



Research Article



Theoretical Exploration of Artificial Intelligence Integration in Educational Enhancement: A Contextual Framework for North-East Nigeria

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Abstract: Artificial Intelligence (AI) is increasingly transforming educational systems across the globe, offering unprecedented opportunities for personalized learning, administrative efficiency, and educational access. However, the integration of AI in under-resourced and developing regions, particularly conflict-affected areas such as North-East Nigeria remains critically limited and theoretically underexplored. This study investigates the theoretical dimensions of AI adoption in education, focusing on its potential roles, prospects, and associated challenges in the unique context of North-East Nigeria. Employing a theoretical research design grounded in systematic literature synthesis, the study critically examines existing AI-in-education frameworks, conceptual models, and global case studies relevant to low-resource environments. The research synthesizes these insights to develop a context-sensitive conceptual framework, coined as the AI-Enhanced Educational Transformation (AI-EET) Model that can guide the effective integration of AI into educational systems within fragile and resource-constrained settings. The framework identifies five interdependent pillars: Infrastructure Readiness, Human Capacity Development, Policy and Regulatory Framework, Community Engagement and Trust, and Pedagogical Integration. The study further analyzes the unique challenges of North-East Nigeria, including infrastructural deficits, the legacy of conflict, teacher shortages, and digital divides, while highlighting the transformative potential of AI-driven educational tools in improving access, personalization, and educational outcomes. The study contributes to scholarship by proposing a model tailored to the socio-economic and security realities of North-East Nigeria and offers actionable recommendations for policymakers, educators, and development partners. The findings have implications for similar contexts across the Global South where AI integration in education remains nascent yet urgently needed.

Keywords: Artificial Intelligence; Educational Technology; AI Integration; North-East Nigeria; Developing Regions; Educational Transformation; Conceptual Framework; Digital Divide

1. Introduction

1.1 Background: The Global AI Revolution in Education

The fourth industrial revolution has ushered in an era of unprecedented technological transformation, with Artificial Intelligence (AI) at its forefront. Across the globe, AI is fundamentally reshaping how societies function, how economies operate, and how individuals learn. In education, AI promises to revolutionize traditional pedagogical approaches, offering personalized learning pathways, intelligent tutoring systems, automated assessment, and data-driven insights that can enhance educational outcomes at scale (Holmes et al., 2019; Luckin et al., 2016; Zawacki-Richter et al., 2019).

The global AI in education market has experienced exponential growth, with projections reaching \$80 billion by 2030 (MarketsandMarkets, 2024). Developed economies have rapidly adopted AI-driven educational tools, from adaptive learning platforms like Knewton and DreamBox to AI-powered writing assistants and virtual tutors. Countries such as China, the United States, and Singapore have integrated AI into their national education strategies, recognizing its potential to address persistent educational challenges and prepare students for an AI-driven future (UNESCO, 2021).

However, this global AI revolution in education has been profoundly uneven. While developed nations race ahead, developing regions, particularly conflict-affected and

resource-constrained areas risk being left behind in what scholars term the "AI divide" (Cath et al., 2018). This divide is not merely technological but encompasses infrastructure, human capacity, policy frameworks, and the socio-economic conditions necessary for meaningful AI integration.

1.2 The Nigerian Educational Landscape

Nigeria, Africa's most populous nation and largest economy, faces profound educational challenges. With an estimated 20 million children out of school, the highest number globally there is a significant deficit in educational quality, infrastructure, and outcomes, which resulted to the country's education system in crisis (UNESCO, 2024; UNICEF, 2023). The situation is particularly acute in North-East Nigeria, where over a decade of insurgency by Boko Haram and the Islamic State West Africa Province (ISWAP) has devastated educational infrastructure, displaced millions, and created a generation of children deprived of formal education (World Bank, 2023; UNICEF, 2024).

