

ORIGINAL ARTICLE

E-learning in times of conflict: an overview of the African context

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ABSTRACT

E-learning has emerged as a crucial tool for sustaining education in Africa during conflict, disasters, and crises. Its flexibility and accessibility position it as a lifeline for learners facing instability, yet its implementation across the continent has been constrained by a multitude of factors involving weak infrastructure, limited resources, and under-financing among others. By drawing upon evidence from diverse case studies and published literature, this review explores the current state of E-learning in African conflict settings by providing insights into its implementation, scalability and outcomes. The findings reveal that while numerous initiatives have been attempted, most remain confined to pilot projects without scalability or long-term integration into educational systems. A critical gap also exists in the documentation of outcomes, with little evidence on the effectiveness, reach, or sustainability of these interventions. The review identifies the importance of context-specific and conflict-sensitive approaches, stronger engagement of governments, NGOs, and international partners, and investments in resilient digital infrastructure. Furthermore, capacity building of educators in digital pedagogy, utilization of open educational resources, and robust monitoring frameworks are identified as key priorities. Despite significant potential, E-learning in conflict-affected African regions remains underdeveloped, emphasizing the urgent need for coordinated strategies that move beyond short-term responses to systemic, scalable, and inclusive solutions.

KEYWORDS:

E-learning, Education, Armed conflict, war, African countries

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INTRODUCTION

Armed conflicts that persistently arise in various regions globally continue to represent a profound threat to the continuity of educational processes. The interruption of educational endeavours critically diminishes access to high-quality education within these affected areas.¹ The ramifications of warfare on the continuity of education can inflict detrimental effects on the long-term educational prospects of a nation. In regions beset by conflict, educational institutions face substantial challenges, including damage to infrastructure, the displacement of both students and educators, and the requirement for alternative pedagogical strategies.¹⁻³ According to the Global Coalition to Protect Education from Attack (GCPEA), the years 2022 and 2023 experienced approximately 6,000 documented assaults on educational institutions alongside a 20% escalation in the military occupation of schools and universities, thereby affecting 10,000 students and educators worldwide.⁴ Nonetheless, the pervasive impact of armed conflict on education continues to exhibit a remarkably consistent pattern across various regions, including Mali, Palestine, Colombia, and Sudan, among others.⁴

Despite the undeniable destruction to educational prospects in war regions, the adoption of methods to help sustain education continuity remains crucial. According to UNESCO, education is a basic human right that works to raise men and women out of poverty, level inequalities and ensure sustainable development.⁵ The 2030 Agenda for sustainable development clearly stipulates the importance of education for the attainment of sustainable development goals.⁶ Instances of disruption to long-term sustainable development are evident in the experiences of multiple countries with conflicts. For example, the war in Central African Republic (CAR) has caused a significant drop in literacy rates, reaching only 37.8% in the year 2015.⁷ The destruction of the educational infrastructure, alongside the recruitment of young people into warfare were noted among the main reasons for such a decline in literacy rates in the country.⁷ In the northeast of Nigeria, the 15 year protracted war has resulted in dire consequences to educational realms. Since 2009, incessant attacks on schools and educators have been

reported. It is also estimated that about 2000 teachers have lost their lives and over one million children were forced out of school, with a rapid decline in school enrolment rates.⁸ Similarly, in South Sudan, war has imposed severe consequences on the educational system, ranking it as one of the world's highest proportions of out-of-school children, with 3 out of 5 children out of school.⁹ After more than four decades of intermittent conflict, the country now has one of the lowest literacy rates in sub-Saharan Africa, with only about 2.3 million out of 6.3 million school-age children currently attending school.⁸

During recent years, E-learning has emerged as a transformative tool for perpetuating educational approaches in contexts of conflict and other disasters. The term E-Learning, or electronic learning, was coined in the late 1990s and describes a method of education that uses technology to facilitate learning experiences.¹⁰ According to Fry¹¹, E-learning can be defined as the delivery of training and education via networked interactivity and a range of other knowledge collection and distribution technologies. Given the versatility of E-learning, one of the main advantages remains to be the flexibility and accessibility to educational content remotely, thereby overcoming the safety concerns and infrastructure damage to educational institutions in conflict-affected regions.¹² However, challenges including the technology and internet connectivity disruptions impose threats to e-learning implementation in resource limited and conflict-afflicted settings.¹³

