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CASE STUDY

TEACHING CONTINUITY DURING AND AFTER THE WAR IN SUDAN: THE EXPERIENCE OF THE MHPE PROGRAMME AND THE NATIONAL E-LEARNING ECOSYSTEM INITIATIVE

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ABSTRACT

PURPOSE: This paper aims to document and analyse the response of higher education institutions (HEIs) in Sudan to the disruptions caused by the war that erupted in April 2023. It particularly highlights the experience of the Master of Health Professions Education (MHPE) programme at the University of Khartoum, the national-level co-ordination by the Association of Sudanese Universities (ASU), and the forward-looking contributions of the Council of Sudanese Experts and Scientists Abroad.

DESIGN: The paper is both conceptual and a case study that applies a qualitative, experience-based approach to describe and reflect upon adaptive strategies used by institutions and national bodies to ensure teaching continuity. These include the transition to online teaching, development of an e-learning and digital simulation ecosystem, and engagement of the diaspora in academic recovery and innovation.

RESEARCH LIMITATIONS: The paper is based on experiences during an active conflict, and this may limit access to quantitative data. Future research may build on these insights by conducting longitudinal evaluations of the initiatives' impact.

FINDINGS: The MHPE programme demonstrated remarkable resilience by leveraging online platforms and community-based support mechanisms. ASU initiated a national project to build a digital learning infrastructure and simulation capacity across Sudanese universities, particularly targeting practice-based disciplines. Additionally, the Council of Sudanese Experts and Scientists Abroad played a key role in facilitating knowledge transfer and fostering digital transformation initiatives.

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ORIGINALITY: This paper presents a unique integration of institutional, national, and diaspora-driven strategies in response to an ongoing conflict. It provides a replicable model for crisis-responsive higher education, especially in resource-constrained and conflict-affected settings.

IMPLICATIONS: The experience shared offers actionable insights into maintaining educational continuity in crisis contexts. It also highlights the importance of digital infrastructure, simulation technologies, and diaspora engagement in rebuilding resilient academic systems.

KEYWORDS: *Higher Education; Sudan; Teaching Continuity; War; Digital Transformation; E-Learning; Simulation; Diaspora; MHPE; ASU.*

INTRODUCTION AND LITERATURE REVIEW:

Education in Emergencies: A Global Perspective

Education in emergency and conflict settings plays a vital role in providing protection, psychosocial stability, and a pathway to future recovery for affected populations. The Inter-Agency Network for Education in Emergencies (INEE, 2004) emphasises that, beyond being a fundamental human right, education in crises contributes to survival and resilience by offering safe spaces, routine, and hope. In contexts of protracted conflict, education mitigates the psychosocial impacts of war by helping learners and communities maintain a sense of normalcy and identity.

In several countries affected by conflict, including Afghanistan, Syria, South Sudan, and Iraq, education systems have experienced direct attacks on infrastructure, targeted violence against students and educators, loss of accreditation pathways, and large-scale displacement of academic communities (Milton, 2019; Orzhel*et al.*, 2023; Darwish and Mihyawi, 2023). For example, the Syrian conflict severely disrupted education access for millions, with widespread school destruction, politicisation of curricula, and chronic underfunding of educational recovery. Similarly, during the civil war in South Sudan, entire universities were forced to relocate, as was the case in Sudan's own history when institutions such as the University of Juba moved to Khartoum during earlier civil unrest.

Despite the widespread devastation, global experience has shown that education systems can respond with innovation, adaptability, and resilience when supported by co-ordinated, context-sensitive strategies. However, these responses often suffer from being fragmented, underfunded, and short-term in vision.

Conceptual Foundations: Education as a Humanitarian Priority

INEE has been instrumental in framing education as a fundamental right in crisis contexts, emphasising its role in mitigating vulnerability and promoting stability (INEE, 2004, 2022). Education in emergencies encompasses immediate interventions, such as temporary learning spaces, and long-term strategies, including curriculum adaptation and digital learning. Resilience-oriented frameworks, as articulated by Duchek (2020), highlight three stages: anticipation (pre-crisis planning), coping (real-time adaptation), and adaptation (post-crisis recovery). These stages

are critical for higher education institutions navigating disruptions caused by conflict, natural disasters, or pandemics, as evidenced by global responses to COVID-19 (Afolabi and Olajuyigbe, 2022a).

Academic Continuity in Emergencies

Academic continuity planning encompasses strategies that enable uninterrupted teaching and learning during crises. Day (2015) underscores that such disruptions, even when temporary, can significantly impact student engagement and institutional operations. His study at Okanagan College found that although web-based conferencing maintained academic outcomes during a one-week disruption, students reported lower engagement and a loss of pedagogical immediacy. The experience highlights the importance of familiarity with digital tools and the need for emotional connectivity in remote education environments.