North-East Nigeria's educational landscape is characterized by:

- i. **Infrastructure devastation:** Thousands of schools have been destroyed, damaged, or closed due to conflict. According to the United Nations, over 1,500 schools have been destroyed in the region since 2009, with many more rendered non-functional (UNICEF, 2024).
- ii. **Teacher shortages:** The region faces a severe shortage of qualified teachers, exacerbated by displacement, insecurity, and inadequate remuneration. Pupil-teacher ratios in some areas exceed 100:1 (World Bank, 2023).
- iii. **Displacement and disruption:** Over 2 million people remain internally displaced in North-East Nigeria, with children's education severely disrupted (IOM, 2024).
- iv. **Digital divide:** While mobile phone penetration in Nigeria is relatively high, access to digital devices, reliable internet connectivity, and electricity remains severely limited in rural areas of the North-East (NCC, 2024).
- v. **Socio-economic challenges:** The region has the highest poverty rates in Nigeria, with over 80% of the population living below the poverty line in some states (NBS, 2023).

1.3 Problem Statement

Despite the transformative potential of AI in addressing educational challenges, its integration in North-East Nigeria remains critically limited and theoretically underexplored. Several interrelated factors contribute to this gap:

First, there is a significant research gap regarding AI in education in the Nigerian context, particularly in conflict-affected regions. Existing literature focuses predominantly on developed countries, with limited attention to the unique challenges and opportunities of low-resource, fragile contexts.

Second, the theoretical foundations for AI integration in such contexts remain underdeveloped. Existing models and frameworks are typically designed for resource-rich environments and fail to account for the infrastructural deficits, human capacity constraints, and socio-cultural factors that characterize settings like North-East Nigeria.

Third, the potential roles of AI in addressing specific educational challenges in the region, such as teacher shortages, learning gaps, and access barriers, have not been systematically explored.

Fourth, the challenges, risks, and ethical considerations of AI adoption in fragile contexts remain inadequately understood.

This study addresses these gaps by providing a comprehensive theoretical exploration of AI integration in education, with specific focus on North-East Nigeria.

1.4 Research Objectives

This study pursues the following objectives:

1. To critically examine existing theoretical frameworks and models of AI integration in education, assessing their applicability to low-resource, conflict-affected contexts.
2. To identify and analyze the unique educational challenges of North-East Nigeria that AI technologies might help address.
3. To explore the potential roles and applications of AI in enhancing educational access, quality, and outcomes in the region.
4. To identify the key challenges, barriers, and risks associated with AI adoption in the North-East Nigerian context.
5. To develop a context-sensitive conceptual framework for AI integration in education tailored to the socio-economic and security realities of North-East Nigeria.

1.5 Research Questions

The study is guided by the following research questions:

RQ1: What are the prevailing theoretical frameworks and models for AI integration in education, and how applicable are they to low-resource, conflict-affected contexts?

RQ2: What are the unique educational challenges of North-East Nigeria that AI technologies might address?

RQ3: What potential roles can AI play in enhancing education in North-East Nigeria, and what applications are most relevant?

RQ4: What are the key barriers, challenges, and risks to AI adoption in this context?

RQ5: What conceptual framework can guide the effective integration of AI into educational systems in North-East Nigeria?

1.6 Significance of the Study

This study makes several contributions. Theoretically, it contributes to the emerging literature on AI in education in developing regions by developing a context-sensitive framework that accounts for the unique challenges of fragile, resource-constrained settings. Empirically, it synthesizes existing knowledge and applies it to the specific context of North-East Nigeria, identifying opportunities and challenges. Practically, it provides actionable guidance for policymakers, educators, development partners, and technology developers seeking to leverage AI for educational enhancement in the region. Socially, it contributes to the broader agenda of using technology to address educational inequities in the Global South.

