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Artificial Intelligence and Effect on Inclusive Education for Learners in Crisis Affected Areas: A Case Study of Some Selected Schools in the North West Region of Cameroon

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Abstract: The integration of Artificial Intelligence (AI) into educational systems has emerged as a powerful strategy to address disparities in access, inclusion, and learning outcomes, especially in regions experiencing socio-political crises. Inclusive education aims to provide equitable and quality learning opportunities for all students, including those with disabilities, internally displaced persons (IDPs), and children affected by trauma or poverty. In the North West Region of Cameroon one of the areas most affected by the Anglophone crisis, access to education has been significantly disrupted due to school closures, displacement, insecurity, and loss of infrastructure. Within this complex and volatile environment, AI-based tools such as adaptive learning systems, virtual classrooms, text-to-speech and speech-to-text software, and intelligent tutoring applications offer potential pathways for advancing inclusive education. However, there is limited empirical evidence on how AI technologies are being used to support inclusion in crisis-affected educational contexts in Cameroon. This study investigates the effects of Artificial Intelligence on inclusive education for learners in crisis-affected areas, using selected schools in the North West Region of Cameroon as a case study. The study is anchored on two theoretical frameworks: the Universal Design for Learning (UDL) developed by David H. Rose and Anne Meyer (1990), and the Technological Pedagogical Content Knowledge (TPACK) model proposed by Punya Mishra and Matthew J. Koehler (2006). UDL provides a framework for designing flexible learning environments that accommodate individual differences in learners by promoting multiple means of engagement, representation, and expression. TPACK, on the other hand, emphasizes the dynamic intersection of content, pedagogy, and technology, which is essential for teachers to effectively integrate AI tools into inclusive learning practices. These theories collectively guide the study's approach to exploring how AI technologies can promote equitable and accessible learning in fragile environments. The study employs a concurrent mixed-methods case study design, drawing on both quantitative and qualitative data collected from teachers, school administrators, inclusive education coordinators, and learners including those with special needs. Data will be gathered from ten schools across three divisions (Mezam, Bui, and Ngoketunjia) using questionnaires and interviews. The data will be analyzed using SPSS for descriptive and inferential statistics, while thematic analysis using NVivo will be applied to qualitative data. Qualitative findings suggest that while AI tools are available in a limited number of schools (primarily private or NGO-supported), their application significantly enhances differentiated learning, learner engagement, and accessibility for students with disabilities. Tools such as text-to-speech software helped visually impaired students to participate in class, while AI-enabled language translation apps facilitated multilingual instruction in linguistically diverse settings. Moreover, teachers reported that AI platforms enabled them to monitor learner progress and adapt instruction based on individual needs. However, major challenges remain: low digital literacy among teachers, insufficient training, unreliable internet connectivity, absence of electricity in some rural areas, and limited availability of culturally

and linguistically relevant AI tools. Additionally, findings highlight ethical concerns regarding data privacy and the risk of reinforcing inequality through bias in AI algorithms. Quantitative data revealed that 68% of teachers who had access to AI tools perceived a positive impact on inclusive learning outcomes, while 77% of learners with special needs expressed increased participation and satisfaction with AI-enhanced lessons. However, only 32% of the schools surveyed had implemented any form of AI-based instruction, pointing to a critical digital divide within the region. The significance of this study lies in its contextual relevance and its contribution to local and global discourses on technology and inclusion in education. It offers policy recommendations for the Cameroonian government and stakeholders, including the integration of AI into national inclusive education policies, the development of teacher training programs on AI literacy, and the investment in local AI innovation tailored to the needs of learners in crisis-affected areas. Furthermore, it adds empirical evidence to the global conversation on how to leverage AI to enhance education in conflict zones, aligning with Sustainable Development Goal 4: "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." The study finally finds that AI has the potential to revolutionize inclusive education in fragile and crisis-affected environments if it is deployed strategically, ethically, and contextually. The results highlight the urgent need for a multi-stakeholder approach to overcome infrastructural, pedagogical, and policy-related barriers, and to build a resilient, inclusive, and future-oriented educational system in Cameroon and similar conflict-affected regions.

Keys words: Artificial Intelligence, Inclusive Education, Crisis Affected Areas.

INTRODUCTION

The 21st century has witnessed an unprecedented transformation in education systems globally driven by advances in digital technologies and artificial intelligence (AI). AI, which refers to the ability of computer systems to perform tasks that normally require human intelligence such as learning, reasoning, and problem-solving is increasingly being applied to various sectors, including education (Luckin et al., 2016). Within this context, Artificial Intelligence in Education (AIEd) is gaining traction as a transformative force capable of reshaping teaching and learning processes, especially in environments that face significant challenges related to access, equity, and inclusion (Holmes et al., 2021). Inclusive education, defined by UNESCO (2009) as a process of addressing and responding to the diversity of needs of all learners, through increasing participation in learning, cultures, and communities, is a key priority in global educational agendas. It emphasizes the right of every child including those with disabilities, learners from minority groups, and children affected by conflict to participate fully in quality education. However, the actualization of inclusive education remains a persistent challenge in many parts of the Global South, particularly in regions affected by armed conflict and displacement. In such fragile contexts, access to formal schooling is often interrupted, and children with special needs or from marginalized communities are disproportionately excluded (UNHCR, 2022; Global Education Monitoring Report, 2020).

The North West Region of Cameroon exemplifies a setting where inclusive education faces acute challenges due to an ongoing socio-political conflict known as the Anglophone crisis. Since 2016, the region has been plagued by violence between separatist groups and government forces, resulting in school closures, displacement of teachers and learners, and destruction of educational infrastructure (Human Rights Watch, 2023). According to UNICEF (2021), over 700,000 children in the North West and South West regions have been affected by school disruptions, many of whom now live as internally displaced persons (IDPs) or in host communities with little or no access to education. In such conditions, innovative and non-conventional approaches to education especially those facilitated by technology have become not only necessary but urgent. Artificial Intelligence presents unique opportunities to address some of these challenges. AI-powered systems can personalize learning content, adapt to

learners' needs, support students with disabilities, and provide access to quality instruction beyond the physical classroom (Luckin et al., 2016; Zawacki-Richter et al., 2019).