Policy responses to large-scale emergencies reinforce this complexity. During the COVID-19 pandemic, institutions such as California State University LA (CSU, 2020) adopted emergency remote teaching policies, including mandatory learning management system (LMS) use, asynchronous access, and compassionate grading policies (CSU, 2020). Such measures reflected a commitment to equitable access, recognising that students lacked uniform Internet connectivity and computing devices.

E-Learning and Digital Ecosystems

The global shift towards online education has underscored the importance of building robust digital ecosystems. Afolabi and Olajuyigbe (2022b) analyse the Nigerian experience using Duchek's resilience model, anticipation, coping, and adaptation, to illustrate how educational systems transitioned to online learning during the pandemic. Their findings emphasise that despite initial resistance and systemic inequities, online tools played a critical role in sustaining learning, provided they were backed by pedagogical and technical support.

The Role of the Diaspora and Transnational Networks

Diaspora engagement has emerged as a key asset in sustaining educational continuity under extreme conditions. INEE documents promised practices in refugee-hosting settings, where displaced teachers and host community educators support learning through hybrid and no-tech strategies (INEE, 2022). In Uganda and South Sudan, collaborative peer-coaching models have strengthened teacher capabilities and built professional communities resilient to conflict and displacement (Ladegaard, 2021).

In Sudan, the Council of Sudanese Experts and Scientists Abroad has played a pivotal role by providing virtual instruction, research supervision, and policy support. These efforts complement national strategies and ensure that knowledge transfer continues despite the country's physical and political fragmentation. This integrated model combining institutional resilience, national

co-ordination, and diaspora contributions, offers a template for other post-conflict education systems.

CONTEXT OF THE SUDANESE CONFLICT (APRIL 2023) AND ITS IMPACT ON HIGHER EDUCATION

The eruption of full-scale war in Sudan on 15 April 2023, between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF), marks one of the most devastating chapters in the country's modern history. Among the sectors hardest hit by the conflict is higher education that was already strained by decades of under-investment, political interference, and infrastructural deficits. Before the war, Sudan had one of the most extensive higher education systems in the Horn of Africa, comprising 39 public and 25 private universities with nearly 700,000 students and more than 14,000 academic staff members; of these, over 8,000 held PhDs (Elgadal and Glade, 2024).

The vulnerability of Sudan's higher education system was exacerbated by its geographic concentration in Khartoum, where over 53% of the country's tertiary institutions were located (Beshir, 1969; Elgadal and Glade, 2024). With Khartoum becoming the primary battlefield, universities such as the University of Khartoum, Nileen University, and Sudan University of Science and Technology saw their campuses occupied, looted, or destroyed. Iconic institutions such as Omdurman Ahlia University lost entire libraries and archival collections (including the Mohamed Omer Bashir Center for Sudanese Studies), while many administrative and academic buildings were reduced to rubble or rendered inaccessible (Elgadal and Glade, 2024).

In Sudan, the war's disruption has created a multi-tiered crisis: physical displacement, digital inaccessibility, administrative paralysis, and the erosion of academic integrity due to fragmented operations and lack of reliable records.

The consequences of the conflict have not been limited to physical infrastructure. As the war intensified, over 90% of Sudanese academics and students were displaced either internally or across borders, fleeing to Egypt, South Sudan, Ethiopia, Uganda, and the Gulf countries (Elgadal and Glade, 2024).

OVERVIEW OF THE CASE STUDIES: MHPE PROGRAMME, ASU INITIATIVE, AND COUNCIL OF SUDANESE EXPERTS ABROAD

The MHPE Programme at the University of Khartoum: A Case of Institutional Resilience

Background of the MHPE programme

The MHPE programme at the University of Khartoum, offered through the Faculty of Medicine and managed by the Educational Development Centre (EDC), serves as a pioneering initiative in advancing educational leadership and pedagogical in0novation within Sudan's health sector. This programme is designed to build the capacity of current and future educators, administrators, and health professionals by equipping them with comprehensive knowledge and practical skills in the

theory and practice of health professions education. Since its establishment, the MHPE programme has successfully graduated four cohorts of health education professionals, many of whom now play key roles in academic institutions and healthcare settings throughout Sudan.

The programme adopts a blended learning approach, combining both face-to-face and online instruction. Teaching methods include synchronous and asynchronous lectures, recorded video sessions, hands-on workshops, small group discussions, problem-based learning activities, seminars, tutorials, and structured reflective assignments. Assessment strategies are varied and include quizzes, individual and group assignments, course examinations, and participation in moderated discussion forums. All online learning activities are delivered via the University of Khartoum's Moodle learning management system, which is locally hosted to ensure accessibility and stable performance.

