

Mobile Learning as Educational Continuity Infrastructure in Fragile Higher Education Contexts: A Thematic Systematic Literature Review

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ABSTRACT:

Mobile learning has become increasingly important in higher education, particularly in contexts where war, displacement, emergency conditions, infrastructure instability and low resources disrupt conventional teaching and learning. However, research on mobile learning in fragile higher education contexts remains fragmented across several labels, including WhatsApp-mediated learning, emergency remote teaching, social media-supported academic communication, blended learning, refugee higher education and digital transformation. This thematic systematic literature review synthesises studies published between 2015 and 2026 to examine how mobile learning has been used, interpreted and positioned in fragile higher education contexts.

Searches were conducted across Google Scholar, Semantic Scholar, BASE, Taylor & Francis Online, SpringerLink, IEEE Xplore and publisher webpages. Following a PRISMA-informed screening process, 24 confirmed studies were included and classified as core, core/contextual or contextual evidence. Thematic synthesis identified seven themes: mobile learning as continuity infrastructure; infrastructure instability and mobile-first adaptation; WhatsApp and social media as substitute academic platforms; institutional adaptation and resilience; displacement, refugee higher education and equity-oriented mobile access; pedagogical, social and emotional functions of mobile learning; and gaps in theory, governance and long-term strategy.

The review argues that mobile learning in fragile higher education should not be understood only as a flexible or innovative learning tool. Rather, it functions as continuity infrastructure that sustains teaching, communication, support and institutional connection under disruption. The review contributes by reframing mobile learning as a sociotechnical and institutional continuity mechanism and by identifying the relevance of Technological Frames Theory (TFT) for future research on how stakeholders interpret, use and strategically position mobile learning in fragile higher education systems. The review further extends mobile learning literature by positioning mobile technologies as continuity-oriented sociotechnical infrastructures within fragile higher education systems.

Keywords: mobile learning; fragile higher education; WhatsApp; educational continuity; conflict-affected education; refugee higher education; low-resource contexts; Technological Frames Theory.

(Dunmade et al., 2023; Maphosa et al., 2020; Okai-Ugbaje et al., 2022; Van den Berg & Mudau, 2022).

Although research in this area is expanding, literature addressing fragile and disrupted higher education contexts remains dispersed across diverse terms, including mobile learning, m-learning, WhatsApp-mediated learning, emergency remote teaching, social media-supported academic communication, crisis-blended learning, refugee higher education, and digital transformation under conflict (Bajger et al., 2025; Berestok, 2025; Brenya, 2024; Dawadi et al., 2024; Drolia et al., 2022; Holovchak et al., 2026). This fragmentation constrains a comprehensive understanding of mobile learning as an adaptive practice and impedes the development of cohesive conceptual frameworks.

This study addresses this gap through a thematic systematic literature review. It investigates how mobile learning has been conceptualised, implemented, and experienced in fragile higher education contexts between 2015 and 2026, drawing on 24 confirmed studies and employing thematic synthesis to identify dominant patterns, methodological tendencies, theoretical gaps, and future research directions. The

1. INTRODUCTION

Higher education systems globally are increasingly challenged by conflict, displacement, instability, and limited resources. In countries including Ukraine, Afghanistan, Syria, Sudan, Zimbabwe, Nigeria, and Uganda, universities frequently operate under crisis conditions (Bauer & Gallagher, 2020; Habib, 2023; Holubnycha et al., 2022; Malysh et al., 2025; Taha et al., 2024). In these contexts, mobile learning often serves as an improvised means of sustaining academic activity when conventional operations are disrupted (Holubnycha et al., 2022; Maphosa et al., 2020; Motaung & Dube, 2020; Van Staden & Nel, 2023).

In stable environments, mobile learning is typically regarded as a means to enhance flexibility and access. However, this perspective does not account for situations in which it is the sole method for students and lecturers to sustain educational engagement (Crompton, 2013; Kukulaska-Hulme, 2020). In fragile settings, smartphones and platforms such as WhatsApp often represent the most dependable learning infrastructure available to students and lecturers

Hulme, 2020). Through mobile learning, students can access resources, communicate with lecturers, participate in discussions, submit assignments, receive feedback, and collaborate with peers beyond the confines of the physical classroom (Dunmade et al., 2023; Maphosa et al., 2020).

However, mobile learning is not solely determined by the device itself. Its educational value is shaped by the interplay among the learner, the technology, the learning task, and the broader institutional context (Kukulska-Hulme, 2020; Okai-Ugbaje, 2022). The mere presence of a smartphone does not guarantee effective mobile learning. Mobile learning is significant when devices and platforms are used to facilitate communication, interaction, content access, feedback, assessment, collaboration, or learner support (Dawadi et al., 2024; Okai-Ugbaje, 2022). In stable higher education environments, mobile learning is typically regarded as an enhancement to existing educational systems. It serves to supplement lectures, support blended learning, increase engagement, or extend learning opportunities beyond scheduled classroom sessions. Conversely, in fragile higher education contexts, mobile learning may assume a more essential function. It can become the primary or most accessible means of sustaining teaching and learning when campuses are closed, physical mobility is limited, infrastructure is compromised, or formal platforms are inaccessible (Bauer & Gallagher, 2020; Holubnycha et al., 2022; Malysh et al., 2025).