The use of E-learning to facilitate the continuity of educational activities is well known globally. Despite the rapid implementation of E-learning in worldwide settings, a closer look at the African continent reveals a significant fallout. The potential of E-learning is limited by lack of supportive infrastructure for the sustenance of education in Africa. Research generated from Sub-Saharan Africa remains scant in examining the potential of E-learning for sustaining higher education.¹⁴ However, challenges including lack of computer skills, technical support, ICT-infrastructure, student related factors and instructor related factors tend to be among the common factors impeding E-learning.¹⁵

To the best of our knowledge, this review is one of the few articles to explore the role of E-learning in supporting educational goals within conflict settings, with a particular emphasis on African countries. The aim of this study is to conduct a thorough review and analysis of existing research on the application of E-learning in conflict-affected areas in Africa and its potential to sustain education in these challenging contexts. While digital E-learning initiatives have been widely implemented in global conflict settings like Ukraine, the African context reveals a noticeable disparity. This review also explores the extent of E-learning adoption in selected African countries. By examining its implementation, the study aims to better assess success and impact of E-learning on educational continuity for African students. The findings may build upon efforts of policymakers and stakeholders to develop long-term strategies and protocols for sustaining education in regions vulnerable to conflict and instability.

METHODS

This review paper synthesizes data from multiple sources to explore the potential of E-learning in sustaining education in conflict-affected countries, with a specific focus on African countries. A case study qualitative research design was employed to identify,

analyze, and synthesize research and case studies pertinent to e-learning and education in conflict zones.

Data sources and collection:

A comprehensive literature search was conducted using multiple academic databases, including PubMed, Google Scholar, Web of Sciences, AJOL and ERIC. The search was performed using a variety of keywords and phrases as follows:

- "E-learning and education in conflict settings"
- "Digital education in war zones"
- "Sustainable education in Africa"
- "Education during armed conflict"

Grey literature, including reports from international organizations (e.g., UNESCO, GCPEA), conference proceedings and communication papers were also included to provide a broader perspective. To ensure consistency of data, studies that addressed the use of E-learning in conflict-affected or resource limited settings were included and studies that focused on African countries were also included. The articles that were not published in English language, articles focusing on the implementation of E-learning during COVID-19 and other contexts were excluded during the process. The final search queries used and results retrieved upon searches was indicated in **Table 1**.

Table 1. Sources of Information / Reference Materials

Database	Search Query	Total Articles Retrieved
AJOL	(online learning OR e-learning) AND Africa AND (war OR conflict OR crisis)	210
ERIC	e-learning conflict Africa	145
PubMed	"E-learning" OR "online education" OR "digital learning" AND "war"	27
Web of Sciences	TS=("e-learning" OR "online education" OR "digital learning" OR "virtual learning" OR "distance learning") AND TS=("conflict-affected" OR "war-affected" OR "fragile states" OR "emergency education")	19
Grey Literature	Conference proceedings, theses, dissertations, organizational reports	17

Data Extraction and Analysis:

A total of 30 articles were included in the final synthesis. In addition to this, further 17 grey article sources including conference proceedings, theses, dissertations and organization reports relevant to the context of E-learning among conflict settings in Africa

were also added. The data extracted from the selected studies have been refined and categorized to include the following themes:

- Global and African perspectives on E-learning.
- E-learning as a means for ensuring education continuity during conflicts.

- Challenges and limitations of implementing E-learning.
- Technologies supporting E-learning in conflict settings.
- Case studies of implementation of E-learning during conflicts.

Thematic analysis was conducted to identify recurring patterns, gaps in the literature, and strategies for implementing E-learning effectively. This synthesized data were used to draw conclusions about the potential of E-learning to sustain education during conflicts. As this study relied exclusively on secondary data from previously published literature and did not involve primary data collection or measurement instruments, validity and reliability testing were not applicable.

Ethical Considerations

As this review relies on publicly available secondary data, no ethical approval was required. Proper citation of all sources was considered.

RESULTS

E-learning as a means for education continuity during conflicts:

War and crisis force institutions to improve and innovate educational delivery methods, including hybrid systems and portable devices for better reach and effectiveness.¹⁶ During conflicts, E-learning tend to be a reliable means for sustaining education. It acts not only as a temporary solution but also a potential catalyst for long-term educational resilience in volatile environments. It can be implemented through various methods and approaches, including digital platforms; distance learning technologies; mobile and flexible learning; radio, community-based, and low-bandwidth solutions. In the context of Ukraine, the war has provoked an intense use of digital platforms for the continuity of education.¹⁷ This transformation towards the digitization of education was positively regarded by both teachers and students in Ukraine thereby underscoring the possibilities of E-learning in this context.¹⁷ The integration of diverse digital technologies in Ukraine has cultivated suitable conditions for the accessibility and sustainability of education, along with the enhancement of essential skills needed by students.¹⁸ Likewise, the establishment of an E-learning