By fostering a learner-centred, practice-oriented educational experience, the MHPE programme at the University of Khartoum continues to be a critical driver of sustainable improvements in the quality and effectiveness of health professions education in Sudan and the wider region.

Challenges faced:

During the 2023 armed conflict in Sudan, the MHPE programme at the University of Khartoum faced a convergence of operational and structural challenges:

- *Widespread Displacement:* The sudden outbreak of violence displaced both students and faculty across Sudan and beyond. Many learners relocated to areas with limited infrastructure or left the country entirely, complicating participation and access to educational resources.
- *Internet Instability and Power Outages:* Widespread infrastructural collapse disrupted electricity and Internet services, key enablers of the programme's blended learning model. Survey data revealed that students could only sustain stable online access for a maximum of two consecutive hours, often through limited devices such as laptops or mobile phones.
- *Collapse of University Infrastructure:* The locally hosted Moodle learning platform became unreliable due to damage and instability in university servers. This severely affected access to course content and forums, necessitating an urgent technological migration.

Adaptive strategies:

Shift to online learning

The EDC transitioned the MHPE programme to fully virtual delivery:

- the EDC implemented a complete migration from in-person to virtual learning, adopting a fully asynchronous and synchronous blended model;
- all remaining modules were conducted via real-time online lectures, asynchronous recorded content, and tele-simulation sessions;
- flexible scheduling (e.g., classes on weekends and evenings) was introduced to match learners' availability based on a rapid readiness assessment;

- real-time classes were reduced; asynchronous materials (recorded lectures, reading packages) were emphasised to support students with intermittent connectivity;
- final exams were redesigned as open-book, week-long take-home assessments, reducing the impact of connectivity interruptions.

Use of available platforms and tools

- a cloud-based Moodle instance hosted by faculty outside Sudan was created to bypass local infrastructure failure;
- diverse tools were integrated into the learning strategy, including Zoom, Google Docs, WhatsApp, and PDF-based submissions to accommodate low bandwidth and device diversity;
- assessments were redesigned as open-book, long-duration assignments to mitigate the risk of submission failure during Internet or electricity cuts;
- learning content was streamlined through module mergers (e.g., Research Ethics I & II) and compression of longer courses to sustain engagement under stressful conditions;
- this aligns with the Education Continuity Framework (ECF) guidance on leveraging low-tech and high-resilience Information and Communications Technology (ICT) solutions during disasters.

Role of faculty and student commitment

- faculty adapted by revising curricula, compressing modules (e.g., merging Research Ethics I & II), and providing personalised support;
- students showed remarkable resilience, with 93.5% retention throughout the conflict period, reflecting strong engagement and the effectiveness of learner-centred strategies;
- alumni from Batch 4 were mobilised as facilitators and technical co-ordinators—mirroring the ECF's recommendation for leveraging institutional human capital in continuity responses: they provided facilitation, mentoring, and technical support, reinforcing peer-led resilience and easing instructional burdens;
- Faculty Engagement: Faculty revised course designs and delivery plans in real-time, often from insecure or improvised locations; their rapid response was critical to continuity;
- Student Support Facilitators were appointed per module to troubleshoot individual concerns, including academic queries and technology access.

Lessons learned from the MHPE experience

Drawing from both the internal review and the education continuity literature, the following key lessons emerged:

1. Readiness Assessments Are Critical: Conducting rapid surveys to identify students' connectivity and scheduling preferences helped shape a feasible delivery strategy optimising delivery modes, reflecting global best practices in conflict education settings. This practice is directly aligned with continuity planning step 2.2 in the ECF.

2. Cloud-Based Infrastructure is a Necessity: Transitioning to externally managed platforms protected continuity amid infrastructural failure - a critical move echoed in other fragile contexts such as Syria and Ukraine. Hosting Learning Management System (LMS) platforms externally should be standard for institutions in volatile environments to eliminate single points of failure.
3. Peer Facilitation Increases Resilience: Mobilising past graduates (alumni and internal leaders) as mentors, empowering them to take over technical and academic facilitation, created a culture of continuity and lowered the demand on core faculty amid staffing shortages.
4. Flexible Curriculum Saves Continuity: Adaptations to syllabi, assessments, and timelines allowed academic integrity to be maintained without overburdening students or staff. Open-book exams, deadline extensions, and low-tech alternatives ensured fair access regardless of students' geographic or technological limitations.
5. Structured Collaboration Models Promote Engagement: The ABCDEFs Model for Virtual Group Work provided clear expectations and responsibilities, enhancing group productivity even in virtual spaces.
6. Innovation Amid Crisis Can Future-Proof Curricula: By integrating topics such as artificial intelligence (AI) and educational technology, the programme remained globally relevant and anticipatory of future disruptions.
7. Institutional Resilience Requires Embedding Continuity Thinking: The experience highlighted the need for MHPE and similar programmes to embed education continuity planning into institutional culture, including:
   - appointing a continuity officer;
   - maintaining updated remote-learning contingencies;
   - holding annual continuity drills and readiness reviews.