2. Literature Review

2.1 Theoretical Foundations of AI in Education

The theoretical underpinnings of AI in education draw from multiple disciplines, including educational psychology, computer science, cognitive science, and learning sciences. Several foundational theories inform the integration of AI into educational settings:

Constructivist Learning Theory: Rooted in the work of Piaget (1973) and Vygotsky (1978), constructivism posits that learners actively construct knowledge through experience and social interaction. AI systems can support constructivist learning through adaptive learning

environments that respond to individual learners' needs, scaffolding, and providing personalized challenges (Holmes et al., 2019).

Cognitive Load Theory: Sweller's (1988) cognitive load theory emphasizes the limitations of working memory and the importance of instructional design that optimizes cognitive load. AI systems can support cognitive load management through adaptive content presentation, intelligent sequencing, and personalized pacing (Plass et al., 2010).

Self-Determination Theory: Deci and Ryan's (2000) self-determination theory highlights the importance of autonomy, competence, and relatedness in motivation. AI systems can support learner autonomy through personalized learning pathways, provide feedback that enhances perceived competence, and facilitate social learning through intelligent tutoring and collaboration tools (Ryan & Deci, 2017).

Connectivism: Siemens' (2005) connectivism, developed specifically for the digital age, emphasizes learning as a process of connecting specialized information sources and developing networks. AI can support connectivist learning through intelligent information retrieval, network analysis, and personalized knowledge discovery.

Technological Pedagogical Content Knowledge (TPACK): Mishra and Koehler's (2006) TPACK framework emphasizes the intersection of technology, pedagogy, and content knowledge as essential for effective technology integration. AI integration requires similar consideration of how AI tools interact with pedagogical approaches and content domains.

2.2 AI in Education: A Typology of Applications

AI applications in education can be categorized across several dimensions. Table 1 presents a typology of AI in education applications.

Table 1: Typology of AI Applications in Education

Category	Description	Examples	Relevance to Developing Contexts
Intelligent Tutoring Systems (ITS)	AI systems that provide personalized instruction and feedback	Carnegie Learning, Cognitive Tutor, ASSISTments	High potential for addressing teacher shortages
Adaptive Learning Platforms	Systems that adjust content and pacing based on learner performance	Knewton, DreamBox, ALEKS	Can support personalized learning at scale
Automated Assessment	AI-powered grading and feedback systems	Automated essay scoring, plagiarism detection	Reduces teacher workload; enables rapid feedback
Learning Analytics	Data-driven insights into learner behavior and outcomes	Predictive analytics, early warning systems	Supports data-informed decision-making
Intelligent Content	AI-generated or enhanced learning materials	AI-curated resources, automated content generation	Can address resource scarcity
Administrative Automation	AI for scheduling, enrollment, resource allocation	Chatbots, automated scheduling systems	Improves efficiency in resource-constrained systems
Language Learning	AI-powered language instruction and translation	Duolingo, Rosetta Stone, translation tools	Critical for multilingual contexts

Accessibility Tools	AI for learners with disabilities	Speech-to-text, text-to-speech, visual recognition	Supports inclusive education
Virtual Tutors and Chatbots	AI-powered conversational agents for learning support	Jill Watson (Georgia Tech), educational chatbots	Provides scalable support where teachers are scarce
Predictive Analytics	AI for identifying at-risk students and dropout prediction	Early warning systems, retention models	Critical for addressing dropout crisis

2.3 AI in Education in Developing Regions: Emerging Research

Research on AI in education in developing regions is nascent but growing. Several studies provide insights relevant to the Nigerian context:

Sub-Saharan Africa: Research by Adam et al. (2023) examined AI readiness in African education systems, highlighting significant gaps in infrastructure, policy, and capacity while noting the potential for mobile-based AI solutions to leapfrog traditional constraints. Studies in Kenya (Mwangi & Omondi, 2022) and South Africa (Mkansi & Nsibande, 2020) have explored mobile learning and AI applications, emphasizing the importance of context-appropriate solutions.