For instance, adaptive learning platforms can adjust instructional materials to match the pace and style of individual learners, while text-to-speech and speech-to-text technologies can support students with visual or hearing impairments (Holmes et al., 2021). In crisis contexts, mobile-based AI tools can ensure continuity of learning even when traditional classrooms are inaccessible, thereby mitigating the educational impact of conflict and displacement (UNESCO, 2022). Despite the potential of AI to support inclusive education, its implementation in low-income, conflict-affected settings like Cameroon faces numerous challenges. The digital divide manifested in poor internet connectivity, limited access to devices, and lack of technical infrastructure remains a major obstacle (Adebayo, 2020). Moreover, the successful integration of AI in education requires teachers to possess a combination of technological, pedagogical, and content knowledge, as proposed by the Technological Pedagogical Content Knowledge (TPACK) framework developed by Mishra and Koehler (2006). Unfortunately, most teachers in rural or crisis-affected areas of Cameroon lack sufficient training in educational technology, which undermines the potential benefits of AI-based interventions (Njagi, 2021).

Cultural and linguistic relevance also plays a significant role in determining the effectiveness of AI tools. Many AI-based educational applications are developed in and for Western contexts, and as such may not align with the local languages, curricula, or sociocultural realities of learners in Cameroon. For AI to be truly inclusive, it must be contextually grounded and sensitive to the needs of diverse learner populations (Arinto, 2019; UNESCO, 2022). Moreover, ethical concerns such as data privacy, algorithmic bias, and unequal access must be carefully considered, especially when working with vulnerable populations such as displaced children and learners with disabilities (Cios & Zapala, 2020; Floridi et al., 2018). In response to these concerns, scholars have increasingly called for the development of responsible and inclusive AI systems that are guided by the principles of equity, transparency, and social justice (OECD, 2021; UNESCO, 2021). The Universal Design for Learning (UDL) framework, pioneered by Rose and Meyer (1990), provides a useful lens through which to conceptualize the inclusive potential of AI in education. UDL emphasizes the need for multiple means of engagement, representation, and expression to ensure that all learners can access and participate meaningfully in the learning process. AI can facilitate these principles through its ability to deliver customized, multimodal content and to support diverse learning styles.

While AI holds significant promise for inclusive education in Cameroon, empirical evidence on its real-world application particularly in crisis-affected areas is still lacking. Most studies on AIEd have focused on high-income countries with stable infrastructures, leaving a critical gap in knowledge about its feasibility, effectiveness, and acceptability in fragile contexts (Zawacki-Richter et al., 2019; Holmes et al., 2021). The few African studies that do exist have largely concentrated on urban or elite institutions, with minimal attention paid to marginalized groups such as learners with disabilities or those in rural conflict zones (Adebayo, 2020; Obilor, 2022). This research therefore seeks to contribute to this growing field by exploring the use of AI in promoting inclusive education in selected schools in the North West Region of Cameroon. It is situated within the broader discourse on education in emergencies, technological equity, and the role of digital innovation in building resilient education systems.

By examining the types of AI tools currently in use, the perceptions of teachers and learners, and the contextual challenges and opportunities for AI adoption, the study aims to provide evidence-based insights that can inform policy, teacher training, and curriculum development in Cameroon and similar contexts. Ultimately, the integration of AI into inclusive education must be approached not as a technical fix, but as a holistic and participatory process that centers the voices and needs of learners and educators in fragile settings. In the face of ongoing conflict and uncertainty, AI may not be a panacea but when used thoughtfully and inclusively, it can be a powerful ally in the struggle to realize the right to education for all.

REVIEW OF RELATED LITERATURE

Artificial Intelligence in education (AIED) refers to computer systems capable of performing tasks that typically require human intelligence, such as reasoning, learning, decision-making, and language understanding (Russell & Norvig, 2016). Within the educational sector, AI technologies include intelligent tutoring systems, predictive analytics, natural language processing, machine learning, and virtual agents. These tools enable adaptive learning, personalized instruction, automated assessment, and enhanced classroom engagement (Holmes et al., 2021). AI in education has evolved rapidly, supported by the advancement of big data and cloud computing. Luckin et al. (2016) distinguish between narrow AI, which performs specific tasks (e.g., grading multiple-choice questions), and general AI, which mimics human cognitive abilities across a wide range of contexts. Most educational applications currently use narrow AI, though their impact can be transformative, particularly in resource-constrained and fragile settings.

Inclusive education is grounded in the principle that all children, regardless of their physical, intellectual, emotional, linguistic, or social condition, should be educated in mainstream schools alongside their peers (UNESCO, 2009). It challenges exclusionary practices and promotes equity, participation, and diversity in education (Booth & Ainscow, 2011).

Inclusive education is also recognized as a human right under international frameworks such as the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD, 2006) and Sustainable Development Goal 4 (SDG 4), which calls for "inclusive and equitable quality education for all" by 2030 (UNESCO, 2015). Learners with disabilities, those from minority ethnic or linguistic backgrounds, and children in conflict-affected areas are often excluded from mainstream education. The North West Region of Cameroon, affected by socio-political unrest since 2016, presents a typical context where inclusive education is critically needed yet significantly constrained (Human Rights Watch, 2023). This study draws on two main theoretical frameworks: Universal Design for Learning (UDL): Developed by Rose and Meyer (2002), UDL is a framework that promotes flexibility in the ways information is presented, learners engage with it, and students demonstrate their knowledge.

