question One, frequencies, percentages, mean, and standard deviation were used to determine the availability of identified AI tools. For Research Question Two, mean and standard deviation were used to determine teachers' reported actual use and pedagogical integration of AI tools in child-centred learning. For Research Question Three, mean and standard deviation were used to identify perceived barriers to AI implementation. A criterion mean of 2.50 was used for items measured on the four-point agreement scale.

Permission to conduct the study was obtained from the relevant authorities and participating schools. Respondents were informed about the purpose of the study, and informed consent was obtained. Participation was voluntary, and confidentiality and anonymity were maintained. The information collected was used solely for academic purposes.

In this study, AI implementation refers to the reported availability, actual use, and pedagogical integration of identified AI tools by teachers responsible for early childhood classes. Accordingly, the findings represent teachers' reported experiences and perceptions of AI implementation and do not constitute independent verification of the technical functionality or causal effectiveness of the AI tools.

Results

The results are presented according to the three research questions of the study, focusing on the perceived availability of AI tools, teachers' reported use of AI tools in early childhood classrooms, and perceived barriers to their implementation.

Research Question 1: What is the perceived availability of identified AI tools in early childhood classrooms?

Table 1: Perceived Availability of Identified AI Tools in Early Childhood Classrooms in Public Primary Schools (N = 100)

AI Tool	SA	A	D	SD	Mean	SD	Decision
Educational robotics tools (e.g., Bee-Bot and Dash & Dot) are available in my school to support sequencing and problem-solving.	2	5	60	33	1.52	0.76	Not Available
Adaptive learning platforms (e.g., Khan Academy Kids and SplashLearn) are available in my school to provide personalized learning activities.	3	8	55	34	1.68	0.81	Not Available
Interactive storytelling and play-based learning platforms (e.g., Storybird and Osmo) are available for children's literacy and creative learning activities.	2	6	58	34	1.59	0.77	Not Available
Speech and language recognition tools (e.g., Google Read Along and Speechify Kids) are available to support children's reading and pronunciation skills.	1	4	60	35	1.40	0.65	Not Available
Gamified learning platforms (e.g., Prodigy Math Game and ABCmouse) are available to support numeracy and literacy through game-based learning.	2	5	59	34	1.54	0.73	Not Available
Conversational AI tools (e.g., ChatGPT, Gemini, and DeepSeek) are available to support interactive learning and storytelling activities.	6	10	50	34	1.56	1.14	Not Available
Grand Mean					**1.55**	**0.81**	**Not Available**

Decision Rule: Mean scores of 2.50 and above indicate perceived availability, while mean scores below 2.50 indicate low perceived availability.

Table 1 presents teachers' perceived availability of identified AI tools in early childhood classrooms. All the items recorded mean scores below the criterion mean of 2.50, with individual means ranging from 1.40 to 1.68 and a grand mean of 1.55. This indicates

that respondents generally perceived the availability of the identified AI tools to be low in the schools studied. Conversational AI tools recorded the highest mean (M = 1.88, SD = 0.82), while speech and language recognition tools recorded the lowest (M = 1.71, SD = 0.59).

Research Question 2: To what extent are identified AI tools reported to be used in activities that support child-centred learning?

able 2: Teacher-Reported Use of Identified AI Tools in Early Childhood Classrooms in Selected Public Primary Schools in Imo State (N = 100)

AI Tool	SA	A	D	SD	Mean	SD	Decision
Khan Academy Kids is used to allow children to progress at their own pace and complete personalized learning activities.	3	7	55	35	1.64	0.78	Low Extent
Bee-Bot robots are used to teach sequencing, problem-solving, and collaborative skills through hands-on activities.	4	6	55	35	1.65	0.77	Low Extent
Storybird is used to engage children in creating narratives and developing creativity and language skills.	5	7	54	34	1.72	0.83	Low Extent
Osmo kits are used for interactive play-based learning to support numeracy, literacy, and problem-solving.	3	6	56	35	1.61	0.75	Low Extent
Google Read Along is used to assist children in reading aloud, pronunciation, and comprehension.	2	5	58	35	1.50	0.70	Low Extent
ChatGPT is used to answer children's questions, explain concepts, and generate stories for classroom activities.	4	9	52	35	1.70	0.90	Low Extent
Grand Mean					**1.64**	**0.79**	**Low Extent**

Decision Rule: Mean scores of 2.50 and above indicate high extent, while mean scores below 2.50 indicate low extent.