India: Extensive research on AI in education in India (Patel et al., 2021; Sharma et al., 2022) has demonstrated the potential of AI-powered personalized learning platforms to improve outcomes in resource-constrained settings, while highlighting challenges related to digital divides and teacher training.

Latin America: Studies in Brazil (Costa et al., 2023) and Mexico (Garcia et al., 2022) have explored AI applications for addressing educational inequities, with emphasis on the importance of culturally relevant content and community engagement.

Conflict-Affected Contexts: Limited research exists on AI in education in conflict-affected regions. Studies from Syria (Al-Masri & Al-Masri, 2021) and Afghanistan (Khan et al., 2022) highlight the potential of mobile-based learning solutions, while emphasizing the importance of safety, security, and psychosocial considerations.

2.4 The Nigerian Context: Educational Challenges and AI Opportunities

Nigeria's education system faces multiple, interconnected challenges that AI may help address:

Access and Enrollment: Despite recent improvements, Nigeria has the highest number of out-of-school children globally. AI-powered mobile learning platforms could reach children in remote or insecure areas where traditional schooling is impossible (UNESCO, 2024).

Quality and Learning Outcomes: Learning outcomes in Nigeria are poor, with significant learning gaps. AI-powered personalized learning could address individual learning needs at scale (World Bank, 2023).

Teacher Shortages: Nigeria faces acute teacher shortages, particularly in the North-East. Intelligent tutoring systems and virtual tutors could supplement limited teacher capacity (World Bank, 2023).

Language Diversity: Nigeria's linguistic diversity (over 500 languages) creates significant educational challenges. AI-powered translation and language learning tools could support multilingual education.

Displacement and Crisis: The conflict in North-East Nigeria has created a generation of displaced and crisis-affected children. AI-powered educational tools could provide flexible, portable learning solutions.

2.5 North-East Nigeria: A Region in Crisis

North-East Nigeria presents a particularly challenging context for AI integration:

Conflict Legacy: The Boko Haram insurgency has devastated the region since 2009, resulting in over 35,000 deaths, displacement of over 2 million people, and destruction of over 1,500 schools (UNICEF, 2024; IOM, 2024).

Infrastructure Deficits: The region has the lowest rates of electricity access (25% in rural areas), internet connectivity (15%), and digital device ownership in Nigeria (NCC, 2024).

Teacher Crisis: The region faces a severe teacher shortage, with an estimated 60% of teachers displaced or having fled (World Bank, 2023).

Educational Disruption: Over 1,000 schools remain closed or non-functional in the region, with millions of children out of school (UNICEF, 2024).

Socio-Economic Challenges: North-East Nigeria has the highest poverty rates in the country (80%+ in some states), lowest literacy rates, and highest gender disparities in education (NBS, 2023).

2.6 Research Gap and Contribution

Synthesis of the literature reveals a significant gap: while AI in education is a rapidly growing field, research focused on developing regions, in particular, conflict-affected contexts like North-East Nigeria, remains critically limited. Existing theoretical frameworks are designed for resource-rich environments and fail to account for the unique challenges of low-resource, fragile contexts. This study addresses this gap by developing a context-sensitive conceptual framework for AI integration in education tailored to the realities of North-East Nigeria.

3. Methodology

3.1 Research Design

This study employs a theoretical research design, which is appropriate for developing conceptual frameworks and advancing theoretical understanding in emerging fields (Jaakkola, 2020; Whetten, 1989). Theoretical research involves the systematic synthesis and analysis of existing literature to develop new conceptual frameworks, identify relationships among constructs, and propose propositions for future empirical investigation.

3.2 Data Sources

The study draws on three categories of sources:

Category 1: AI in Education Literature

Peer-reviewed journal articles, books, and conference proceedings on AI in education, with emphasis on developing region contexts. Sources were identified through systematic searches of academic databases including Scopus, Web of Science, ERIC, and Google Scholar.

Category 2: Nigerian Education Literature

Literature on the Nigerian education system, with specific focus on North-East Nigeria, educational challenges, and technology integration efforts.