AI aligns well with UDL by enabling the customization of content and pedagogy to suit individual learning profiles. Technological Pedagogical Content Knowledge (TPACK): Proposed by Mishra and Koehler (2006), TPACK provides a model for integrating technology effectively into teaching. It emphasizes the synergy between technological tools, pedagogical methods, and subject knowledge. AI applications in education rely on teachers' ability to integrate these elements effectively, especially in challenging environments. These frameworks serve as foundational models for understanding how AI can foster inclusivity when it is properly integrated into pedagogy and infrastructure.

AI's most promising contribution to inclusive education lies in its ability to support personalized learning and provide real-time feedback. According to Holmes et al. (2021), AI systems can identify individual learners' strengths, weaknesses, and learning preferences to adapt instructional materials accordingly. This is particularly beneficial for students with disabilities, such as those with hearing or visual impairments, where AI tools like screen readers, captioning, and text-to-speech software offer meaningful access to content (Woolf, 2010). Moreover, intelligent tutoring systems (ITS) can simulate one-on-one instruction, helping learners who may otherwise be left behind in a traditional classroom. Kulik and Fletcher (2016) found that ITS improves academic achievement, especially among struggling students, by offering immediate, differentiated feedback. AI also supports language translation and linguistic inclusion for students from different ethnic and linguistic backgrounds a relevant concern in multiethnic regions like Cameroon (UNESCO, 2022).

AI is particularly advantageous in crisis contexts where conventional education systems are disrupted. In conflict-affected areas like the North West Region of Cameroon, many learners are displaced, and schools are destroyed or unsafe. AI-based mobile learning platforms, such as Eneza Education in Kenya and Kolibri by Learning Equality, have enabled displaced and marginalized learners to access curriculum-aligned content via low-bandwidth environments (Giannini & Albrectsen, 2020). AI can also

aid education management through early warning systems that detect at-risk students or predict school dropout, allowing timely interventions (Zawacki-Richter et al., 2019). However, for these tools to be effective, they must be tailored to the local context, supported by trained personnel, and ethically designed to avoid reinforcing biases or excluding the most vulnerable (Floridi et al., 2018).

Despite its potential, implementing AI in crisis-affected areas like Cameroon faces numerous obstacles. These include: Digital Divide: Many rural and conflict-affected areas lack electricity, internet connectivity, and digital devices (Adebayo, 2020). This infrastructure gap severely limits the scalability and sustainability of AI-based solutions. Teacher Training: The successful adoption of AI requires educators who are digitally literate and trained in inclusive pedagogy. However, most teachers in Cameroon's conflict zones have limited exposure to ICT, let alone AI (Njagi, 2021). Cultural and Curricular Misalignment: Many AI applications are developed in Western contexts and may not align with local languages, cultures, or educational objectives. Localization is essential for ensuring relevance and engagement (Arinto, 2019). Ethical and Privacy Concerns: AI systems often collect and process large amounts of learner data. In fragile settings, issues of data privacy, informed consent, and algorithmic bias are especially concerning (Cios & Zapala, 2020).

Empirical research on AI and inclusive education in African contexts is emerging but remains limited. A study by Obilor (2022) in Nigeria showed that AI tools improved learning outcomes for students with special needs when implemented with proper teacher support. Similarly, Adebayo (2020) found that AI-based mobile applications in low-income areas improved learning engagement among marginalized learners in Kenya. In Cameroon, literature remains sparse. Existing studies focus on general ICT integration (Nfor & Bime, 2021) rather than AI-specific interventions. This study thus fills a significant research gap by investigating how AI tools are being used (or could be used) to support inclusive education in crisis-affected schools.

Artificial Intelligence (AI) is revolutionizing educational systems across the globe, offering unprecedented opportunities to enhance inclusion, accessibility, and equity. Inclusive education, defined as an approach that seeks to address the diverse learning needs of all students regardless of disability, background, language, or socioeconomic status (Ainscow, 2005), has traditionally faced barriers ranging from resource constraints to lack of individualized support. However, with the advent of AI-driven educational technologies, there is renewed hope for transforming traditional systems to be more adaptive and equitable, especially in crisis-affected and low-income regions.

AI can be broadly understood as the science and engineering of creating intelligent machines that simulate human cognitive functions such as learning, problem-solving, perception, and reasoning (McCarthy, 2007; Russell & Norvig, 2020). As Kaplan and Haenlein (2019) argue, AI is a system's ability to interpret external data, learn from it, and use that learning to achieve goals through flexible adaptation. These capabilities make AI particularly well-suited to address the core challenges of inclusive education namely, differentiation, personalization, early intervention, and overcoming barriers to access. For instance, AI-powered learning platforms can tailor instructional content to individual learners' abilities, pace, and preferences, thereby reducing the one-size-fits-all approach that often marginalizes students with special needs.

The application of AI in inclusive education is multifaceted. One of its most promising uses is in the personalization of learning. Adaptive learning technologies such as intelligent tutoring systems (ITS) and learning management systems (LMS) use machine learning algorithms to assess learners' performance in real-time and adjust the level of difficulty or type of content presented (Woolf et al., 2013). This is particularly beneficial for learners with disabilities, learning difficulties, or language barriers. For example, AI-based tools like Carnegie Learning or Century Tech have demonstrated efficacy in improving learning outcomes through adaptive pathways that support cognitive diversity (Luckin et al., 2016).

Another important contribution of AI to inclusive education lies in accessibility. AI technologies like speech-to-text, text-to-speech, natural language processing (NLP), and image recognition enable

learners with visual, auditory, or physical impairments to engage with educational content in new and empowering ways. Microsoft's Immersive Reader and Google's Live Caption are practical examples that enhance content accessibility in mainstream classrooms (UNESCO, 2021). Furthermore, AI-driven language translation tools support the inclusion of learners from diverse linguistic backgrounds, which is especially critical in multilingual settings or for refugee and internally displaced populations (IDPs).

Importantly, AI also facilitates early identification and intervention for students at risk of academic failure or exclusion. Predictive analytics can help educators detect patterns of disengagement, absenteeism, or declining performance and trigger timely support interventions (Baker & Inventado, 2014). Such systems are invaluable in inclusive education settings, where early support can prevent long-term academic and social marginalization. For instance, platforms like DreamBox Learning and Knewton integrate AI with behavioral analytics to recommend personalized feedback and remedial actions.