initiative in Palestine, orchestrated by the Palestinian Ministry of Education, has provided a framework for the continuation of education amid the ongoing conflict; however, it faced considerable constraints due to limitations in internet and electricity infrastructure.¹⁹ In addition, the successful application of an E-learning strategy at a university located in Southern Saudi Arabia during the conflict with Yemen demonstrates the significant promise inherent in E-learning.²⁰ The study notes that E-learning serves as an indispensable tool to deliver educational goals effectively to areas and regions affected by conflict. Additionally, E-learning has been shown to maintain the integrity of educational content and student performance when juxtaposed with conventional face-to-face learning methodologies.²⁰

In comparison, Syria utilized comprehensive digital education platforms during war period. Its strategy comprised four main pillars: hardware, software, curriculum, and support services to provide displaced and refugee children access to education.²¹ While in Sri Lanka, the use of Open Distance and Flexible Learning (ODFL) was deemed integral for sustaining education to displaced and traumatized populations.²²

Within the African continent, the interplay appears to be less promising with obstacles largely stemming from the digital divide. These challenges are reflected in disparities in access to electricity and internet connectivity, device ownership, and digital literacy. However, given the extensive penetration of mobile phones throughout Africa, mobile flexible learning has emerged as a critical mechanism for the continuation of education amid interruptions in schooling.²³ Essentially, mobile learning has served as a significant adjunct to both formal and informal educational systems, effectively addressing educational disparities during periods of disruption.²³ In countries such as Kenya and Côte d'Ivoire, mobile learning has constituted a pivotal intervention during instances of school interruptions where parental engagement has proven essential in sustaining educational continuity through mobile platforms.²³ This shows that while E-learning presents an important pathway towards educational sustainability in conflict zones, it also requires concerted efforts to overcome infrastructural, technological, and socio-cultural challenges.

Technologies and Strategies supporting E-learning in conflict settings:

Numerous technologies and methodologies have been adopted and executed across various conflict-affected regions to facilitate and ensure the continuity of educational opportunities for students. In particular, the Central African Republic (CAR) has instituted an initiative known as Zeroconf, which is designed to automatically configure a local network via a designated VPN mode, enabling users to engage in a multitude of functions such as instant messaging, audio and video communication, and file sharing. Distance learners and educators interact as if they are in face-to-face settings, thereby creating opportunities for collaboration in real-time and allowing them to resume their educational pursuits instead of becoming involved in armed factions.²⁴

Moreover, the Central African Republic (CAR) provides another notable example of an innovative educational intervention in conflict-affected rural areas. A proposed solution involves the implementation of MOODLE (Modular Object-Oriented Dynamic Learning Environment), an E-learning platform tailored to meet the needs of disrupted education systems. While MOODLE shares common features with other digital learning platforms, it is distinguished by its capacity to facilitate knowledge capitalization through shared databases and glossaries. The platform offers various activity modules, such as forums, surveys, and chat functions, which foster interaction between teachers and learners.²⁵ Educational content is uploaded by instructors, while parents play a supervisory role to support and monitor their children's engagement with the platform.²⁵

Another E-learning initiative was implemented in Liberia through a collaboration between the Stellenbosch University Rural Medical Education Partnership Initiative (SURMEPI), the College of Health and Life Sciences (COHLS) at the University of Liberia (UL), and the Health Resources and Services Administration (HRSA). This partnership introduced the use of Office 365 as an E-learning platform, chosen for its accessibility and adaptability in low-resource settings. As an integrated intranet, internet, and software suite, Office 365 provided a flexible solution

suitable for both students and staff. To enhance the platform's effectiveness, several strategies were employed, including curriculum content and delivery review, IT skills training, improved affordability and access to technology, promotion of online resource utilization, and efforts to increase motivation among users.²⁶

An integrative approach adopted by Salha et al.²⁷ identified 14 different scenarios that can be implemented during times of war to ensure the continuity of education. Central to these strategies is digital-based online learning, which has been harnessed in several countries, including but not limited to Palestine and Ukraine, where social media and online platforms have served as valuable tools to address the challenges posed by catastrophic disruptions. In contexts where internet access is limited, low-bandwidth solutions such as offline educational applications and preloaded digital content have been employed to strengthen the resilience of education in the face of connectivity constraints.²⁷ Moreover, in many other conflict-affected countries, such as South Sudan and Somalia, radio-enabled learning has provided a vital alternative, enabling lessons to be broadcasted widely to reach learners despite infrastructural limitations.^{28, 29}