2.2 Fragile Higher Education Contexts

Fragile higher education contexts are university or tertiary education settings affected by factors that undermine the effective functioning of teaching, learning, governance, infrastructure, and institutional support. Such factors include war, armed conflict, political instability, forced displacement, refugee conditions, economic crises, natural disasters, pandemics, institutional disruption, electricity shortages, connectivity issues, infrastructure damage, and resource constraints (Bajger et al., 2025; Holovchak et al., 2026; Malysh et al., 2025; UNESCO, 2020).

In these environments, higher education institutions encounter challenges that exceed typical resource limitations. Students may experience displacement, insecurity, travel restrictions, financial hardship, or disconnection from campus. Academic staff may face increased workloads, limited access to digital resources, psychological stress, or disruptions to professional routines. Institutions may lack reliable electricity, internet connectivity, learning management systems, technical support, emergency protocols, or adequate capacity to sustain teaching. Recent studies have documented these pressures in conflict-affected and low-resource higher education settings (Bajger et al., 2025; Dawadi et al., 2024; Malysh et al., 2025). This review adopts a broad definition of fragile higher education contexts. The term is not limited to countries officially designated as fragile states, but also

review is guided by a conceptual model based on Technological Frames Theory (Orlikowski & Gash, 1994) which is applied to analyse how various stakeholder groups, including students, lecturers, and administrators, interpret, negotiate, and position mobile learning as they navigate disruptions and institutional constraints.

The central argument advanced in this review is that, within fragile higher education contexts, mobile learning should be reconceptualised as essential continuity infrastructure. Rather than being perceived solely as a tool for flexible learning, mobile learning constitutes the critical set of practices, platforms, and devices that sustain educational relationships, processes, and institutional connections during periods of disruption. This perspective is fundamental to understanding its actual function and value in these environments (Bauer & Gallagher, 2020; Holubnycha et al., 2022; Okai-Ugbaje et al., 2022; Taha et al., 2024).

1.1 Review Aims and Research Questions

This systematic literature review examines the conceptualisation, implementation, and experience of mobile learning in fragile higher education contexts. The review focuses on conflict-affected settings, educational disruption, infrastructure instability, displacement, continuity-oriented learning, mobile-first practices, and institutional adaptation. Through thematic synthesis, dominant patterns, methodological tendencies, theoretical gaps, and future research directions are identified.

Main review question: In what ways has mobile learning been examined as a mechanism for educational continuity and institutional adaptation in fragile higher education contexts?

The following sub-questions inform the thematic synthesis:

RQ1. Which fragile-context conditions are addressed in mobile learning research in higher education, such as conflict, displacement, infrastructure instability, institutional disruption, and emergency conditions?

RQ2. How is mobile learning utilised to support educational continuity in fragile and disrupted higher education environments?

RQ3. What barriers and enabling factors influence the implementation of mobile learning in fragile higher education contexts?

RQ4. What theoretical, methodological, and empirical gaps persist in the literature on mobile learning in fragile higher education contexts?

2. Literature Background:

2.1 Mobile Learning in Higher Education

Mobile learning is generally defined as learning that is mediated or supported by mobile devices, applications, smartphones, tablets, wireless connectivity, and mobile-accessible digital platforms. In higher education, mobile learning is frequently associated with flexibility, learner autonomy, anytime-anywhere access, collaboration, digital engagement, and personalised learning (Crompton, 2013; Kukulska-

institutional support, WhatsApp is already integrated into daily communication practices and can function under low-bandwidth conditions (Motaung & Dube, 2020; Okai-Ugbaje, 2022; Sobaih et al., 2020). However, WhatsApp is not a comprehensive pedagogical tool. It presents limitations concerning privacy, potential distractions, message overload, inadequate content organisation, and blurred boundaries between academic and non-academic interactions (Maphosa et al., 2020; Van den Berg & Mudau, 2022). Despite these shortcomings, the consistent references to WhatsApp in the literature suggest that mobile-first platforms frequently serve as alternative academic infrastructures when formal systems are compromised. This observation aligns with previous studies on the use of WhatsApp and social media for academic communication during periods of disruption (Maphosa et al., 2020; Motaung & Dube, 2020; Van den Berg & Mudau, 2022).

2.5 Infrastructure, Access and Digital Inequality

Mobile learning in fragile higher education environments is significantly influenced by infrastructure and access. The mere presence of mobile phones does not resolve existing inequalities. While students may possess mobile devices, they often lack reliable electricity, stable network connections, sufficient data, appropriate devices, quiet study environments, or adequate digital literacy (Okai-Ugbaje et al., 2022; Valencia-Arias et al., 2024). Similarly, lecturers may express willingness to adopt mobile learning but frequently lack the necessary training, institutional guidance, or support (Bajger et al., 2025; Holovchak et al., 2026).