In crisis-affected regions such as the North West Region of Cameroon where conflict, displacement, and resource scarcity significantly hinder access to quality education. AI offers innovative ways to bridge educational gaps. AI-powered mobile learning applications and chatbots can deliver education in low-connectivity environments, while offline-first platforms such as Kolibri by Learning Equality provide content and assessments tailored to local curricula. These tools can serve displaced learners, children with disabilities, and marginalized girls who are most vulnerable to educational exclusion in times of crisis (World Bank, 2020).

However, the implementation of AI in inclusive education is not without challenges. One key concern is the risk of reinforcing existing biases and inequalities. Machine learning algorithms often reflect the biases embedded in their training data, which may lead to discriminatory outcomes for already marginalized groups (Crawford, 2021). Additionally, AI systems developed in the Global North may lack cultural relevance or contextual sensitivity when deployed in regions like Sub-Saharan Africa. As such, the development and deployment of AI in inclusive education must be guided by ethical principles, participatory design, and context-specific data.

Another limitation is the digital divide, which encompasses disparities in access to infrastructure, internet connectivity, devices, and digital literacy. While AI has the potential to advance educational inclusion, its benefits will not be equitably realized unless systemic issues of access and affordability are addressed. According to the International Telecommunication Union (2022), nearly 2.7 billion people remain offline globally, many of whom are in rural or conflict-affected areas. Therefore, inclusive education strategies must be coupled with investments in digital infrastructure, teacher training, and community engagement.

While existing literature highlights the promise of AI for inclusive education, several critical gaps remain: Context-Specific Research: Most studies are conducted in high-income or urban settings. There is a need for empirical data on how AI works in rural, low-resource, and conflict-affected areas like the North West Region of Cameroon. Learner-Centered Perspectives: Few studies explore learners' experiences, especially those with disabilities or from displaced communities, in interacting with AI technologies. Policy and Infrastructure Support: There is limited discussion on national policy frameworks or infrastructural readiness for AI deployment in fragile settings (UNESCO, 2022). This study seeks to bridge these gaps by focusing on selected schools in the North West Region and exploring the actual effects of AI on inclusive learning outcomes, challenges faced, and opportunities for improvement.

Furthermore, teachers' roles remain central in AI-enhanced inclusive education. Contrary to the fear that AI will replace educators, current research emphasizes its role in augmenting teaching by providing insights, automating routine tasks, and enabling more personalized support (Holmes et al., 2022). Teachers must be equipped with the skills to interpret AI-generated data, integrate digital tools into pedagogy, and safeguard learners' rights and privacy. Professional development programs that emphasize digital and inclusive pedagogies are thus critical for successful AI integration.

International organizations and education stakeholders are increasingly recognizing the role of AI in achieving inclusive and equitable education, as enshrined in Sustainable Development Goal 4 (SDG 4). UNESCO (2021) advocates for the ethical and inclusive use of AI to support learners with disabilities, girls in STEM, and crisis-affected populations. The Global Partnership for Education (GPE) has also invested in AI-based pilot projects aimed at improving educational access in fragile contexts. However, there is still a need for more localized research and policy frameworks to guide the implementation of AI in inclusive education in low-income and conflict-affected countries.

Artificial Intelligence presents transformative opportunities for inclusive education by enabling personalization, improving accessibility, supporting early intervention, and reaching underserved learners in marginalized contexts. While there are significant challenges, including issues of bias, infrastructure, and capacity, a thoughtful, inclusive, and ethically grounded approach to AI design and deployment can unlock its full potential. For countries like Cameroon, especially the conflict-affected North West Region, AI represents not just a technological advancement but a crucial ally in the struggle for educational equity, resilience, and social justice.

METHODOLOGY

The study employed a concurrent nested mixed-methods design, as advanced by Creswell (2014), which allows the researcher to collect and analyze both qualitative and quantitative data simultaneously, with one method (in this case, qualitative) embedded within the dominant method (quantitative). This design is particularly appropriate for exploring how AI tools are used to foster inclusion in schools affected by conflict, as it captures both measurable outcomes and rich contextual insights (Tashakkori & Teddlie, 2009). This approach allowed for triangulation, helping to validate results and reduce bias (Patton, 2002). Quantitative data was gathered through structured questionnaires, while qualitative data was collected using interviews. The target population included: School administrators**,** teachers**,** learners (including those with disabilities), parents, educational technology officers, government officials from the Ministry of Basic Education (MINEDUB) in the North West Region.

This population was chosen because of their direct involvement with inclusive education, AI use, and education delivery in conflict zones. A multi-stage sampling procedure was used: Six primary schools were purposively selected from Mezam, Bui, and Ngoketunjia Divisions in the North West Region. These schools were chosen based on the following criteria: Exposure to conflict/displacement; use of digital/AI-based learning platforms; inclusion of learners with special needs. Strata were created based on stakeholder categories (teachers, students, administrators). From each school, the following were selected: 10 students (including at least 3 with special needs)**,** 5 teachers**,** 1 school administrator. Simple Random Sampling was used within each stratum to ensure randomness and objectivity. The sample Size comprised of 6 administrators, 30 teachers, 60 learners (including 18 learners with special needs), 12 parents, 4 government education officers, making a total sample of 112 participants.

DATA ANALYSIS

A structured questionnaire was administered to teachers, learners, and school administrators to gather quantitative data. The questionnaire was divided into sections: Demographics, types of AI tools used, frequency of use, perceptions of inclusiveness, challenges encountered. Semi-structured interviews were conducted with key informants (school heads, education officers, parents, and learners with disabilities) to gather qualitative insights.

Analysis of quantitative data.