During times of war, Salha et al.²⁷ also identified a range of non-digital learning strategies that help sustain education. These include approaches such as multigrade teaching, hands-on learning, and fun-based learning. Despite the presence of initiatives designed to foster E-learning in conflict settings, there is very limited evidence regarding their successful large-scale implementation. Existing data highlight a persistent gap between the launch of such initiatives and their practical execution. This indicates the presence of critical barriers to E-learning that prevent many projects from progressing beyond the initial pilot stage. Furthermore, evidence on the widespread adoption of e-learning approaches in war-affected and vulnerable regions remains scarce. **Table 2** provides an overview of E-learning initiatives introduced across several African countries, with a notable observation that many remain confined to the pilot phase without broader development or institutional integration.

Table 2. Case-Based Overview of E-Learning Implementation in Conflict-Affected African Countries.

Country	E-learning Tool / Platform	Target Population	Implementing Body / Source	Year	Status	Outcome	Reference
Sudan	ODL* Program for EFL*	English as a Foreign Language (EFL) university Students	Khartoum University	2023–24	Ongoing (Wartime)	-Improved access to literature studies during war. - There is a need to enhance technology infrastructure. - Technology challenges impede the participation of 60% of students.	47
Sudan	Learning Management System, Moodle	University Students	Comboni College of Science and Technology, Italian Agency for Development Cooperation (AICS), Italian NGO	2023-2024	Ongoing (Wartime)	-To resume educational activities interrupted by war.	48
DR Congo	General E-learning	Students in Eastern conflict areas	National Ministry & NGOs	2025	Proposed	-To improve access to education despite instability.	49
Libya	General E-learning	Students	–	2021	Proposed	-To provide continuity of learning. -To protect students from danger -To foster essential skills like English and computer literacy	50
Central Africa	Moodle (Virtual Schools)	Basic education students	Organizations and NGO	–	Proposed	- To foster sustainable education.	51
Central Africa	African Virtual Campus	Tertiary students	Organizations and NGO	–	Proposed	- To foster sustainable education.	51
Chad	Can't Wait to Learn (via tablets and mobile devices)	Children	GPE / KIX, War Child	2019	Completed-require Scaling up	- To strength fundamental mathematical and literacy competencies and knowledge.	52
Somalia	African Virtual University (AVU)	Multiple universities	World Bank, UNDP	1997	Ongoing	-To facilitate quality tertiary education.	53

		(university students, learners and active workers)					
Central African Republic (CAR)	International Dialogue Centre - KAICIID and the University of Bangui.	Primary and secondary schools; university students	University of Bangui	2021	Proposed	-partial resumption of pedagogical activities in these institutions.	54
Kenya	Social Media / LMS in Refugee Camps	Somali refugees and high school graduates	Health NGOs	Feb 2017- Feb 2018	Completed	- Blended learning can enable the design and delivery of high-quality medical education.	55
Liberia	LMS* at University of Liberia	Medical students	University of Liberia & partners	2020+	Pilot small-scale implementation	-To improve learning and teaching at the university. -Increase the number of qualified doctors.	26
Niger	The Unlock Literacy model project	School children	World Vision Niger organization	2019	Ongoing	-Showed effectiveness for educational continuity in recurrent crisis situations.	56
Nigeria	Interactive radio instruction (IRI), mobile phone-based, Internet-Enabled Computer Labs	Students and Teachers	Government / NGOs	-	Proposed	-To continue education.	32
Eritrea	- open distance learning (ODL) program - UNISA programme - Multiple Distance Education programmes	Various	Various (Asmara University, UK, MOE, UNISA)	2003-2007	Completed	-Improve education access and literacy rates following conflict.	57
Kakuma refugee camp in Northern Kenya and the Dzaleka refugee camp in Malawi	ANGEL-Regis University (JC: HEM)	African refugees	-Instructors from Jesuit universities in US	2012	Completed	-Provide better education access during war and displacement	58