Infrastructure limitations are particularly pronounced in low-resource and conflict-affected settings. Damaged facilities, unreliable electricity, poor connectivity, high data costs, and limited access to computers hinder the implementation of formal online learning (Al Mahdi & Fahal, 2024; Malysh et al., 2025; Taha et al., 2024). While mobile learning may present a more feasible alternative, its effectiveness depends on careful consideration of these constraints. Mobile learning should not be idealised; although it can promote inclusion, it may also exacerbate exclusion if certain students are unable to participate. Comparable access challenges have been documented in low-resource, refugee, and developing-country higher education contexts (Bauer & Gallagher, 2020; Dawadi et al., 2024; Okai-Ugbaje, 2022).

2.6 Institutional Adaptation and Strategy

Mobile learning in fragile contexts extends beyond individual student or lecturer practices and constitutes a broader institutional concern. Numerous studies indicate that mobile learning often emerges as an informal workaround rather than a formally endorsed strategy. Lecturers and students frequently utilise platforms such as WhatsApp and smartphones for their immediacy, rather than as a result of institutional

encompasses higher education settings affected by war, displacement, emergencies, resource constraints, or infrastructure instability. This broader perspective is warranted because educational fragility can result from multiple overlapping factors, such as conflict, crisis, poverty, weak infrastructure, and sudden disruption, which may not correspond with formal state fragility classifications (Bauer & Gallagher, 2020; Dawadi et al., 2024; Taha et al., 2024).

2.3 Educational Continuity under Constraint

Educational continuity denotes the capacity for teaching, learning, academic communication, assessment, support, and institutional connection to persist despite disruptions. In higher education, continuity extends beyond lecture delivery to include student engagement, communication with academic staff, access to learning materials, peer interaction, emotional support, administrative coordination, and progression through academic programmes (Dawadi et al., 2024; Malysh et al., 2025). In Fragile contexts, continuity becomes a major concern because conventional educational arrangements are often interrupted. Classrooms may be inaccessible, campuses may be unsafe, students may be displaced, internet access may be unstable and institutional systems may be under strain (Bajger et al., 2025; Taha et al., 2024). Under such conditions, mobile learning can help sustain the basic relationships and processes that allow education to continue (Holubnycha et al., 2022; Maphosa et al., 2020; Van Staden & Nel, 2023). This review, therefore, uses educational continuity as a central organising concept.

2.4 WhatsApp and Mobile-First Platforms as Academic Environments

A prominent trend identified in the literature is the adoption of WhatsApp and other mobile-first platforms during periods of educational disruption. WhatsApp is frequently utilised due to its familiarity, affordability, accessibility, smartphone compatibility, and its capacity to facilitate group communication, voice notes, file sharing, reminders, and rapid interaction (Dunmade et al., 2023; Maphosa et al., 2020; Motaung & Dube, 2020). In higher education settings affected by COVID-19, particularly those with limited resources or sudden transitions to online learning, WhatsApp often served as an academic platform (Martínez Rodríguez & Díaz Crespo, 2021; Rabotapi & Matope, 2024; Van Staden & Nel, 2023). Lecturers employed it for announcements, lectures, tutorials, postgraduate seminars, task clarification, resource sharing, and feedback. Students used the platform to pose questions, interact with peers, seek emotional support, and sustain a sense of community (Dunmade et al., 2023; Rabotapi & Matope, 2024; Van den Berg & Mudau, 2022).

The significance of WhatsApp in resource-constrained contexts is primarily attributed to its practical accessibility. In contrast to formal learning management systems, which often require stable internet connections, laptops, user training, and

different fragile settings (Snyder, 2019). Additionally, it must address why mobile learning serves as formal pedagogy in some instances and as informal communication in others, and why institutional strategies for mobile learning are frequently lacking despite widespread usage (Dunmade et al., 2023; Okai-Ugbaje, 2022). A purely descriptive synthesis is insufficient to address these complexities; thus, an analytical lens is essential (Snyder, 2019; Xiao & Watson, 2019).

3.2 Technological Frames Theory

This review employs Technological Frames Theory (TFT), as developed by Orlikowski and Gash (1994). TFT posits that individuals' understanding and use of technology are shaped by cognitive frames, which encompass the assumptions, expectations, and interpretations brought to technological encounters. These frames extend beyond individual opinions and are shared among members of the same occupational or institutional group. They influence what aspects of technology are noticed, how individuals respond, and the purposes assigned to technological tools (Orlikowski & Gash, 1994).