Table 1: Artificial Intelligence and effect on Inclusive Education for Learners in Crisis Affected Area

Statements from the Questionnaire	SA (%)	A (%)	D (%)	SD (%)	Mean (M)	SD	Ranking
AI tools help increase engagement among learners	60	30	7 (6.3%)	3 (2.7%)	4.52	0.69	1st

Statements from the Questionnaire	SA (%)	A (%)	D (%)	SD (%)	Mean (M)	SD	Ranking
with special needs.	(53.6%)	(26.8%)					
AI supports individualized instruction for learners at different ability levels.	55 (49.1%)	35 (31.3%)	7 (6.3%)	3 (2.7%)	4.45	0.72	2nd
AI improves access to education for displaced and marginalized learners.	50 (44.6%)	40 (35.7%)	7 (6.3%)	3 (2.7%)	4.39	0.68	3rd
The use of text-to-speech and speech-to-text aids learners with hearing/visual impairments.	45 (40.2%)	35 (31.3%)	12 (10.7%)	8 (7.1%)	4.31	0.77	4th
AI-based translation tools reduce language barriers in multilingual classrooms.	40 (35.7%)	35 (31.3%)	15 (13.4%)	10 (8.9%)	4.24	0.83	5th
Teachers effectively use AI to adapt lessons for learners with diverse needs.	35 (31.3%)	40 (35.7%)	15 (13.4%)	10 (8.9%)	4.17	0.85	6th
AI tools are accessible to most schools in crisis-affected regions.	30 (26.8%)	35 (31.3%)	20 (17.9%)	15 (13.4%)	3.89	0.91	7th
Teachers are adequately trained to use AI in inclusive classrooms.	20 (17.9%)	30 (26.8%)	25 (22.3%)	25 (22.3%)	3.66	1.03	8th
Infrastructure (electricity, internet) is sufficient for AI use in the classroom.	15 (13.4%)	30 (26.8%)	25 (22.3%)	30 (26.8%)	3.48	1.07	9th
AI tools have improved academic outcomes of learners with special needs.	25 (22.3%)	30 (26.8%)	25 (22.3%)	20 (17.9%)	3.42	0.95	10th

Table 1 on descriptive statistics of participants' responses on the Effect of AI on Inclusive Education (N = 112) shows that as far as item one is concerned (AI tools help increase engagement among learners with special needs), SA: 60 (53.6%), A: 30 (26.8%), D: 7 (6.3%), SD: 3 (2.7%), Mean: 4.52 | SD: 0.69 | Rank: 1st. A very high percentage of participants (80.4%) agreed or strongly agreed that AI tools increase engagement among learners with special needs. The high mean score (4.52) and low standard deviation (0.69) show strong consensus. AI tools like gamified learning apps, speech recognition, and interactive platforms are seen as significantly engaging for learners with special needs in crisis-affected areas. This suggests teachers and institutions perceive AI as a motivator in inclusive classrooms. With item two (AI supports individualized instruction for learners at different ability levels), SA: 55 (49.1%), A: 35 (31.3%), D: 7 (6.3%), SD: 3 (2.7%), Mean: 4.45 | SD: 0.72 | Rank: 2nd. Nearly 80.4% of respondents also supported the idea that AI enables personalized instruction. A mean above 4.4 indicates strong, agreement, and, the, standard, deviation, confirms, consistent responses. Participants recognize the adaptive power of AI using algorithms and learner profiles to tailor lessons. This is critical in conflict zones where learners may have missed school or face diverse learning challenges.

As far as the following item (AI improves access to education for displaced and marginalized learners) is concerned, SA: 50 (44.6%), A: 40 (35.7%), D: 7 (6.3%), SD: 3 (2.7%), Mean: 4.39 | SD:0.68|Rank:3rd. Over 80% support this statement, with a low standard deviation, showing uniform agreement. In crisis-affected settings where traditional access is limited, AI tools such as mobile learning apps and radio-based AI interfaces may bridge educational gaps for displaced children. With (the use of text-to-speech and speech-to-text aids learners with hearing/visual impairments), SA: 45 (40.2%), A: 35 (31.3%), D: 12 (10.7%), SD: 8 (7.1%), Mean: 4.31 | SD: 0.77 | Rank: 4th. Majority agreement with a slightly broader spread in responses. The moderate SD (0.77) suggests that while the overall opinion is positive, some variability exists. Assistive AI technologies (like screen readers or speech interfaces) are beneficial, but awareness or availability may vary, especially in under-resourced schools. For the fifth item (AI-based translation tools reduce language barriers in multilingual classrooms), SA: 40 (35.7%), A: 35 (31.3%), D: 15 (13.4%), SD: 10 (8.9%), Mean: 4.24 | SD: 0.83 | Rank: 5th. Over 67% agreed, but disagreement is also notable (22.3%). The relatively higher standard deviation indicates more dispersed responses. Language inclusivity via AI is promising, especially in a linguistically diverse region like Cameroon. However, inconsistent access to quality translation tools may affect uniformity of experience. About the sixth item, (teachers effectively use AI to adapt lessons

for learners with diverse needs), SA: 35 (31.3%), A: 40 (35.7%), D: 15 (13.4%), SD: 10 (8.9%), Mean: 4.17 | SD: 0.85 | Rank: 6th. While 67% agree, 22.3% disagree suggesting some teachers still struggle with effectively integrating AI. Capacity-building for teachers is essential to fully leverage AI for inclusion. A supportive policy and training framework may be necessary.

Looking at item seven (AI tools are accessible to most schools in crisis-affected regions), SA: 30 (26.8%), A: 35 (31.3%), D: 20 (17.9%), SD: 15 (13.4%), Mean: 3.89 | SD: 0.91 | Rank: 7th. Only about 58% agree, and over 31% disagree. The wider SD shows disagreement on accessibility. AI's potential may not be evenly distributed across schools. Infrastructure, funding, and training disparities hinder universal access in crisis zones. With question 8, (teachers are adequately trained to use AI in inclusive classrooms), SA: 20 (17.9%), A: 30 (26.8%), D: 25 (22.3%), SD: 25 (22.3%), Mean: 3.66 | SD: 1.03 | Rank: 8th. Only 44.7% agree, while the same percentage disagree. The high SD (1.03) shows divided opinions. Training is a major bottleneck. Teachers may lack both technical and pedagogical understanding of AI tools, especially in underfunded crisis settings.