National Response: The Association of Sudanese Universities (ASU) and the E-Learning and Digital Simulation Ecosystem Project

Role and mandate of ASU

The Association of Sudanese Universities (ASU) is the co-ordinating body for higher education institutions in Sudan, encompassing both public and private universities. Its mandate includes promoting academic collaboration, formulating national education strategies, and supporting capacity building across institutions. In the wake of the 2023 armed conflict, which caused widespread displacement, institutional collapse, and halted educational delivery, ASU took a central role in sustaining and reviving the country's higher education sector.

ASU's Leadership in Crisis Response

ASU emerged as the central co-ordinating institution for the revitalisation of Sudan's higher education system in the aftermath of the armed conflict that began in April 2023. Faced with massive

disruption, displacement of over 8.6 million citizens, destruction of universities, looting of libraries and laboratories, and loss of lives within the academic community, ASU assumed a leadership role that extended beyond co-ordination to proactive national strategy development.

ASU's leadership was defined by its comprehensive, system-level response that included emergency recovery, capacity building, policy formulation, and long-term educational transformation:

1. Emergency Digital Education Deployment
   - ASU launched a unified national e-learning platform to allow universities to resume theoretical teaching.
   - It hosted displaced institutions lacking digital infrastructure on shared platforms supported by ASU and Arab innovation alliances.
2. Initiation of Virtual Laboratory and Simulation Education
   - Recognising the breakdown of practical teaching capacity, ASU pioneered a virtual simulation initiative, with tools that will substitute for destroyed physical laboratories and hospitals.
3. Deployment of Mobile E-Learning Laboratories
   - ASU successfully designed, equipped, and deployed three mobile e-learning labs, each outfitted with tablets, servers, WiFi, solar-powered UPS systems, and offline-accessible LMS platforms.
   - These mobile labs were strategically stationed in relatively stable towns and allowed displaced students from multiple universities to access online courses and sit for exams.
   - Each lab could accommodate up to 50 students simultaneously and was managed by a trained local technician.
4. Institutional Co-ordination and International Outreach
   - ASU mobilised a multi-sectoral Steering Committee including representatives from:
     - The Ministry of Higher Education and Scientific Research
     - The Sudan National Information Center
     - Diaspora academic networks such as University of Khartoum Alumni Association (UOKANA), Sudanese American Physicians Association (SAPA), and the Association of Sudanese Professors in Qatar (ASPQ)
5. Policy and Governance Development
   - ASU will oversee the drafting of a national policy and governance framework for e-learning and digital simulation integration, addressing quality standards, data protection, access equity, and academic integrity.
   - A specialised team was assigned to develop monitoring and evaluation tools (e.g., SPSS dashboards) to measure performance and inform continuous improvement.

6. Long-Term Sustainability Planning
   - ASU will lead the design of a sustainability model encompassing financial, institutional, technical, and social pillars.
   - It aligned the project with national digital transformation strategies, embedding it into Sudan's post-conflict education recovery plan.

Rationale for a national-level digital education response

Sudan's higher education system faced systemic collapse due to the April 2023 armed conflict:

- over 8.6 million people were displaced, including faculty and students;
- more than half a million students dropped out or were at risk of doing so;
- multiple universities were damaged or occupied, with libraries, labs, and hospitals looted or destroyed;
- a 5-month suspension of salary disbursement led to brain drain and mass faculty migration;
- Internet disruptions and institutional fragmentation isolated academics and students from global networks.

ASU recognised that a conventional physical recovery model would not be viable in the short-to-medium term. A national digital response became necessary for several reasons:

- to rapidly restore access to education for displaced students;
- to reduce disparities between digitally advanced and lagging institutions;
- to create a national-level resilience infrastructure capable of withstanding future crises;
- to capitalise on ICT investments made prior to the war, and bridge gaps in institutions with less digital capacity;
- to leverage simulation technologies in place of physical lab work and clinical placements.

.The initiative draws lessons from global experiences, highlighting how ICT can sustain learning under crisis conditions.