Orlikowski and Gash identified three domains within technological frames: the nature of technology, technology-in-use, and technology strategy. The nature of technology concerns stakeholders' understanding of what a technology is and its capabilities. Technology-in-use pertains to stakeholders' perceptions of how technology is applied in practice. Technology strategy involves stakeholders' views on the role of technology in achieving organisational objectives. Misalignments among the frames held by different stakeholder groups, such as students, lecturers, and institutional leaders, can result in fragmented, inconsistent, or unsupported use of technology (Okai-Ugbaje, 2022)

3.3 Application of TFT to Mobile Learning in Fragile Higher Education

Within fragile higher education contexts, TFT provides a valuable interpretive framework. Students may perceive mobile learning as a survival tool or an emergency measure. Lecturers may regard it as an additional workload or an informal communication channel. Institutional leaders may view it as an unproven risk or a cost-saving strategy. These varying perspectives shape the adoption, support, and sustainability of mobile learning beyond the immediate crisis (Dunmade et al., 2023; Holovchak et al., 2026).

TFT does not necessitate the use of survey instruments or structured interviews to be effective in a literature review. In this context, it serves as an interpretive framework for analysing and organising existing evidence regarding the understanding, enactment, and positioning of mobile learning in fragile higher education settings. TFT is applied deductively during thematic synthesis to identify patterns of interpretation, alignment, and misalignment across the reviewed studies (Snyder, 2019; Thomas & Harden, 2008).

3.4 Mobile Learning as a Continuity Infrastructure

mobile learning policies (Dunmade et al., 2023; Motaung & Dube, 2020; Van Staden & Nel, 2023). While this approach can facilitate rapid adaptation, it also introduces risks, including inconsistent practices, privacy concerns, increased workload, lack of quality assurance, and unequal student experiences (Sobaih et al., 2020; Van den Berg & Mudau, 2022).

A central challenge for fragile higher education institutions is transitioning from emergency improvisation to a structured and supported mobile learning strategy. Institutions should acknowledge existing mobile practices and provide appropriate guidance, support, training, and policies that are sensitive to infrastructural limitations (Holovchak et al., 2026; Okai-Ugbaje et al., 2022). While mobile learning should not substitute for investment in formal systems, it ought to be incorporated into continuity planning, as it frequently serves as the most resilient means of communication and access during disruptions. This necessity is consistently highlighted in literature on conflict-affected digital transformation and wartime higher education, where institutional support, continuity planning, and infrastructure adaptation are emphasised (Bajger et al., 2025; Holovchak et al., 2026).

2.7 Research Gap Identification

Existing literature demonstrates that mobile learning can enhance teaching, communication, engagement, and access within fragile higher education contexts (Holubnycha et al., 2022; Motaung & Dube, 2020; Van Staden & Nel, 2023). Nevertheless, the evidence remains fragmented, with studies using varying terminology and lacking a comprehensive synthesis of the interrelations among these practices (Brenya, 2024; Dawadi et al., 2024; Drolia et al., 2022). A theoretical gap is also evident: while many studies examine adoption, acceptance, or perceptions, fewer investigate how mobile learning is interpreted by diverse stakeholder groups or integrated into institutional strategies (Okai-Ugbaje, 2022). This review addresses these deficiencies by synthesising direct mobile learning studies and research focused on fragile higher education contexts, employing the concept of continuity infrastructure to reconceptualise the role of mobile technology in disrupted environments. The research gap is particularly pronounced when direct mobile learning studies are considered alongside contextual evidence from war-affected, refugee, and low-resource higher education settings (Bauer & Gallagher, 2020; Malysh et al., 2025).

3. Conceptual and Analytical Lens

3.1 Rationale for an Analytical Lens

A comprehensive review of mobile learning in fragile higher education contexts necessitates more than a summary of the technologies employed and their applications. It requires an explanatory framework to account for the varying interpretations, adoption patterns, and positioning of mobile learning across

3.5 Conceptual Analytical Framework

Figure 1 illustrates the conceptual framework that underpins this review. The framework identifies fragile conditions in higher education as the contextual foundation. Such conditions, including war, conflict, displacement, refugee status, emergency disruption, low-resource environments, and infrastructure instability, influence how higher education stakeholders interpret mobile learning through three adapted domains of Technological Frames Theory: the nature of technology, technology-in-use, and technology strategy. These interpretive frames subsequently shape mobile learning practices, including the use of WhatsApp, smartphones, mobile applications, social media, mobile-accessible platforms, and distance or blended learning modalities. When these practices are effectively understood and supported, they contribute to educational continuity by enhancing teaching delivery, academic communication, learner engagement, support, a sense of belonging, access, and institutional resilience. The framework also acknowledges a feedback loop, whereby mobile learning practices that successfully sustain continuity may, over time, reshape stakeholder perspectives and institutional strategies.

The central contribution of this review is the introduction of mobile learning as a continuity infrastructure. This perspective reframes mobile learning in fragile higher education not as a flexible or innovative pedagogical tool, but as a sociotechnical mechanism that sustains relationships, processes, and institutional connections that might otherwise be disrupted (Bauer & Gallagher, 2020; Holubnycha et al., 2022; Van Staden & Nel, 2023).