Central African Republic (CAR)	Moodle- open access platform	Primary and secondary school students	-Teachers -NGOs -Opinion leaders	2020	Proposed	-Expected to improve access to education.	25
Sudan	Telegram based Emergency ECHO Programs	Health-care workers	-SUDRO -Project ECHO -WHO EMRO	2023	Completed	-Enhanced capacity building through education, training, and ongoing bidirectional information sharing.	59
Libya (Post-conflict)	ICT and E-learning	Students	Proposed-Not given	2012	Proposed	-Support affected learners and educators. -Increase access to, and improve the relevance and quality of, higher education.	60
Chad	First Digital platform	School children during crisis events (conflict zones, refugees, etc)	UNESCO-IBE	2023	Ongoing	-Enhanced education during crisis (i.e. conflict, displacement, pandemics)	61
Various African countries	School for All program	School children	JICA (Japan International Cooperation Agency) initiative	Initiated in 2004	Ongoing	-Involves 70,000 primary and secondary schools across 11 African countries.	62
Burkina Faso, Cameroon, Niger	The Distance Learning Programme through Radio (PEDIR)	Displaced children	-UNICEF -ECHO -Local Governments	2017	Ongoing	-Potential of reaching out-of-school children.	63
Central African Republic (CAR)	Zeroconf protocol-TVWS* Technology	Young refugees	NGOs	2020	Proposed	-Improved access to education in conflict settings. -Real Time collaboration between teachers/students.	24

*ODL: Open and Distance Learning

*EFL: English as a Foreign Language

* LMS: Learning Management System

*TVWS: Television White Spaces

Challenges impeding the implementation of E-learning in context of war and conflict:

Whereas E-learning has had success in some countries, there are still challenges facing its implementation in times of war and conflict. According to a recent systematic review, these challenges are institution related, student related and instructor related.^{15, 30} Below are some of the challenges commonly faced while implementing E-learning within African war context.

Technological challenges

Africa hosts 33 out of 45 of the least developed countries (LDCs) according to (UN 2024) marking it as the continent housing the highest number of LDCs. Despite the progress made by these countries, there are still technological challenges that hinder effective implementation of E-learning such as power outages, inadequate infrastructure and limited access to the internet.^{15, 30} Maintaining electronic equipment in insecure environments requires ongoing investment and technical support that is rarely available in resource-constrained regions. Most importantly, the risks of censorship or surveillance impinge on safe digital participation. Levchuk et al.³¹ states the importance of employing low-resource and offline compatible technologies to mitigate such constraints.

During the Ebola epidemic and the civil war in Liberia, E-learning was introduced as a solution at the College of Health and Life Sciences, University of Liberia. Despite the collaborative effort, the initiative faced challenges such as limited electricity, lack of IT skills, low bandwidth, and inadequate infrastructure.²⁶ Similarly, the experience of Northern Nigeria with the Boko Haram insurgency revealed the major logistical barriers pertinent in technology deployment and maintenance.³²

Digital literacy

Digital literacy is a critical skill for the successful adoption of E-learning by both students and teachers. However, in marginalized African communities, there is an ongoing debate about whether limited resources should instead be allocated to more urgent needs rather than investing in digital technologies for education.³³ This leads to persistently low levels of digital literacy that make it hard for students and

teachers to navigate E-learning platforms and thereby being a hindrance to the adoption of E-learning. Fundamentally, a conclusion made by³³ demonstrates a clear relationship between digital literacy and poverty alleviation.

Moreover, the scarcity of trained digital educators and technical support staff in conflict zones threatens the overall expansion of E-learning. This causes the capacity strengthening initiatives to fall short of addressing local needs due to inadequate contextualization and resource constraints.³⁴ Subsequently, these limitations restrict the quality and reach of digital educational programs.

Financial constraints

Financial constraints represent a significant barrier to the implementation of E-learning, particularly in low-resource settings. Many institutions that aim to adopt E-learning technologies are limited by tight budgets, making it difficult to invest in both the necessary infrastructure and training programs. This challenge is further intensified during times of conflict, as seen in Sudan, where some universities attempted to adopt E-learning and relocate students to safer areas. While these efforts were commendable, they proved to be financially burdensome, adding to the already strained institutional resources.³⁵ Additionally, in certain African communities, there is skepticism regarding the value of investing in information and communication technologies (ICT) for education. Critics argue that the benefits of ICT in education are not immediately visible, and therefore, limited resources should be directed toward more urgent needs rather than the purchase of computers and digital tools.³⁶

Lack of access to educational materials

Displacement caused by war often forces families to leave behind essential educational resources such as books, computers, and other learning tools. As a result, students who attempt to continue their education through E-learning frequently lack the necessary reference materials.^{37, 38} Additionally, access to online academic resources is often limited by high subscription costs, which many institutions in conflict-affected regions are unable to afford. This creates a substantial barrier to equitable learning. One potential solution is to foster collaboration and partnerships with other academic institutions within the country or in the

diaspora. Such cooperation can facilitate resource sharing, allowing for improved access to educational materials and better continuity in learning.³⁹