Description of the e-learning and simulation ecosystem project:

Goals and components

The project, led by ASU, is titled: Development of an E-Learning and Digital Simulation Ecosystem for Sudanese Universities. Its goals are to:

- rebuild educational capacity and access using scalable digital technologies;
- enhance practical learning through immersive simulations;
- build long-term sustainability into digital education across Sudanese universities.

Faculty development and capacity building

A three-tiered training and capacity-building framework was adopted, targeting:

1. Trainers of Trainers (ToT): Selected from universities and trained intensively in virtual lab management, instructional design, and troubleshooting.
2. Teaching Staff: Equipped with skills to develop digital content, manage LMS, and integrate simulations into pedagogy.
3. Students: Oriented to virtual lab usage, academic integrity tools, and asynchronous learning environments.

Implementation strategies and expected outcomes

Implementation Strategies:

- A 24-month, phased rollout, starting with digital infrastructure (cloud, LMS), followed by simulations and faculty development;
- Work Breakdown Structure (WBS) aligning major tasks with a Gantt timeline:
  - Months 1-4: Infrastructure setup and vendor selection;
  - Months 5-12: Faculty training and content digitisation;
  - Months 13-20: Policy, governance, and sustainability planning;
  - Months 21-24: Performance assessment and handover;
- deployment of mobile labs to three pilot universities;
- establishment of feedback and grievance redress mechanisms for users;
- integration of data analytics tools for monitoring and evaluation (M&E) and adaptive management.

Expected Outcomes:

- A fully functional national digital learning platform serving public and private universities;
- over 1,000 trained faculty and support staff;
- delivery of virtual lab simulations in five major academic fields;
- development of multilingual interactive content aligned with Sharable Content Object Reference Model (SCORM) and International Organization for Standardization (ISO) standards;
- creation of a resilient governance framework for sustained ICT use in education;
- improved access, equity, and educational quality across conflict-affected institutions.

Diaspora Engagement: The Role of the Council of Sudanese Experts and Scientists Abroad

Introduction to the Council and its mission

In the wake of the devastating conflict that erupted in Sudan in April 2023, the Council of Sudanese Experts and Scientists Abroad, the Sudanese Partnership for Knowledge Transfer by Expatriate Nationals affiliated with the Knowledge Transfer Directorate of the Secretariat for Sudanese

Expatriates Affairs (SSWA), stepped forward as vital actors in educational continuity and national recovery.

The Council is a multidisciplinary and geographically dispersed body composed of Sudanese professionals, academics, and researchers living abroad. Its core mission is to serve as a bridge for knowledge transfer, capacity building, and technical collaboration between the Sudanese diaspora and domestic institutions. Post-conflict, the Council aligned its efforts with the national education response plan, recognising that recovery required not just reconstruction, but innovation-and that Sudan's global brainpower was central to both.

Strategies for knowledge transfer and digital transformation

Amid infrastructural destruction and academic disintegration, the Council pursued a multi-phase strategic framework centred on:

- Reorganising and expanding the Council's membership: A digital membership campaign and the creation of regional chapters (e.g., in the Gulf, Europe, and North America) helped activate previously dormant networks;
- Digital engagement: The Council launched webinars, virtual seminars, and online mentorship programmes using platforms such as Zoom and Microsoft Teams to sustain academic dialogue and mobilise expertise;
- Technology-driven collaboration: Members provided input into the national digital transformation agenda, particularly in shaping e-learning, virtual lab systems, and data analytics strategies in partnership with the ASU e-learning and digital simulation project;
- Emergency education recovery plans: The Council co-designed assessment tools and policy proposals for higher education resumption, integrating Geographic Information System (GIS) tools to map institutional damage and student displacement.

These strategies were not reactive but deliberately designed to transition from crisis management to sustainable innovation, rooted in the vision of a digitally resilient post-conflict higher education system.

Diaspora support mechanisms:

Virtual teaching and mentorship

One of the most impactful interventions was the organisation of virtual teaching rotations and mentorship schemes:

- Sudanese professors abroad, co-ordinated via SSWA and ASU, delivered online lectures and short courses in medicine, engineering, public health, and education;
- a "teaching-from-abroad" model was adopted by universities such as the University of Khartoum and the University of Gezira, where diaspora academics covered core modules using Zoom, Google Meet, and pre-recorded content;

- graduate students and junior faculty in Sudan were assigned mentors from the diaspora for guidance on thesis development, grant writing, and academic publishing.

These interventions sustained academic progression for hundreds of students and laid the foundation for future blended models in Sudanese universities.

Research collaboration

To bridge the research paralysis caused by war, the Council:

- brokered collaborative research partnerships between Sudanese universities and international institutions in the Gulf, North America, and Europe;
- facilitated co-supervision of graduate research, enabling Sudan-based students to access diaspora expertise and international labs virtually;
- supported the formation of thematic research clusters in fields such as crisis management, health systems recovery, and digital education, aligning with Sudan's reconstruction priorities.