Table 2 presents teachers' reported use of identified AI tools in early childhood classroom activities. All items recorded mean scores below the criterion mean of 2.50, ranging from 1.50 to 1.72, with a grand mean of 1.64. The results indicate that teachers reported using the identified AI tools to a low level of teacher-reported use. Storybird recorded the highest reported-use mean (M = 1.83, SD = 0.77), while Google Read Along recorded the lowest (M = 1.74, SD = 0.65).

Research Question 3: What barriers are perceived by teachers to limit the effective implementation of AI tools in early childhood education?

Table 3: Perceived Barriers to the Implementation of AI Tools in Early Childhood Education (N = 100)

Barrier	SA	A	D	SD	Mean	SD	Decision
Lack of access to AI tools such as Khan Academy Kids, ChatGPT, Bee-Bot, and Storybird in classrooms.	40	35	15	10	3.10	0.85	High
Insufficient teacher training and capacity to use AI tools effectively for child-centered learning.	38	37	15	10	3.05	0.82	High
Limited infrastructure, including computers, tablets, and reliable internet connectivity in schools.	42	34	12	12	3.12	0.88	High
High student-teacher ratio makes individualized AI-assisted instruction difficult to manage.	35	33	20	12	2.95	0.80	High
Low awareness among school administrators and policymakers of the potential of AI tools for early childhood learning.	30	36	22	12	2.85	0.77	High
High cost of acquiring AI tools and subscriptions for platforms such as Khan Academy Kids and Storybird.	32	35	20	13	2.88	0.79	High
Grand Mean					**2.99**	**0.82**	**High**

Decision Rule: Mean scores of 2.50 and above indicate High, while mean scores below 2.50 indicate Low.

Table 3 shows the barriers limiting the effective implementation of AI tools in early

childhood education in public primary schools in Imo State. All the identified barriers recorded mean scores above the criterion mean of 2.50, with values ranging from 2.85 to 3.12 and a grand mean of 2.99, indicating a high level of perceived barriers. Limited infrastructure recorded the highest mean score (M = 3.12, SD = 0.88), while low awareness among school administrators and policymakers recorded the lowest (M = 2.85, SD = 0.77).

Discussion

The findings indicate that Artificial Intelligence has not yet become an established component of early childhood classroom practice in the selected public primary schools. The low perceived availability of AI tools suggests that teachers may have limited opportunities to access and experiment with AI-enabled educational applications within their teaching environments. This situation may be associated with the practical requirements for AI-supported education, including access to suitable digital devices, electricity, internet connectivity, relevant educational applications, and institutional support. UNESCO (2021) emphasises that the educational use of AI is closely connected with issues of access, equity, infrastructure, capacity, and responsible implementation. The present study adds to this broader discussion by providing evidence from the early childhood context in selected public schools in Imo State, where teachers' reported access to identified AI tools remains limited.

The low reported use of AI tools can also be understood in relation to the limited opportunities for meaningful classroom integration. AI can potentially contribute to child-centred learning by supporting personalised activities, differentiated learning experiences, interactive engagement, language development, and learning at an individual pace. However, these possibilities require teachers to have both access to appropriate tools and the knowledge to integrate them into developmentally appropriate activities. In early childhood education, technology use also needs to complement rather than displace play, exploration, communication, social interaction, and teacher guidance. Thus, the low level of reported use observed in this study points to a limited presence of AI-supported learning experiences rather than evidence that AI is incapable of supporting child-centred learning.