Security challenges

Security and safety concerns in conflict settings represent major barriers to sustaining education. In Sudan, for instance, the recent outbreak of war severely disrupted medical education, as institutions faced damaged infrastructure, faculty shortages, limited access to learning resources, and pervasive security threats.³⁵ These conditions hindered both physical attendance and online education, as instability and unsafe environments restricted participation for both students and educators.³⁵ Medical students in such contexts also encounter heightened safety risks during clinical training and while delivering essential healthcare services.³⁵

Similarly, the protracted military crises in the Central African Republic (CAR) since 1996 have devastated the education system, with many children out of school for over a decade. In response, a Moodle-based e-learning platform was proposed as a mechanism to recover lost educational opportunities, reduce illiteracy, and improve living standards among youth.^{24, 25} While technologically promising, its success was seen to depend heavily on improvements in the broader security situation to facilitate enrollment and participation.^{24, 25}

Moreover, evidence indicates that even when students gain access to online learning opportunities, their academic progress is still constrained if they reside in insecure or unstable areas.⁴⁰ This shows that improving safety is not only complementary but also a critical prerequisite for ensuring equitable access to quality education in conflict-affected regions.

Psychological factors

Psychological trauma resulting from conflict significantly affects both teaching and learning processes. In several conflict-affected countries, frequent bombings and ongoing violence disrupted not only physical attendance but also participation in E-learning, as students and teachers often lacked stable internet access and experienced heightened psychological stress. In response, initiatives such as

webinars and virtual sessions with psychologists were organized to help address the mental health challenges and alleviate the trauma associated with war, thereby supporting the continuation of education in these difficult circumstances.^{41, 42}

Times of war also result in social isolation, which can negatively impact the psychological well-being of both students and teachers and diminish the motivation necessary for effective learning.⁴⁰ According to Galynska Olena et al.⁴⁰, while E-learning was considered an effective means of delivering education in war-affected regions, its success was limited. Ukrainian students residing in bombed areas experienced reduced access to remote learning due to frequent internet disruptions and reported feelings of loneliness, which negatively impacted their academic performance. To address these issues, communication platforms were established to facilitate interaction between students and teachers.

Socio-political challenges

Governance failures and corruption which is common in many conflict-affected African countries represent a major barrier to effective E-learning implementation, thus limiting policy execution, resource allocation, and institutional coordination.^{43, 44} The uprising insecurity and population displacement further create fluid learner demographics that complicates outreach and education continuity. According to John Sunday Ojo et al.⁴⁵, governance failure along with corruption significantly hindered the effective management of the public sector in Nigeria, which can eventually extend to E-learning implementation efforts. Other social tensions related to ethnicity and religion may also further marginalize specific groups, limiting their inclusion in digital education efforts.⁴⁶ Thus, navigating these socio-political complexities through transparent governance, community engagement, and inclusive policies represent a cornerstone for improving the success of E-learning implementation.

Cultural factors

In some communities, cultural resistance to modern technologies poses a barrier to the adoption of E-learning. A study by Slay and Dalvit³³ highlighted ongoing debates regarding the appropriateness of internet-based knowledge and ICTs in relation to local

cultures, as well as their perceived relevance to addressing local problems. In such contexts, skepticism toward the value and cultural compatibility of E-learning may hinder its full acceptance and implementation.

Case Studies

The following section draws upon the data synthesized from multiple papers included in this review to provide insight into the attempts of implementation of E-learning initiatives in the context of war and also further summarize the status and outcomes of these initiatives in African war-affected regions. This is shown in **Table 2**.

DISCUSSION

The intersection of technology and education during wartime reveals both challenges and innovative solutions. The capacity of educational institutions to utilize technological resources to sustain education constitutes a critical aspect, particularly in protracted circumstances such as armed conflict. The implementation of E-learning has demonstrated a significant degree of resilience and adaptability among impacted educational entities, thereby engendering a positive outlook on educational prospects.³⁸ Fundamentally, the integration of mobile applications and virtual technologies within crisis situations has been widely recognized as an exemplary solution to the disruptions faced by education in a multitude of contexts.³⁹

E-learning, being highly regarded and implemented within the global war impacted settings, generates a number of viable question for the context of Africa. To what extent is E-learning implemented within African countries impacted by war? And has E-learning in African settings matured beyond the pilot-scale level? And whether E-learning is a commendable solution for improving learning experiences and generating positive outcomes among Africans? And whether, more critically, given the unique challenges in African contexts, should stakeholders look toward more context-specific, conflict-sensitive solutions? In the following sections, a discussion of the findings and their future implications for education in volatile settings in Africa will be reported.