Furthermore, members contributed to the development of Sudan-focused research agendas, ensuring local relevance and international visibility.

Technical and policy advice

Diaspora experts played a crucial advisory role in:

- developing national policy briefs on digital education governance, cybersecurity, academic accreditation, and emergency education law;
- contributing to the ASU-led simulation ecosystem by advising on technology selection, interoperability, and quality assurance standards (e.g., SCORM compliance);
- advising ministries and universities on cloud infrastructure migration, data backup strategies, and ethical standards in virtual learning environments.

The Council's input was instrumental in shaping the post-war education roadmap and aligning Sudanese higher education with international quality benchmarks.

Integration with national and institutional efforts

What distinguished the Council's engagement was its seamless integration into formal recovery structures, such as:

- the ASU E-Learning and Digital Simulation Project, where diaspora members served on the ASU E-Learning and Digital Simulation Project, where diaspora members served on the project team, provided technical input, and contributed to training design;
- The National Emergency Education Response Plan, to which the Council contributed frameworks for psychosocial support, temporary education hubs, and mobile learning units;
- government co-ordination through SSWA that facilitated partnerships with ministries, donor agencies, and UN bodies such as UNESCO and UNICEF (UNICEF 2019a, b).

Diaspora involvement was not limited to volunteering; it became institutionalised through formal Memoranda of Understanding (MoUs), joint taskforces, and a commitment to Sudan's long-term reconstruction vision.

The Council of Sudanese Experts and Scientists Abroad exemplifies how diaspora communities can move from symbolic solidarity to strategic partnership. Their engagement provided not only a lifeline during the educational blackout but also a blueprint for future academic resilience. As Sudan transitions from war to reconstruction, the diaspora remains one of the country's most powerful untapped resources, not as an external actor, but as a co-author of a sustainable, inclusive, and digitally empowered higher education system.

INTEGRATED INSIGHTS: TOWARDS A MODEL FOR CRISIS-RESPONSIVE HIGHER EDUCATION

The Sudanese experience in navigating the educational fallout of war reveals a compelling blueprint for how fragmented, under-resourced higher education systems can respond to crisis through strategic integration, digital innovation, and collaborative governance. This section synthesises the multi-layered experiences of institutional actors (such as the University of Khartoum's MHPE programme), national leadership (via the Association of Sudanese Universities), and global partnerships (spearheaded by the Council of Sudanese Experts and Scientists Abroad), proposing an integrated model for crisis-responsive higher education in fragile contexts.

Interconnection of Institutional, National, and Diaspora Efforts

The effectiveness of Sudan's educational continuity measures during and after the 2023 conflict hinged on interconnected and mutually reinforcing interventions across three levels:

- Institutional Level: Programmes such as the MHPE at the University of Khartoum showcased the ability of university-based teams to adapt rapidly through online delivery, curriculum restructuring, and the leveraging of peer networks. Faculty commitment and alumni facilitation emerged as critical enablers of operational continuity, despite the collapse of physical infrastructure.
- National Level: The Association of Sudanese Universities (ASU) provided strategic co-ordination and systems-wide infrastructure. By launching the E-learning and Digital Simulation Ecosystem Project, ASU addressed systemic inequalities and built a centralised architecture that supported digital continuity across institutions, particularly those with limited technical capacity. ASU also facilitated cross-institutional access to mobile e-learning labs and virtual simulations, effectively democratising digital resources.
- Diaspora Level: The Council of Sudanese Experts and Scientists Abroad, in collaboration with SSWA, served as a catalytic third pillar. Through virtual teaching, research mentoring, policy advisory roles, and technical consultancy, diaspora professionals filled expertise gaps and acted as transnational bridges connecting Sudanese academia to global best practices.

Key Enablers of Success: Digital Tools, Leadership, Community Resilience

Sudan's crisis-era academic recovery underscores several key enablers that collectively shaped a functional and replicable model:

Digital infrastructure and tools

- Cloud-based LMS platforms, mobile labs, and simulation tools enabled teaching to resume without dependence on physical campuses.
- Tools such as Zoom, Moodle, Google Meet, and SPSS were adapted for teaching, evaluation, and feedback under austere conditions.
- Simulation technologies replaced practical learning lost to the destruction of labs and teaching hospitals, maintaining academic standards in medicine, engineering, and the sciences.