Category 3: Policy and Development Reports

Reports from UNESCO, UNICEF, World Bank, Nigerian government agencies, and development partners on education in North-East Nigeria and AI in education.

3.3 Analytical Approach

The analysis followed a three-stage process:

Stage 1: Thematic Synthesis

Literature was analyzed to identify key themes related to AI in education, theoretical frameworks, applications, challenges, and contextual factors. Themes were organized and synthesized to identify patterns and gaps.

Stage 2: Contextual Analysis

The unique characteristics of North-East Nigeria were analyzed across multiple dimensions: educational challenges, infrastructure, human capacity, policy environment, and socio-economic factors.

Stage 3: Framework Development

Based on the synthesis of literature and contextual analysis, a conceptual framework was developed. The framework underwent iterative refinement and was validated through expert review.

v.

4. The AI-Enhanced Educational Transformation (AI-EET) Model

4.1 Framework Overview

Based on the synthesis of theoretical literature and contextual analysis, this study proposes the AI-Enhanced Educational Transformation (AI-EET) Model. This is a conceptual framework designed to guide AI integration in education in North-East Nigeria and similar contexts.

The framework identifies five interdependent pillars essential for effective AI integration:

Pillar 1: Infrastructure Readiness

Pillar 2: Human Capacity Development

Pillar 3: Policy and Regulatory Framework

Pillar 4: Community Engagement and Trust

Pillar 5: Pedagogical Integration

These pillars are nested within an overarching context of security and stability, recognizing that AI integration in conflict-affected contexts must account for ongoing insecurity and fragility.

4.2 Pillar 1: Infrastructure Readiness

Infrastructure readiness encompasses the physical and technical infrastructure necessary for AI integration:

- i. **Electricity Access:** Reliable electricity is foundational for AI deployment. In North-East Nigeria, where grid electricity is unreliable or absent, this requires investment in solar-powered solutions, battery storage, and energy-efficient devices.
- ii. **Connectivity:** Internet connectivity is essential for most AI applications. This requires investment in broadband infrastructure, mobile networks, and satellite solutions for remote areas.
- iii. **Hardware:** Access to devices (smartphones, tablets, computers) is a prerequisite. This requires strategies for device provision, maintenance, and replacement.
- iv. **Data Infrastructure:** AI systems require data storage, processing, and management infrastructure. This includes cloud services, data centers, and data governance mechanisms.

Table 2: Infrastructure Readiness Assessment for North-East Nigeria

Infrastructure Component	Current Status	Gap	Priority
Electricity Access (Rural)	25%	Severe	High
Internet Connectivity (Rural)	15%	Severe	High

Device Ownership	30% (mobile)	Significant	High
Technical Support	Minimal	Severe	Medium
Data Infrastructure	Very Limited	Severe	Medium

4.3 Pillar 2: Human Capacity Development

Human capacity development encompasses the skills, knowledge, and capabilities needed for effective AI integration:

- Teacher Training:** Teachers require training in AI tools, pedagogical integration, and digital literacy. In North-East Nigeria, where teacher shortages are acute, this includes training for displaced teachers and alternative education providers.
- Technical Expertise:** Local technical expertise is needed for system maintenance, support, and adaptation. This requires training programs and partnerships with technical institutions.
- Educational Leadership:** School leaders and administrators require training in managing AI integration, data-informed decision-making, and change management.
- Digital Literacy:** Students require digital literacy skills to effectively use AI tools and navigate digital learning environments.