Continuity infrastructure extends beyond technical resources. It encompasses a set of practices, platforms, and interpretations that collectively enable the maintenance of educational continuity under constraints. Tools such as WhatsApp groups, smartphone communication, mobile-accessible platforms, and academic interactions via social media can serve as continuity infrastructure when they are utilised, recognised, and supported in ways that sustain teaching and learning (Dunmade et al., 2023; Motaung & Dube, 2020; Van den Berg & Mudau, 2022). The value of these tools depends not only on their technical availability but also on how they are understood and employed by students, lecturers, and institutions (Okai-Ugbaje, 2022; Valencia-Arías et al., 2024).

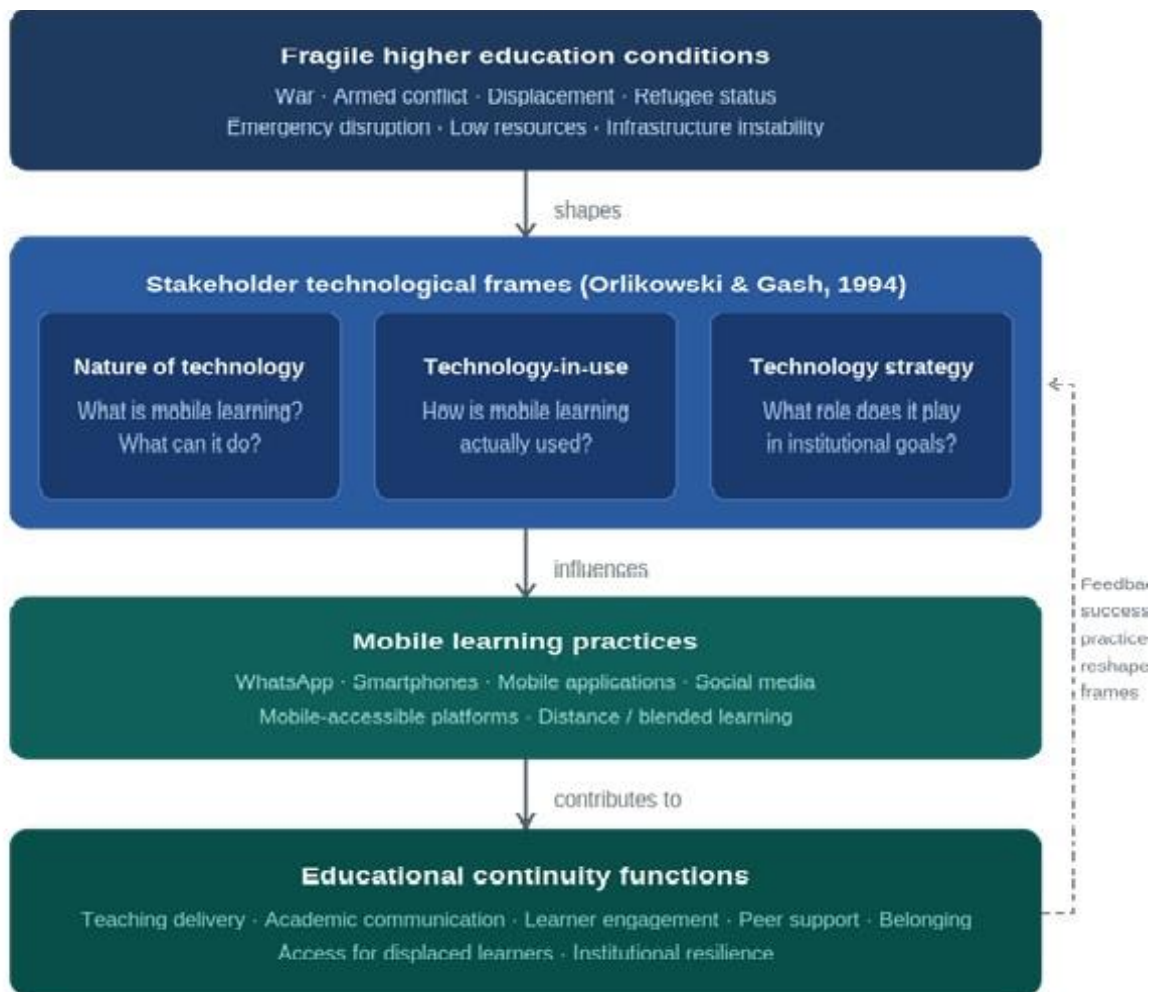


Figure1. Conceptual framework illustrating mobile learning as continuity infrastructure in fragile higher education contexts.