E-learning implementation in the African context of war and instability

It is undeniable that E-learning provides a flexible alternative for students in conflict zones, allowing them to continue their education despite the multiple constraints and physical barriers. Our findings indicate that multiple attempts for establishing E-learning in various African contexts have been active across multiple educational levels with the goal of sustaining education during conflicts. For instance, in Libya, E-learning has been instrumental in securing the educational needs during civil unrest, thereby helping students avoid recruitment by armed groups.⁵⁰ The proposed Moodle platform in the case of Central African Republic also shows potential in facilitating remote learning and enabling children who have been out of school to catch up on their education.²⁵

Despite this, the results additionally remark to another critical point that indicate that the majority of these E-learning attempts never grew beyond being proposed or piloted. A clear paucity of data also pertains to whether these E-learning initiatives were scaled up to wide implementation in these conflict settings. This is in line with the critical findings of Barteit et al⁶⁴, who referred to the wide failure of E-learning initiatives in progressing beyond the pilot phase in low-resource settings. Most of scalability non-success was attributed to a lack of system-wide approaches, insufficient training, and unrealistic expectations. According to Duggal et al⁶⁵, digital health initiatives in low- and middle-income countries face challenges such as fragmented systems and lack of coordination, which exacerbate implementation and sustainability issues.

Notably, in the majority of E-learning initiatives evaluated in our study, the initiatives were launched through concerted efforts mostly involving NGOs and individual institutional efforts, with minimal involvement of governmental efforts and national strategies. This lack of oversight by governmental bodies draws critical questions regarding the effectiveness, scalability and reach of these initiatives within African conflict settings. It is evident the exclusion of governmental and national bodies limits resources that are often needed for wide implementation.⁶⁴ Our findings also illustrated that a

range of these E-learning initiatives were devised for the post-conflict period rather than the immediate conflict conditions. This shows that E-learning value may extend beyond the immediate fragility imposed by conflict and would be beneficial for managing the transition of students in the post-conflict era. This is in line with Rehman et al.⁶⁰ findings, where E-learning served as a vital tool for reconstructing higher education systems in post-conflict era.

Outcomes for E-learning implementation in the African context of war and instability

As previously noted, E-learning is a promising solution for continuing educational prospects and overcoming disruptions in the context of conflict. However, the available literature also highlights a clear paucity of information regarding the measurable outcomes of E-learning and attainment of educational goals. In addition to the observable fact that most of these E-learning programs never mature beyond the pilot stage, thereby resulting in lower reach and impact, is the fact that these initiatives are almost always challenged by significant barriers in terms of technology access and infrastructure.⁶⁶

Within global war settings, E-learning was deemed a remarkable and vital tool for achieving educational goals and success, however; in the African context, questions regarding the effectiveness of E-learning need better assessment.^{18, 20} The adoption of a systemic approach, as indicated by Barteit et al.⁶⁴ highlights one of the main solutions to overcome this shortcoming and ensure that the objectives of E-learning in African conflict settings are fully achieved. A holistic, systematic framework utilized for the planning, implementation, and evaluation of E-learning programs will undoubtedly result in optimized evaluation and educational goals. Additionally, the contextualization of E-learning solutions by taking into account the cultural and political differences between the different settings is another pivotal way of ensuring the integration of E-learning initiatives within the country's specific context. Fundamentally, Dalrymple et al.⁶⁷ cautions against one-size-fits-all solutions which may not reflect cultural contexts. This establishes an urgent need for program designs that are context-aware and co-developed with communities to ensure relevance and sustainability.⁶⁷ Additionally, in depth understanding of the underlying

enablers and barriers in conflict settings remains crucial to ensure E-learning success.

The Way forward

In order to strengthen E-learning programs in Africa, especially during conflict, disasters, and crisis, a coordinated and strategic approach initiates the way forward towards the success of E-learning. Although the potential of E-learning is undeniable, it is evident that implementation must move beyond a one-size-fits-all model. Therefore, establishment of regional committees involving higher education institutions, policy makers, and international partners for development of context sensitive E-learning strategies is therefore critical. Furthermore, these committees can serve as an important tool for effective joint planning, mobilization of resources and quality assurance thereby ensuring the continuous scalability and sustainability of these initiatives.