Conceptual model for education continuity during crises

A TRIAD Model (Transformative Resilience through Institutions, Alignment, and Diaspora) is an holistic, adaptable framework for rebuilding and safeguarding higher education in post-conflict settings. It draws on Sudan's experience during the 2023 war and synthesises global best practices to guide long-term educational resilience and crisis preparedness. The model rests on three interdependent pillars:

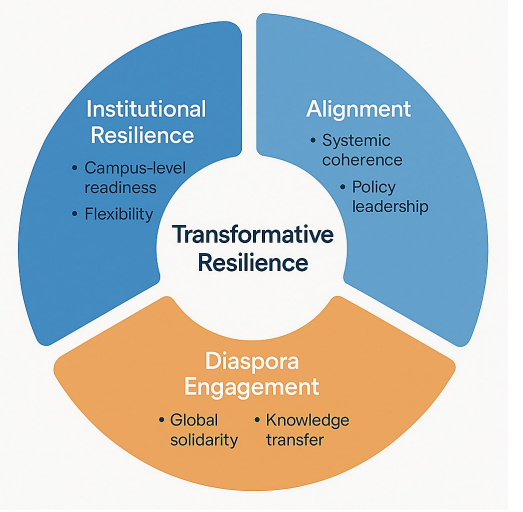

Figure 1: The TRIAD Framework Model

Source: Constructed by author

Institutional Resilience (Campus-Level Readiness and Flexibility)

Objectives::

- Strengthen the autonomy and adaptive capacity of universities to maintain academic operations under duress.
- Build internal digital infrastructure and human capital to support continuity.

Core Elements:

- Digital Integration: Develop blended learning platforms and remote assessment systems (even in low-connectivity areas).
- Faculty Capacity: Continuous digital pedagogy training; crisis-informed curriculum design.
- Emergency Governance: Create institutional contingency plans (e.g., academic continuity teams, cloud-based archives).
- Mental Health and Well-being: Integrate psychosocial support services for faculty, students, and administrative staff.

National Co-ordination (Systemic Coherence and Policy Leadership)

Objectives:

- Align institutional responses under a unified national framework led by the Ministry of Higher Education and the Association of Sudanese Universities (ASU).
- Promote equity, resource pooling, and policy coherence.

Core Elements:

- Digital Ecosystem: Scale up the ASU-led national e-learning and simulation infrastructure across all universities.
- Policy Alignment: Standardise virtual course recognition, credit transfer, and national student databases.
- Emergency Education Fund: Establish a central fund for rapid response, infrastructure repair, and continuity support.
- Capacity Building: National faculty development programmes (in instructional design, digital literacy, trauma-informed teaching).

Diaspora Engagement (Global Solidarity and Knowledge Transfer)

Objectives:

- Mobilise Sudanese academics and professionals abroad for sustained remote support, training, and investment in local institutions.
- Promote academic diplomacy and innovation through global partnerships.

Core Elements:

- Virtual Faculty Networks: Create subject-specific networks to support co-teaching, mentorship, and thesis supervision.

- Diaspora Talent Portal: Match diaspora expertise with institutional needs (curriculum development, research collaboration, infrastructure planning).
- Knowledge Repatriation Hubs: Leverage embassy, consular, and university networks to organise virtual conferences, policy roundtables, and technology transfer initiatives.
- Micro-grants for Innovation: Fund diaspora-led pilot projects (e.g., low-bandwidth LMS platforms, mobile learning units).

Model Integration and Operation

The TRIAD model functions through vertical and horizontal alignment:

- Vertical: Ensures coherence from institutional implementation up to national policy-making and global support.
- Horizontal: Promotes collaboration across institutions, disciplines, and stakeholder groups (students, faculty, administrators, diaspora, and partners).

A National Higher Education Resilience Council (NHERC) can be proposed to co-ordinate this model, ensuring synergy, avoiding duplication, and measuring outcomes through a unified dashboard of resilience indicators.

Application After the Cessation of Hostilities

Phase 1: Stabilisation: Reconnect dispersed institutions through cloud services, establish mobile examination centres, and resume hybrid instruction with diaspora teaching support.
Phase 2: Recovery and Transformation: Institutionalise digital learning, rebuild and modernise physical infrastructure, and implement a national resilience curriculum across universities.
Phase 3: Resilience for the Future: Formalise TRIAD as part of national education law, integrate it into faculty performance standards, and conduct simulation-based emergency drills annually.

Applicability to Other Post-Conflict Contexts

This model is adaptable to other low-resource, conflict-affected countries facing educational disruption. Its modular design allows governments or coalitions to scale or customise components based on national capacity, geographic fragmentation, or technological readiness.