Note. The framework was developed from the thematic synthesis and informed by Technological Frames Theory (Orlikowski & Gash, 1994). It is intended as an analytical model, not a causal model

The framework does not conceptualise mobile learning as a linear technical solution. Instead, it positions mobile learning as a sociotechnical continuity mechanism. Fragile conditions disrupt conventional higher education systems and generate pressure for adaptive practices. Stakeholders interpret mobile learning based on their specific roles, needs, and constraints. These interpretations shape mobile learning practices and determine whether they persist as informal workarounds or evolve into institutionally supported strategies. This perspective clarifies why mobile learning in fragile higher education contexts cannot be assessed solely by device availability or platform adoption. Its educational value is contingent upon the interplay among contextual factors, stakeholder interpretations, actual usage, and institutional strategies.

4. Methods

4.1 Review Design

A thematic systematic literature review approach was employed, guided by PRISMA 2020 reporting principles (Page et al., 2021) and informed by the thematic synthesis method described by (Thomas & Harden, 2008). This approach was selected instead of a bibliometric review because the objective was to synthesise evidence on the role of mobile learning as a continuity practice in fragile higher education, rather than to map the volume or structure of publications. Thematic synthesis facilitates both deductive and inductive coding, enabling the identification of patterns across individual studies and the development of interpretive themes that extend beyond descriptive summary (Snyder, 2019).

4.2 Search Strategy

The search encompassed multiple scholarly sources and publisher databases, including:

- Google Scholar: <https://scholar.google.com>
- Semantic Scholar: <https://www.semanticscholar.org>
- BASE – Bielefeld Academic Search Engine: <https://www.base-search.net>
- Taylor & Francis Online: <https://www.tandfonline.com>
- SpringerLink: <https://link.springer.com>
- IEEE Xplore: <https://ieeexplore.ieee.org>

and publisher webpages accessed via DOI records. Google Scholar and Semantic Scholar supported the exploratory and supplementary phases by identifying relevant terminology, seminal studies, and citation trails. BASE extended coverage to open-access scholarly records and institutional repositories. Taylor & Francis Online, SpringerLink, and IEEE Xplore enhanced publisher-specific and technology-oriented coverage. Direct DOI and publisher-page searches verified bibliographic metadata, abstracts, and full-text availability.

The search strategy combined three main concept groups using Boolean logic:

Group 1: Mobile learning and mobile-first platforms: mobile learning, m-learning, smartphone, mobile phone, mobile device, WhatsApp, social media, mobile-assisted learning, mobile technology

Group 2: Higher education context: higher education, university, universities, college, tertiary education, postgraduate students, faculty, educators

Group 3: Fragility, disruption and constraint: conflict, war, conflict-affected, displacement, displaced students, refugees, crisis, emergency, COVID-19, lockdown, low-resource, resource-constrained, developing countries, infrastructure, connectivity, electricity, data cost.

4.3 Inclusion and Exclusion Criteria

Studies were selected for inclusion or exclusion based on the criteria outlined in Table1.

Table1. Inclusion and Exclusion Criterion

Criterion	Inclusion	Exclusion
Publication type	Peer-reviewed journal articles and book	Theses, conference abstracts, grey

	chapters	literature, non-peer-reviewed sources
Language	English only	Non-English publications
Date range	2015–2026	Studies published before 2015
Education level	Higher education, university, tertiary or postgraduate education	School-level (K–12), vocational only, or unspecified education level
Technology focus	Mobile learning, m-learning, WhatsApp, smartphone, mobile device, mobile application, mobile-accessible platform	Studies where mobile technology is not the primary or substantial focus
Context relevance	Conflict, war, displacement, refugee status, emergency, COVID-19, low-resource, infrastructure instability, crisis, disruption	Studies set exclusively in stable, high-resource higher education contexts with no disruption relevance
Thematic relevance	Educational continuity, institutional adaptation, access, resilience, distance or blended learning under disruption	Studies focused solely on gamification, language learning apps, or unrelated technology adoption in stable contexts

4.4 Screening Procedure

The literature search was conducted in five rounds. In the first round, Google Scholar and Semantic Scholar were used to identify an initial body of studies and to refine relevant terminology. This exploratory phase indicated that pertinent literature was not consistently indexed under 'mobile learning' alone, but also appeared under terms such as WhatsApp learning, social media academic communication, emergency remote learning, distance learning, blended learning, and digital transformation in conflict-affected higher education (Xiao & Watson, 2019).

Subsequent rounds focused on specific contexts, including WhatsApp and mobile-first learning in African higher education during COVID-19; refugee higher education; displacement and mobile-accessible learning; war-affected and post-conflict higher education; and open-access and technology-oriented sources via BASE and IEEE Xplore. Titles and abstracts were initially screened against predefined inclusion and exclusion criteria. Records were retained for full-text review if they addressed at least two of the following elements: higher education or postgraduate education, mobile learning or mobile-accessible platforms, and fragile-context or continuity relevance. Full texts and extended abstracts were then reviewed to determine final classification.