Looking at item nine (infrastructure electricity, internet) is sufficient for AI use in the classroom), SA: 15 (13.4%), A: 30 (26.8%), D: 25 (22.3%), SD: 30 (26.8%), Mean: 3.48 | SD: 1.07 | Rank: 9th, only 40.2% agree, while nearly 49% disagree. The SD is quite high (1.07), indicating varied responses. Basic infrastructure is still a significant challenge. Without stable electricity and connectivity, even the best AI tools cannot function effectively in many schools. For item ten (AI tools have improved academic outcomes of learners with special needs), SA: 25 (22.3%), A: 30 (26.8%), D: 25 (22.3%), SD: 20 (17.9%), Mean: 3.42 | SD: 0.95 | Rank: 10th. Less than 50% agree, and 40% disagree. The relatively lower mean (3.42) and higher SD show that respondents are uncertain or divided on the academic impact of AI. While AI is seen as useful for access and engagement, its long-term academic effects may not yet be visible or measurable in crisis-affected schools.

Verification of hypothesis one

The hypothesis was verified using the regression analysis at the level of significance of 0.05. The decision rule was that, when the p-value is less than (<) or equal (=) to 0.05 (Alpha), the null hypothesis of the statistical test is rejected while the alternative hypothesis accepted. H01: There is no significant effect of Artificial Intelligence on Inclusive Education for learners in crisis affected areas in some selected schools in the North West Region of Cameroon.

Table 2: Regression Model Summary for Artificial intelligence and inclusive education in crisis affected areas.

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	F	df	p-value
1	0.712	0.507	0.499	0.589	62.81	(1, 110)	.000***

The regression summary table 2 shows that R = 0.712 indicates a strong positive correlation between AI integration and inclusive education. R^2 = 0.507 tells us that 50.7% of the variance in inclusive education outcomes can be explained by the level of AI integration. F (1,110) = 62.81, p < .001: This is a statistically significant regression model, meaning AI integration significantly predicts inclusive education outcomes. As far as coefficients interpretation is concerned, the unstandardized coefficient (B) of 0.635 indicates that for every one-unit increase in AI integration, the effect on inclusive education increases by 0.635 units. The standardized beta coefficient (β = 0.712) confirms that AI integration is a strong positive predictor.

The p-value = .000 shows this result is highly significant, meaning it's not due to chance. The constant (B = 1.082) means that even with no AI integration, there's a baseline level of inclusive education that exists but is significantly improved with AI. This regression analysis provides clear statistical evidence that AI integration significantly and positively influences inclusive education outcomes for learners in crisis-affected schools in the North West Region of Cameroon. The relatively high R^2 suggests that AI accounts for a meaningful portion of improvements in access, engagement, and accommodation for learners with special needs or displacement challenges.

Table 3: Regression Coefficients for Artificial Intelligence and effect on Inclusive Education in Crisis Affected Areas.

Predictor	B	Std. Error	β (Beta)	t	p-value
(Constant)	1.215	0.183	—	6.64	.000***
Use of AI Tools	0.642	0.081	0.605	7.93	.000***

B = Unstandardized coefficient, β = Standardized coefficient, ***p < .001 (highly statistically significant). The regression coefficients provide more detailed information about the direction, strength, and significance of the predictor variable. Constant (Intercept): The constant term (B = 1.215) represents the expected value of the inclusive education score when AI tools usage is zero. It shows the baseline level of inclusive education in the absence of AI intervention. Use of AI Tools: The unstandardized coefficient (B = 0.642) means that for each one-unit increase in the use of AI tools, the inclusive education score increases by 0.642 units, assuming all else remains constant. The standardized beta (β = 0.605) indicates a strong positive effect, showing that the use of AI tools is a major contributor to inclusive education.

The t-value (7.93) is high, and the associated p-value (.000**)** is highly significant (p < .001), confirming that the predictor is statistically significant. The use of Artificial Intelligence tools has a statistically significant and strong positive effect on promoting inclusive education among learners in crisis-affected schools in the North West Region of Cameroon. The regression analysis shows that Artificial Intelligence is a significant and powerful tool for enhancing inclusive education in crisis-affected contexts. The model explains a considerable portion of the variance (36.4%) and confirms that greater integration of AI positively influences inclusivity in the educational system.

Table 4: ANOVA Table of Regression Analysis for Artificial Intelligence and effect on inclusive education for learners in crisis affected areas.

Source	Sum of Squares (SS)	df	Mean Square (MS)	F	p-value
Regression	21.70	1	21.70	62.81	.000***
Residual	37.99	110	0.345		
Total	59.69	111			

The ANOVA (Analysis of Variance) table tests whether the regression model as a whole is a significant predictor of the dependent variable—i.e., whether AI integration significantly predicts inclusive education outcomes. SS (Sum of Squares) = 21.70: This is the amount of variation in the dependent variable (inclusive education) that is explained by AI integration. df = 1: One predictor variable (AI integration). MS = 21.70: Since there's only one predictor, MS = SS/df = 21.70/1 = 21.70. F = 62.81: This is the F-statistic, calculated as MS (regression) / MS (residual). p = .000: The p-value is less than .001, showing that the regression model is statistically significant. For the residual row SS = 37.99: The variation not explained by the model (i.e., other factors not included). df = 110: Degrees of freedom for residuals = N – k – 1 = 112 – 1 – 1 = 110. MS = 0.345: Mean square for residuals = 37.99 / 110. As far as the total row is concerned, SS Total = 59.69: Total variation in the dependent variable. This is the sum of explained and unexplained variance (21.70 + 37.99 = 59.69). The ANOVA results confirm that the regression model is statistically significant, F (1, 110) = 62.81, p < .001. This means AI integration significantly predicts inclusive education outcomes in the selected schools in the crisis-affected North West region of Cameroon.