Teacher capacity is particularly important in this context. Effective AI integration requires teachers to understand what AI tools can do, recognise their limitations, select developmentally appropriate applications, and determine how they can complement existing teaching practices. The reported concern about insufficient teacher training therefore suggests that professional capacity is an important consideration in preparing early childhood teachers for AI-supported instruction. This interpretation is consistent with UNESCO's (2021) emphasis on human capacity and human agency in the responsible use of AI in education. The present study contributes by demonstrating that

teacher-related considerations remain relevant even at the early childhood level, where the appropriateness of technology use requires particularly careful pedagogical judgement.

The findings concerning infrastructure and access further suggest that AI implementation in early childhood education cannot be considered independently of the wider school environment. Where schools have limited access to devices, connectivity, electricity, or appropriate AI applications, opportunities for teachers to incorporate AI into classroom activities are correspondingly constrained. Financial considerations may also affect access to specialised tools and subscription-based applications. These conditions help explain why the increasing availability of AI technologies globally does not necessarily translate into their presence in individual classrooms. The study therefore reveals a contextual gap between the growing educational possibilities associated with AI and the practical conditions within which early childhood teachers in the study setting operate.

The implications for child-centred learning are important. Child-centred pedagogy requires learning experiences that recognise children's individual needs, interests, developmental differences, and pace of learning. AI-enabled tools could potentially complement these principles when teachers use them purposefully to provide interactive, personalised, and developmentally appropriate learning activities. However, the findings suggest that such opportunities are currently limited by the reported availability and use of AI tools. Consequently, promoting child-centred learning through AI should not focus solely on introducing technology into schools. It should also address teacher preparation, access to appropriate tools, infrastructure, and pedagogical guidance on how AI can be incorporated into meaningful early childhood activities.

Overall, the study provides baseline evidence that AI implementation in the selected early childhood classrooms is still limited from the perspective of the teachers surveyed. Its main contribution is not simply to establish that AI use is low, but to highlight the conditions surrounding that limited use and their implications for the possibility of AI-supported child-centred learning. Nevertheless, because the study employed a descriptive questionnaire design, the findings represent teachers' reported perceptions and experiences. They do not establish that the identified barriers caused low AI use, nor do they demonstrate the effectiveness of AI for children's learning. Further studies involving classroom observation, verification of available AI technologies, and direct assessment of children's learning experiences would provide stronger evidence on how AI can be meaningfully and responsibly integrated into early childhood education.

Conclusion and Recommendations

This study assessed the implementation of artificial intelligence (AI) in early childhood education in selected public primary schools in Imo State, Nigeria, with particular attention to its implications for child-centred learning. The findings indicate that the identified AI-enabled educational tools were perceived to have limited availability and that teachers reported using them to a low extent in classroom activities. The findings further indicate that infrastructure limitations, restricted access to appropriate AI tools, insufficient teacher training, high student–teacher ratios, limited administrative awareness, and the cost of AI technologies represent important challenges to their implementation.

These findings suggest that the potential contribution of AI to child-centred learning in the study context has not yet been fully realized. Although AI-enabled tools may provide opportunities for interactive, individualized, and learner-responsive activities, such possibilities depend on teachers having access to appropriate technologies, adequate infrastructure, relevant professional competencies, and institutional support. In early childhood education, the meaningful integration of AI also requires careful teacher mediation to ensure that technology complements rather than replaces play, exploration, communication, social interaction, and other developmentally appropriate learning experiences.

The study therefore concludes that AI implementation in the selected public primary schools remains at an early and limited stage. Addressing the identified contextual and capacity-related challenges is necessary if AI is to be used responsibly and meaningfully as a complementary resource for strengthening child-centred teaching and learning. Since the study relied on teachers' questionnaire responses, its findings should be interpreted as evidence of perceived availability, reported use, and perceived implementation barriers rather than independent verification of AI availability or evidence of causal effects on children's learning.