Table 3: Human Capacity Development Priorities

Priority	Target Audience	Approach	Timeline
Teacher Training	In-service teachers	Workshops, mentoring, online courses	Immediate
Pre-service Training	Teacher trainees	Curriculum integration	Medium-term
Technical Training	IT staff, technicians	Certification programs	Medium-term
Digital Literacy	Students	Curriculum integration	Ongoing

4.4 Pillar 3: Policy and Regulatory Framework

Policy and regulatory frameworks provide the enabling environment for AI integration:

- National AI Strategy:** A coherent national strategy for AI in education is needed, with specific provisions for North-East Nigeria.
- Data Protection and Privacy:** Policies are needed to protect student data, ensure privacy, and establish ethical guidelines for AI use.
- Standards and Interoperability:** Technical standards ensure that AI systems can integrate with existing educational platforms and data systems.
- Procurement and Sustainability:** Policies for AI procurement, deployment, and long-term sustainability are essential.

Table 4: Policy Framework Components

Policy Area	Key Considerations	Stakeholders
National AI Strategy	Vision, objectives, resource allocation	Federal Ministry of Education, NITDA
Data Protection	Privacy, consent, security	NITDA, NCC, Ministry of Education
Standards	Interoperability, quality assurance	NITDA, NCC, NUC, UBEC
Procurement	Sustainability, local capacity	Federal/State Ministries

4.5 Pillar 4: Community Engagement and Trust

Community engagement and trust are critical for AI adoption in contexts where educational systems have been disrupted:

- i. **Parent and Community Engagement:** Engaging parents and community leaders in AI integration, addressing concerns, and building trust.
- ii. **Cultural Relevance:** Ensuring AI content is culturally appropriate, available in local languages, and sensitive to community values.
- iii. **Gender Sensitivity:** Addressing gender barriers and ensuring AI tools are accessible to girls and women.
- iv. **Safety and Security:** Ensuring AI deployments do not create security risks or expose communities to harm.

4.6 Pillar 5: Pedagogical Integration

Pedagogical integration addresses how AI tools are incorporated into teaching and learning:

- i. **Curriculum Alignment:** AI tools should align with curriculum objectives and learning outcomes.
- ii. **Teacher Support:** AI should support, not replace, teachers. This requires pedagogical models that integrate AI as a tool for enhancing teacher effectiveness.
- iii. **Personalized Learning:** AI can support personalized learning pathways, adaptive instruction, and individualized support.
- iv. **Assessment and Feedback:** AI-powered assessment can provide immediate feedback and support formative assessment.