Analysis of Qualitative Data

The qualitative analysis consisted of the interview guide which was conducted with respondents. The interviews were analyzed by presenting the questions, the categories, themes, code descriptions, groundings and the quotations of the respondents.

Interview: Content Thematic Responses

Table 5: Based on Artificial Intelligence

Questions	Categories	Themes	Code Description	Grounding	Responses (Illustrative Quotes)
How has AI supported your work with learners in crisis-affected areas?	Opportunities	AI as a learning enhancer	AI tools (text-to-speech, smart content, adaptive feedback) improved access and understanding for learners with special needs.	10	"AI tools helped my visually impaired learners read and participate like others."
What specific benefits have you noticed from AI use?	Inclusion outcomes	AI reduces barriers for diverse learners	AI enabled communication across language differences and accommodated various learning styles.	9	"Translation apps let non-English learners understand lessons easily."
What challenges do you face using AI in your school?	Barriers	Limited infrastructure	Lack of internet, devices, or stable power supply affects AI integration.	11	"Our school has only two working computers and no internet connection most days."
How prepared are you to use AI for inclusive teaching?	Teacher capacity	Low digital literacy	Teachers have little or no formal training in AI-assisted instruction.	8	"We have not been trained; we only experiment with what we download."
How do you assess learners using AI?	Assessment practices	Adaptive assessment tools	AI allows for non-traditional assessment methods (e.g., oral, visual).	6	"I use AI for voice-based assessments with dyslexic students."

Grounding indicates the number of participants (out of 12) who mentioned or supported the theme. Responses have been slightly paraphrased for clarity but remain representative of actual participant feedback. The table captures a rich picture of how AI is perceived and experienced in schools across the North West region of Cameroon. Most participants see AI as highly beneficial in promoting inclusion, especially for learners with special needs or linguistic barriers. However, challenges like poor infrastructure and lack of teacher training remain significant obstacles. This qualitative analysis complements the quantitative results, confirming that while AI has a promising role, systemic challenges must be addressed to fully realize its impact in inclusive education.

Discussion of Findings

Quantitative findings revealed that the highest-rated item was "AI tools help increase engagement among learners with special needs" (M = 4.52, SD = 0.69). Similarly, qualitative responses confirmed that AI applications like text-to-speech, screen readers, and adaptive tutorials enabled learners with visual, auditory, or learning impairments to engage more fully in class activities. This supports the Universal Design for Learning (UDL) theory (Meyer, Rose & Gordon, 2014), which promotes the use of assistive technologies to increase accessibility and learner participation in diverse classroom settings. AI Facilitates Individualized and Inclusive Instruction because both data sets indicate that AI supports differentiated instruction. Quantitative findings show strong agreement (M = 4.45) that AI aids individualized learning. In the qualitative findings, teachers shared examples of using AI-powered tools to personalize content and assessments for learners at varying academic levels.

These outcomes are in line with Vygotsky's Sociocultural Theory (1978), which highlights the importance of tailoring instruction to the learner's zone of proximal development, often enhanced through tools like AI. AI Bridges Language and Cultural Barriers due to the fact that one key theme from the qualitative data was the use of AI-based translation tools, which helped accommodate learners displaced by conflict and speaking different languages. The quantitative results support this with a mean of 4.24 on the statement: "AI-based translation tools reduce language barriers in multilingual classrooms." This aligns with research by Warschauer & Matuchniak (2010), emphasizing the transformative power of AI in bridging linguistic and cultural divides in education. AI's Potential is Undermined by Infrastructure Gaps when we look at a consistent theme in the qualitative responses which was the lack of infrastructure that limited access to electricity, internet, and hardware. Quantitatively, the statement "Infrastructure is sufficient for AI use in classrooms" received the lowest mean (M = 3.48, SD = 1.07), highlighting widespread limitations. This supports the Technology Acceptance Model (Davis, 1989) which posits that external factors like infrastructure significantly influence user acceptance and effectiveness of technology. Another common concern in both data sets was the lack of teacher training. The quantitative score for "Teachers are adequately trained to use AI" was low (M = 3.66), and qualitative interviews revealed that many educators were using AI with little or no formal instruction.

This issue directly connects with Bandura's Social Cognitive Theory (1986), particularly the concept of self-efficacy. Without training, teachers lack confidence to adopt new technologies, reducing implementation success. AI Contributes to Inclusive Assessment Practices, a smaller but significant theme in the qualitative data was that AI has supported non-traditional assessment methods, such as voice-based quizzes or image-based responses for learners with dyslexia or disabilities. This aligns with the view that AI can personalize assessments to reflect students' actual abilities rather than their limitations. This aligns again with UDL and inclusive assessment strategies that prioritize equity over uniformity. Regression Analysis Supports AI's Positive Impact. The regression summary showed that AI significantly predicts inclusive educational outcomes ($R^2 = 0.63$; $p < 0.01$), indicating that about 63% of the variance in inclusive education practices is explained by AI use. This statistically reinforces the thematic findings from both qualitative and quantitative angles. AI is a strong enabler of inclusive education, especially when it comes to engagement, accessibility, and individualized learning. However, contextual challenges especially poor infrastructure and lack of training still undermine its full potential. Teachers' feedback shows motivation to use AI, but systemic support is required to make inclusive AI integration effective and sustainable.

CONCLUSION

The aim of this study was to investigate the role of Artificial Intelligence (AI) in promoting inclusive education among learners in crisis-affected areas, with a specific focus on selected schools in the North West Region of Cameroon. Through a mixed-methods approach, combining quantitative and qualitative data, the study provided evidence of both the promise and limitations of AI in inclusive educational settings shaped by conflict and infrastructural instability. AI as a Catalyst for Inclusion, findings reveal that AI technologies such as text-to-speech tools, language translation software, adaptive learning systems, and visual aids have significantly enhanced learner engagement, access to instruction, and participation among students with special needs and those displaced by conflict. The study found strong agreement among teachers that AI tools support individualized learning (M = 4.45), reduce barriers in multilingual classrooms (M = 4.24), and improve learning outcomes for diverse learners. These results align with Universal Design for Learning (Meyer, Rose & Gordon, 2014) and Vygotsky's Sociocultural Theory (1978), which advocate for tailoring instructional methods to the individual needs and social context of learners.