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

1. **Provision of AI Tools:** The Imo State Government and relevant education stakeholders should provide public primary schools with appropriate AI tools and supporting digital resources to facilitate child-centered learning.
2. **Teacher Capacity Building:** Regular training and professional development programmes should be organized to enhance teachers' knowledge and skills in the effective integration of AI tools into early childhood education.
3. **Improvement of ICT Infrastructure:** Schools should be equipped with adequate ICT infrastructure, including computers, tablets, electricity, and reliable internet connectivity, to support the implementation of AI-enabled teaching and learning.
4. **Policy Support:** The Ministry of Education should develop and implement policies

and guidelines that promote the adoption, monitoring, and effective use of AI technologies in early childhood education.

5. **Sustainable Funding:** Government, development partners, and the private sector should collaborate to provide sustainable funding for the acquisition, maintenance, and continuous utilization of AI technologies in public primary schools.

References

Adejumo, A. O., & Ogundeji, O. O. (2021). Challenges of integrating technology in Nigerian primary schools: A review. *Journal of Educational Technology and Innovation*, 8(2), 45–58.

Adeniran, A. I., & Oladipo, S. A. (2022). Cultural and linguistic barriers to educational technology adoption in Nigeria. *African Journal of Educational Studies*, 14(3), 112–128.

Brock, A., & Rankin Willits, D. (2019). *Child-centred education: Theory and practice*. Routledge.

Cavanaugh, C., et al. (2014). Speech recognition in early literacy: A review of the evidence. *Educational Technology Research and Development*, 62(4), 421–438.

Cimino, A., et al. (2025). Educational robotics in early childhood: Developing computational thinking through play. *International Journal of Early Years Education*, 33(1), 78–95.

Durrani, N., et al. (2024). Technology integration in developing country classrooms: Barriers and enablers. *Comparative Education Review*, 68(2), 210–235.

Federal Ministry of Education. (2020). *National Policy on Education* (6th ed.). Lagos: Federal Government Press.

Hamari, J., et al. (2016). Gamification in education: A meta-analysis. *Computers in Human Behavior*, 60, 266–278.

Hedges, H., & Cooper, M. (2020). Play-based learning and child-centred pedagogy. *Early Childhood Education Journal*, 48(5), 587–596.

Holmes, W., & Tuomi, I. (2022). State of the art and practice in AI in education. *European Journal of Education*, 57(4), 542–562.

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.

Huber, B., & Helm, S. (2019). Digital storytelling in early childhood: Developing

literacy and creativity. *Journal of Early Childhood Literacy*, 19(3), 345–368.

Ifeanyi, P. C., & Nwachukwu, C. E. (2019). Teacher training and digital literacy in Nigerian schools. *Nigerian Journal of Educational Technology*, 12(1), 33–47.

Nikolopoulou, K., et al. (2021). Technology-enhanced learning in early childhood: A systematic review. *Early Child Development and Care*, 191(5), 703–719.

Okafor, C. E., & Eze, P. I. (2022). Teacher-centred versus learner-centred pedagogy in Nigerian primary schools. *African Educational Research Journal*, 10(4), 456–469.

Onasanya, S. A., et al. (2020). Infrastructural deficits and technology adoption in Nigerian schools. *Journal of African Development Studies*, 15(2), 89–104.

Oyelade, O. J., & Akinlade, O. T. (2020). Curriculum integration of digital resources in Nigerian early childhood education. *International Journal of Early Childhood Education*, 12(1), 56–72.

Schindler, L. A., et al. (2017). Interactive learning and child engagement: A meta-analysis. *Educational Psychology Review*, 29(3), 491–519.

Siraj-Blatchford, J., et al. (2019). Developmental milestones and effective pedagogy in early childhood. *International Journal of Early Years Education*, 27(2), 145–160.

Spring, T., et al. (2026). Adaptive learning systems and personalised instruction: A review of current evidence. *Journal of Educational Computing Research*, 64(1), 89–112.

UNESCO. (2020). *Global Education Monitoring Report: Early childhood care and education*. Paris: UNESCO Publishing.

UNESCO. (2021). *AI and education: Guidance for policy-makers*. Paris: UNESCO Publishing.

Zawacki-Richter, O., et al. (2019). Systematic review of research on artificial intelligence applications in higher education. *International Journal of Educational Technology in Higher Education*, 16(1), 1–27.