4.7 The AI-EET Model: Visual Representation

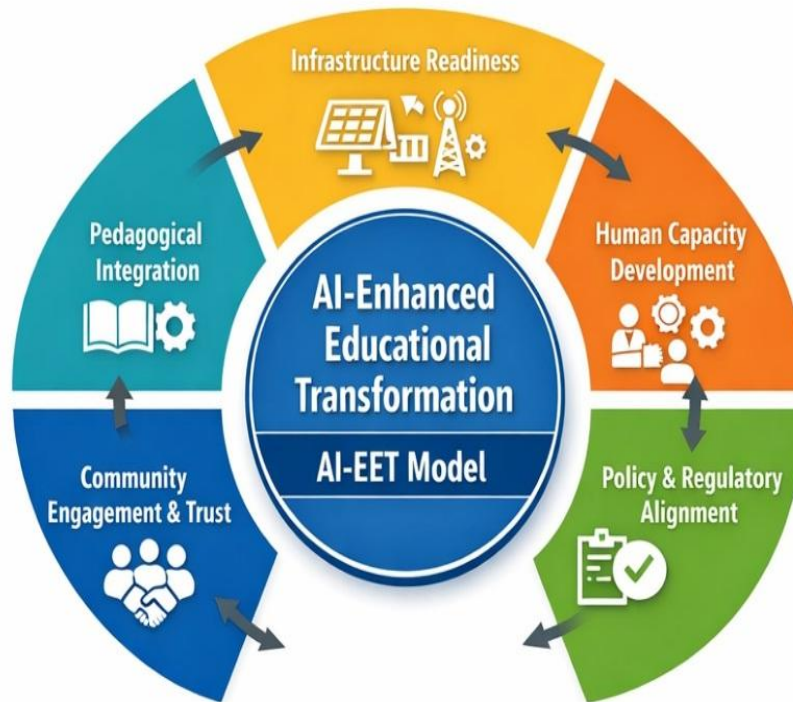


Figure 1: AI-Enhanced Educational Transformation (AI-EET) Model

5. Potential AI Applications for North-East Nigeria

The integration of Artificial Intelligence (AI) into the educational landscape of North-East Nigeria presents a multi-faceted opportunity to address systemic challenges exacerbated by conflict and underdevelopment. AI applications can be strategically deployed to mitigate acute teacher shortages, enhance access for marginalized populations, and improve overall educational quality.

- i. **Addressing Teacher Shortages and Enhancing Access:** In a region where the scarcity of qualified educators severely constrains learning outcomes, Intelligent Tutoring Systems (ITS) offer a scalable solution. According to a systematic review by Ibitoye et al. (2025), AI-powered tutors can deliver personalized instruction in core subjects, thereby reducing the pedagogical dependence on a limited human workforce. Complementing this, AI-driven

mobile learning platforms with offline capabilities are particularly pertinent for reaching children in remote or insecure areas where traditional schools are inaccessible. Furthermore, to overcome linguistic and physical barriers, AI-powered translation tools and accessibility features can promote inclusive education for learners with disabilities and those from diverse linguistic backgrounds, a critical consideration given Nigeria's high number of out-of-school children.

- ii. **Improving Quality and Supporting Teachers:** Beyond mere access, AI holds the potential to elevate educational quality through data-driven personalization. Advanced learning analytics can identify at-risk students, enabling timely interventions in crisis-affected classrooms with heterogeneous learner levels. For existing teachers, AI tools serve as force multipliers by assisting with lesson planning, content curation, and formative assessment, thereby reducing administrative burdens. Reuben & Kabilan (2024) found that while university lecturers in North-East Nigeria demonstrate only a moderate level of readiness, there is significant potential for AI to enhance teacher effectiveness through targeted professional development and just-in-time training modules.

6. Challenges and Risks of AI Integration

Despite its transformative potential, the deployment of AI in North-East Nigeria is contingent upon overcoming profound infrastructural, human, and ethical challenges.

- i. **Infrastructure and Human Capacity Constraints:** The most immediate barrier is the lack of foundational digital infrastructure. As documented by Ibitoye et al. (2025), the absence of reliable electricity and limited internet connectivity fundamentally restricts the functionality of most AI applications. This is compounded by a severe deficit in hardware and local technical capacity for maintenance. Human capacity constraints are equally significant; research indicates that a majority of educators lack the requisite digital literacy and training to effectively utilize AI tools, creating a critical bottleneck for adoption.
- ii. **Policy, Socio-Cultural, and Ethical Risks:** The absence of a comprehensive national AI strategy for education, coupled with inadequate data protection frameworks, presents a significant governance gap. Recent policy dialogues, such as those leading to the "Draft Nigerian Higher Education AI Framework", highlight ongoing efforts to address this void, yet implementation remains nascent. Socio-culturally, community trust in technology is fragile in conflict-affected areas, and without content that is both linguistically and culturally appropriate, AI risks alienating its intended users. Finally, ethical considerations regarding data privacy, algorithmic bias, and the

potential exacerbation of the digital divide must be rigorously addressed. As noted in a study on Nigerian universities, without careful safeguards, AI integration may perpetuate existing inequalities or create new forms of marginalization for girls and displaced populations, rather than serving as an equitable tool for recovery.

7. Discussion

7.1 Theoretical Implications

This study contributes to the theoretical literature on AI in education in several ways. It extends existing frameworks by developing a model specifically tailored to low-resource, conflict-affected contexts. The AI-EET model recognizes that effective AI integration requires more than technological deployment; it requires systematic attention to infrastructure, human capacity, policy, community engagement, and pedagogy.