CHALLENGES AND LIMITATIONS

Ongoing War and Security Issues

The most significant barrier to implementing a co-ordinated post-conflict educational recovery model is the unpredictability and duration of armed conflict. The current war in Sudan has not only physically destroyed campuses and displaced faculty and students, but has also severely fragmented institutional governance. In some regions, educational institutions are occupied by armed groups or are located in zones inaccessible due to active conflict. These conditions make it nearly impossible

to restore physical infrastructure, resume in-person operations, or ensure consistent delivery of remote learning solutions. Moreover, the threat of secondary displacement continues to disrupt any initial gains made in digital learning or institutional rebuilding, creating a volatile environment where long term stability is never guaranteed so that reforms can be implemented sustainably.

Unequal Internet Access and Digital Divide

Digital transformation, a cornerstone of the TRIAD model, relies heavily on stable electricity, high-speed Internet, and access to learning devices, all of which are severely limited in Sudan, particularly outside urban centres. In many rural or conflict-affected areas, even mobile network coverage is unreliable. Students and faculty without laptops or smartphones are excluded from online platforms, and asynchronous alternatives (such as radio or offline learning modules) often lack the pedagogical rigour or interactivity required for higher education. This digital divide risks entrenching inequality further, as only students in wealthier, more connected areas benefit from e-learning, while others fall behind or drop out altogether.

Resource Constraints and Faculty Burnout

Years of under-investment in Sudan's higher education system, compounded by the current economic collapse, have left universities with fragile administrative structures, inadequate salaries, and depleted teaching capacity. Faculty members often continue to teach out of a sense of duty, despite receiving reduced or no pay, and while managing personal insecurity, displacement, or trauma. Burnout is widespread, particularly among those juggling teaching, caregiving, and administrative responsibilities without institutional support. Additionally, there is limited funding for critical components of the TRIAD model, such as digital infrastructure, simulation labs, or faculty development programmes. Without significant external support or national budget allocation, implementation efforts may falter due to sheer financial unsustainability and human exhaustion.

Limitations in Data Collection and Evaluation

Reliable data is essential for co-ordinating responses, allocating resources, and monitoring the effectiveness of educational recovery efforts. However, the war has severely disrupted data systems at both institutional and national levels. Many universities have lost academic records, admissions databases, and research archives due to looting, fires, or the collapse of digital servers. In displaced or diaspora-led initiatives, data often remain fragmented, informal, or outdated. The absence of consistent data makes it difficult to assess student needs, faculty availability, infrastructure damage, or learning outcomes. This, in turn, impairs evidence-based planning, donor engagement, and policy formulation, weakening the feedback loops necessary for scaling and refining the TRIAD model.

FUTURE DIRECTIONS AND RECOMMENDATIONS

As Sudan begins its long road to recovery, the education sector stands at a critical juncture. While the innovations and adaptations born out of crisis have proven their value, they must now be scaled,

institutionalised, and aligned with national reconstruction priorities. This section outlines a roadmap for sustaining and expanding crisis-responsive higher education.

Sustaining Digital Transformation Post-Conflict

To preserve the gains made through emergency digital interventions, Sudanese universities must embed e-learning and digital tools into their long-term strategic plans. This requires:

- institutionalisation of LMS platforms within core university operations;
- establishing permanent digital education units in all major universities with trained staff, budgets, and clear mandates;
- integrating digital literacy and instructional design training into faculty development programmes;
- enabling offline accessibility and localised content to reach students in areas with unstable connectivity.

The transition from digital survival to digital maturity will demand intentional investment, policy alignment, and a cultural shift within academia.

Scaling Up Simulation and E-Learning Platforms

Virtual labs and simulation-based learning, initially deployed as stopgap solutions, should now be scaled into permanent educational infrastructure. Key steps include:

- expanding the ASU digital simulation ecosystem to cover more universities and disciplines;
- establishing regional simulation hubs with access to Virtual Reality/Augmented Reality (VR/AR) tools, particularly for medical and engineering education;
- promoting open-source, SCORM-compliant simulation modules to reduce cost barriers;
- developing evaluation frameworks to assess the pedagogical effectiveness of simulation technologies in Sudan's unique context.

Scaling must also prioritise equity, ensuring that rural and underfunded institutions are not left behind.

Strengthening Regional and Global Partnerships

Crisis-responsive education is inherently transnational. The momentum built during the war must now be leveraged to forge sustained international co-operation through:

- formal MoUs between Sudanese universities and global academic institutions;
- deepening engagement with diaspora councils, especially the Council of Sudanese Experts and Scientists Abroad;
- participation in regional digital education alliances across Africa and the Arab world;

- engaging international bodies such as UNESCO, the World Bank, and the African Union in joint funding, research, and capacity-building initiatives.
- These partnerships should aim not only to mobilise resources but also to co-create knowledge and co-design systems that are resilient and globally relevant.

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