4.5 Classification of Studies

Studies were classified as core, core/contextual or contextual evidence. Core studies were those in which mobile learning, WhatsApp, smartphones, mobile devices, or mobile-supported learning formed the central focus within a higher education setting affected by disruption, crisis, resource constraints, conflict, or emergency conditions. Core/contextual studies directly addressed mobile learning or mobile-accessible technologies in higher education, but their relevance to fragile contexts was broader. Contextual studies did not always focus directly on mobile learning, but were retained because they provided essential evidence on fragile higher education, war-affected institutions, digital transformation, infrastructure instability, distance or blended learning, displacement, or institutional resilience. Critically, contextual studies were not used as direct evidence of the effectiveness or impact of mobile learning. They were retained solely to map the fragile conditions of higher education within which mobile learning practices operate, ensuring that the thematic synthesis remains contextually grounded. All claims about the effects of mobile learning are derived exclusively from core and core/contextual studies (Snyder, 2019; Thomas & Harden, 2008; Xiao & Watson, 2019).

4.6 PRISMA-Informed Screening Flow

Table 2 presents the PRISMA-informed screening numbers. One potentially relevant record on mobile computer-supported collaborative learning in resource-constrained nations was identified during searching, but was not included in the final synthesis because complete bibliographic and eligibility information could not be verified. Furthermore, a comparative evaluation study of four mobile learning pilots in Africa was identified but excluded at the eligibility stage because it focuses on K–12 schooling contexts rather than higher education, which does not meet the higher-education inclusion criterion for this review. Table 2b details the reasons for full-text exclusions. Together, Tables 2 and 2b provide the complete PRISMA flow data required for transparent reporting of the screening process (Page et al., 2021). Figure 2 presents the formatted PRISMA 2020 flow diagram corresponding to these screening numbers.

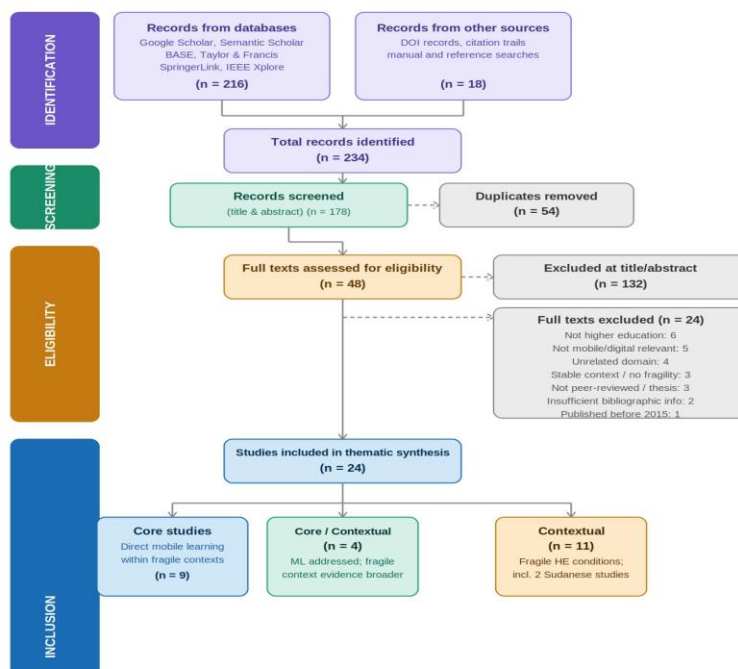
Table 2 . PRISMA-Informed Screening Flow

PRISMA Stage	Number of Records
Records identified through database and publisher searches	216
Additional records identified through DOI, citation and manual searches	18
Total records identified	234
Duplicate records removed	54
Records screened by title and abstract	180
Records excluded at title/abstract stage	132
Full texts/abstracts assessed for eligibility	48
Full texts/abstracts excluded (with reasons)	24
Studies included in final thematic synthesis	24

Table 2b. Full-Text Exclusion Reasons

Reason for Exclusion	n
Not higher education	6
Not mobile/mobile-accessible or digital-continuity relevant	5
Unrelated domain (health, banking, forensics, addiction)	4
Stable context with no fragility or continuity relevance	3
Non-peer-reviewed or thesis/student project	3
Insufficient bibliographic or full-text information	2
Published before 2015	1
Total	24

Figure 2. PRISMA 2020 flow diagram illustrating the study selection process.



Note. Adapted from Page et al. (2021) PRISMA 2020 statement. Contextual studies (n = 11) were retained to map fragile conditions in higher education. All claims regarding the effects of mobile learning derive exclusively from core and core/contextual studies. One K–12 comparative evaluation was excluded at the eligibility stage because it did not meet the higher-education inclusion criterion.

4.7 Data Extraction and Thematic Synthesis

Data were extracted from each included study using a structured form (see Appendix A). Fields covered: author(s), year, title, journal or source, country or region, context type (conflict, COVID-19, refugee, low-resource, emergency, displacement), research focus, methodology, sample, mobile learning platform or practice, key findings and classification. Thematic synthesis proceeded through three stages: free line-by-line coding of findings from included studies; grouping of codes into descriptive themes; and development of analytical themes that interpreted patterns across the evidence base in relation to the review questions and the TFT framework (Snyder, 2019; Thomas & Harden, 2008).