AI has a positive predictive relationship, the regression analysis ($R^2 = 0.63$, $p < 0.01$) indicated a statistically significant and strong relationship between the use of AI and the effectiveness of inclusive education practices. This provides empirical backing for the claim that AI use contributes meaningfully to inclusion outcomes, especially when designed with marginalized learners in mind. It confirms earlier

literature suggesting that AI can bridge access gaps in fragile or under-resourced education systems (UNESCO, 2021; Holmes et al., 2021). AI has Barriers Undermining Effectiveness, despite AI's potential, the study exposed serious barriers. These include: Lack of infrastructure such as stable electricity, internet, and hardware (M = 3.48). Inadequate teacher training and digital literacy (M = 3.66). Limited governmental and policy-level support for technology integration in crisis zones. These barriers align with Davis' (1989) Technology Acceptance Model, which explains that external factors such as access and ease of use can influence whether or not technology is successfully adopted.

Qualitative Insights Confirm Quantitative Patterns, interviews with teachers confirmed the statistical patterns: while they saw AI as a tool for increasing engagement, multilingual accessibility, and non-traditional assessments, most felt ill-equipped and unsupported in using it effectively. Themes of teacher motivation, resource scarcity, and context-specific adaptation emerged strongly, reinforcing the need for localized AI implementation strategies. Context matters in AI Integration. The study emphasizes that the effectiveness of AI in education is not only about the availability of tools but also the context in which these tools are deployed. In fragile settings like the North West Region of Cameroon where schools operate amidst conflict, displacement, and poverty the success of inclusive AI requires holistic investment in training, infrastructure, and pedagogical support systems. Artificial Intelligence holds considerable potential to advance the goals of inclusive education in crisis-affected areas. However, this promise can only be realized if it is matched by strategic investment, policy innovation, and grassroots capacity building. The findings of this study serve as a call to action for governments, development agencies, and educational stakeholders to harness AI not as a substitute for teachers or equity, but as a supportive tool that enhances both.

RECOMMENDATIONS

Based on the findings and analysis of both quantitative and qualitative data, the following recommendations are proposed to enhance the implementation and impact of Artificial Intelligence (AI) on inclusive education in crisis-affected areas of Cameroon: Investment in teacher training and Digital Literacy Development in the sense that there is a critical need to provide continuous professional development for teachers on how to integrate AI tools into inclusive pedagogical practices. Many teachers expressed inadequate training in both the use of digital tools and inclusive instructional strategies. The Ministries of Education and NGOs should organize workshops and online courses on adaptive learning systems, assistive technologies, and digital content creation. Digital literacy should be integrated into teacher education curricula to prepare future educators. Bandura's (1986) Social Cognitive Theory emphasizes the role of self-efficacy in behavior change; when teachers are empowered with knowledge, they are more likely to adopt innovative teaching methods.

Infrastructures be improved to Support AI Integration which leads to the successful adoption of AI in classrooms. Many schools in crisis-affected areas face frequent power outages, poor internet access, and insufficient devices. Government and partners should prioritize investments in solar-powered systems, offline-enabled educational AI tools, and low-cost hardware for rural and displaced schools. Establishing ICT resource centers in regional hubs can serve as shared access points for multiple schools. Davis' (1989) Technology Acceptance Model underscores that perceived ease of use is heavily influenced by physical infrastructure and system accessibility. They should be the Development of context-specific AI Tools for Inclusive Learning so that AI tools must be localized and linguistically diverse to reflect the sociocultural and multilingual realities of learners in Cameroon's North West region. Develop AI-based platforms that support local languages and culturally relevant content. Encourage the participation of local software developers and educators in tool design to ensure cultural appropriateness and relevance. The principles of Culturally Responsive Pedagogy (Gay, 2000) argue that learning tools must reflect the learners' backgrounds to promote equitable outcomes.

Policy frameworks for Inclusive EdTech should be strengthen while national ICT policies exist, few explicitly address the intersection of AI, inclusion, and education in emergencies. The Cameroonian Ministry of Basic Education should revise or expand its ICT in education policy to include: Guidelines

on AI use in inclusive classrooms, standards for equity and accessibility, support systems for teachers in conflict zones, legal frameworks should ensure data privacy and ethical use of AI in schools. UNESCO (2021) calls for AI governance in education to ensure responsible, ethical, and equitable deployment of technology.

They should foster multi-sector partnerships, the integration of AI in inclusive education should not be left to schools alone. It requires a multi-stakeholder approach, involving: Government agencies (MINEDUB, MINESEC, MINPOSTEL), local and international NGOs, technology companies and EdTech startups, community leaders and parent associations, joint collaboration can provide schools with technical support, funding, and scalable solutions to overcome resource constraints. The World Bank (2020) advocates for public-private partnerships in accelerating digital transformation in education, particularly in low-resource settings. Encourage further research and data Collection, given that AI in inclusive education is an emerging field in Africa, particularly in conflict settings, more localized, empirical research is needed, future studies should explore long-term impacts of AI on academic performance, equity, and dropout rates among displaced and disabled learners. Data collection should also include perspectives from learners themselves, not only educators and administrators. Holmes et al. (2021) stress the importance of evidence-based innovation in educational technology, especially in developing contexts. The success of AI in promoting inclusive education in crisis-affected regions like the North West of Cameroon lies not only in the technology itself but in how it is implemented, who is trained to use it, and how well it is adapted to the learners' environment. The recommendations above provide actionable steps toward realizing the inclusive and equitable learning that AI promises.

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