Secondly, investing in resilient digital infrastructure is crucial. This includes developing flexible platforms, harnessing mobile technology, and establishing community-based digital hubs. The prioritization of open educational resources (OERs) by institutions also represents a major step toward reducing costs and improving accessibility. Thirdly, the delivery of high-quality E-learning requires the capacity building of educators in digital pedagogy and E-learning methodologies. This involves leveraging artificial intelligence (AI), fostering mentorship, and strengthening peer-learning networks to enhance teaching practices.

The utilization of the full capabilities of E-learning requires comprehensive policy integration at both institutional and national levels. Therefore, collaborations between the different stakeholders and at all levels to ensure smooth transition, fostering resilience, and innovation, to create sustainable E-learning system to protect education disruption. Without appropriate policy frameworks, the implementation of digital education initiatives remains fragmented, limiting their potential impact and sustainability.³⁶ Finally, the development of a robust monitoring and evaluation framework is necessary to assess the effectiveness of E-learning interventions. Such a framework will ensure accountability, promote

evidence-based decision-making, and guide continuous improvement.

Innovative Educational Initiative is here to stay for Africa

In correspondence with the global surge in use of Artificial Intelligence (AI), it is clear that continuous innovation encompassing the field of education delivery will continue to expand. Within conflict settings, Artificial Intelligence appears to have a transformative potential for educational endeavours. Given the adaptive capabilities of AI, it has the ability to overcome some of the conflict driven challenges that impedes the sustainability of E-learning initiatives. Therefore, it is without doubt that the emergence of AI adaptive E-learning systems presents significant opportunities towards education in conflict settings. Importantly, AI-driven e-learning systems can enhance educational outcomes by providing personalized, flexible, and scalable learning experiences.⁶⁸ The integration of personalized learning pathways, adaptive features and enhanced content delivery systems represent some of the ways through which AI can help adjust and improve the learner experience.⁶⁸ In conflict settings, AI can help to overcome multiple challenges such as language barriers, literacy deficits, and resource constraints by providing tailored support and real-time interaction.⁶⁹

Despite its major potential, the integration of AI in education is faced with challenges such as resource constraints, lack of skilled professionals, and ethical concerns regarding data privacy.⁷⁰ Although Chisom et al⁷⁰ demonstrated the potential of AI in enhancing educational outcomes and inclusion within the continent, there is a clear paucity pertaining to the potential of AI in conflict-afflicted settings and its integration with the current E-learning initiative deployed in these fragile situations. This demands the comprehensive exploration of how AI adaptive E-learning platforms would be successfully deployed in the setting of conflict and instability.

Limitations

Our study is limited by a number of factors. Firstly, this review relies on available literature and grey sources which emphasizes the need for further comprehensive studies that include primary data from conflict-affected

settings. The review relies exclusively on secondary sources, which may not capture all context-specific challenges or unpublished initiatives. Consequently, the findings and recommendations require empirical validation in future studies. Secondly, much of the existing research is confined to pilot initiatives with limited evaluation of scalability or long-term outcomes which constrains the generalizability of our findings. This indicates need for longitudinal qualitative and quantitative studies to provide more robust evaluation. Thirdly, variations in infrastructure, socio-cultural contexts, and policy environments across African countries may limit the applicability of certain conclusions. Finally, the exclusion of non-English papers may have resulted in the omission of relevant studies. Future research should focus on empirical assessment of E-learning interventions, their effectiveness, and context-specific adaptation across diverse conflict settings in Africa.

CONCLUSION

E-learning in African conflict settings presents a vital tool with a multitude of inherent opportunities that can sustain education during times of instability. The flexibility and accessibility to educational resources remains one of the hallmarks pertinent to E-learning, however; it has been challenged by multiple factors including weak infrastructure, lack of resources and under-financing. During times of conflict and instability, the African continent reveals a wide variety of attempts for incorporating E-learning within different educational levels. Nonetheless, most of these interventions remained stagnant at the pilot level, with little evidence of scalability. Moreover, the findings reveal a critical lack of data on the outcomes, effectiveness, and overall reach of these initiatives during times of war. This indicates a dire need for development of context-specific and conflict-sensitive solutions, the engagement of diverse stakeholders and comprehensive evaluation of E-learning outcomes.

ACKNOWLEDGMENTS

We would like to express our gratitude to the African Science Frontiers Initiatives (ASFI) for inviting us to contribute to this review. *AI disclosure:* Artificial intelligence was used only for minor grammar and

language corrections and was not involved in the synthesis, analysis or evaluation of the content.

CONFLICT OF INTEREST

The authors declare that they have no competing interests

AUTHORS' CONTRIBUTIONS

All authors conceptualized the research and wrote the main manuscript. All the authors reviewed the manuscript.

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