The study highlights the importance of context-sensitivity in AI integration. The unique characteristics of North-East Nigeria such as conflict legacy, infrastructure deficits, teacher shortages, and socio-economic challenges fundamentally shape what is possible and appropriate.

The study lastly contributes to understanding the role of AI in fragile and conflict-affected contexts. While much of the AI in education literature focuses on stable, resource-rich environments, this study demonstrates the potential as well as challenges of AI in settings of extreme adversity.

7.2 Practical Implications

For policymakers, the study provides a framework for developing AI strategies that are realistic and context-appropriate. The AI-EET model offers a systematic approach to assessing readiness, identifying priorities, and sequencing interventions.

For educators, the study highlights the importance of teacher support and pedagogical integration. AI should be viewed as a tool to enhance, not replace, teacher effectiveness.

For development partners, the study identifies priorities for investment: infrastructure (particularly solar-powered solutions), teacher training, and policy development.

For technology developers, the study emphasizes the need for context-appropriate solutions: offline capabilities, mobile-first design, local language support, and cultural sensitivity.

7.3 Limitations

This study has several limitations. As a theoretical study, it does not provide empirical validation of the proposed framework. The framework requires empirical testing in the context of North-East Nigeria. The study also does not address specific technical aspects of AI deployment, which would require specialized technical expertise.

8. Conclusion

8.1 Summary of Contributions

This study has provided a comprehensive theoretical exploration of AI integration in education, with specific focus on North-East Nigeria. The study has:

1. Synthesized existing theoretical frameworks and models of AI in education, assessing their applicability to low-resource, conflict-affected contexts.
2. Analyzed the unique educational challenges of North-East Nigeria, highlighting the potential roles AI might play in addressing these challenges.
3. Developed the AI-Enhanced Educational Transformation (AI-EET) Model—a context-sensitive framework for AI integration in education tailored to the realities of North-East Nigeria.
4. Identified potential AI applications, challenges, and risks relevant to the region.
5. Proposed a research agenda for further investigation.

8.2 Recommendations

Based on this analysis, the following recommendations are offered:

For Federal Government:

- i. Develop a national AI in education strategy with specific provisions for North-East Nigeria.
- ii. Establish data protection and privacy frameworks.
- iii. Invest in infrastructure (electricity, connectivity) in the North-East.
- iv. Support teacher training and digital literacy programs.

For State Governments (North-East):

- i. Develop state-level AI in education strategies aligned with national frameworks.
- ii. Pilot AI interventions in safe, accessible locations.
- iii. Invest in local technical capacity.
- iv. Engage communities in AI planning and implementation.

For Development Partners:

- i. Support infrastructure development (solar, connectivity) in the region.
- ii. Invest in teacher training and digital literacy.
- iii. Support policy development and implementation.
- iv. Fund pilot AI interventions and evaluation research.

For Technology Developers:

- i. Develop AI solutions tailored to low-resource, offline, and multilingual contexts.

- ii. Design with cultural sensitivity and local language support.
- iii. Ensure accessibility for learners with disabilities.
- iv. Prioritize data privacy and security.

8.3 Concluding Reflections

The integration of AI into education in North-East Nigeria is not a panacea, but it represents a significant opportunity to address persistent educational challenges. In a region where teachers are scarce, schools destroyed, and generations of children have been deprived of education, AI offers the possibility of reaching learners in ways previously unimaginable.

However, realizing this potential requires more than technology. It requires a comprehensive approach that addresses infrastructure deficits, builds human capacity, establishes enabling policies, engages communities, and integrates AI thoughtfully into pedagogy. It requires recognizing that technology is a tool, not a replacement for the human relationships at the heart of education.

The journey toward AI-enhanced education in North-East Nigeria will be long and challenging. But for the millions of children who have been denied education, it is a journey worth undertaking. With thoughtful, context-sensitive approaches, AI can help restore educational opportunity, rebuild hope, and transform lives in one of the world's most challenging educational contexts.

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