4.8 Methodological Limitations

Several methodological limitations should be noted. First, the literature on mobile learning in fragile higher education is dispersed across multiple labels, which may have meant that some relevant studies were not retrieved despite the broad search strategy (Snyder, 2019; Xiao & Watson, 2019). Second, access to subscription-based databases was limited; the search therefore relied on open scholarly indexes, publisher platforms and available full texts. Third, the inclusion of contextual studies means that not all evidence relates directly to mobile learning; this is justified by the need to understand the fragile conditions of higher education within which mobile learning operates. This applies in particular to the two contextual studies from post-April 2023 Sudanese higher education (Al Mahdi & Fahal, 2024; Taha et al., 2024) which document educational disruption, institutional collapse, and growing dependence on remote and socially mediated practices during armed conflict, rather than empirically examining mobile learning. Their inclusion is warranted because they provide essential contextual grounding for the fragile conditions of higher education within which mobile learning may emerge as continuity infrastructure. Fourth, the methodological diversity across included studies, ranging from quantitative surveys to qualitative phenomenology and conceptual frameworks, required careful weighting during thematic synthesis(Thomas & Harden, 2008).

5. Results: Thematic Findings

5.1 Overview of Included Studies

The final thematic synthesis comprised 24 confirmed studies published primarily between 2020 and 2026, with most studies concentrated in the period following the onset of COVID-19. These studies examined contexts in Afghanistan, Ukraine, Syria, Uganda, Zimbabwe, South Africa, Nigeria, Cuba, Peru, Kenya, Nepal, and Latin America, addressing fragile conditions such as war, displacement, pandemic impacts, post-conflict reconstruction, low-resource environments, and infrastructure instability. The geographic distribution of included studies is uneven: South Africa (5 studies), Ukraine (4 studies), and Nigeria (3 studies) are most heavily represented. This distribution reflects both the productivity of research communities in these countries and the availability of English-language publications. In contrast, contexts such as Yemen, the Democratic Republic of Congo, Myanmar, and Central America remain underrepresented, indicating significant gaps for future research. Although Sudan is also comparatively underrepresented, two recent studies following the April 2023 conflict (Al Mahdi & Fahal, 2024; Taha et al., 2024). provide valuable contextual evidence on institutional disruption, displacement, infrastructure collapse, and increased reliance on remote and socially mediated educational practices to maintain continuity. Table 3 presents the complete list of included studies with full author names.

The thematic synthesis incorporated 24 confirmed studies published primarily between 2015 and 2026. The reviewed evidence encompasses a range of fragile, disrupted, and resource-limited higher education settings, including war-affected Ukraine and Sudan, pandemic-impacted higher education in Zimbabwe and South Africa, post-conflict and resource-challenged institutions in Afghanistan and Nigeria, and refugee-related higher education access in Uganda. Sudanese studies are included as contextual evidence, as they document disruptions to higher education, displacement, and the adoption of remote or socially mediated continuity practices during armed conflict, rather than directly evaluating mobile learning outcomes.

Recent Sudanese literature published after the April 2023 conflict further emphasises the extent of educational disruption in fragile higher education settings. Although these studies do not focus exclusively on mobile learning, they document widespread **institutional collapse, displacement of students and faculty, interruptions to academic activities, and an increasing reliance on remote, asynchronous,** and socially mediated educational methods to sustain continuity during conflict.

Table 3. Final Included Studies Used in the Thematic Synthesis

Study	Focus	Context	Method	Classification
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Holubnycha, L., Besarab, T., Pavlishcheva, Y., Romaniuk, S., Sytnykova, Y., Ahibalova, T., & Alpatova, O. (2022)	Effectiveness of mobile learning during military conflict at tertiary level	Ukraine / conflict	Empirical study	Core
Maphosa, V., Dube, B., & Jita, T. (2020)	WhatsApp for lecture delivery during COVID-19 lockdown	Zimbabwe / COVID-19	Qualitative study	Core
Motaung, L. B., & Dube, B. (2020)	WhatsApp-mediated e-tutorial engagement at rural HEI	South Africa / COVID-19	Qualitative study	Core
Van den Berg, G., & Mudau, P. K. (2022)	WhatsApp groups for postgraduate teaching and communication	South Africa / COVID-19	Qualitative study	Core
Dunmade, A. O., Agboola, O. J., Oyelami, B. T., & Amodu, L. O. (2023)	WhatsApp for postgraduate instruction	Nigeria / COVID-19	Empirical study	Core
Martínez Rodríguez, D., & Díaz Crespo, G. (2021)	WhatsApp as academic platform in higher education	Cuba / COVID-19	Phenomenological study	Core
Van Staden, C., & Nel, L. (2023)	WhatsApp-based mobile learning during abrupt online transition	South Africa / disruption	Duoethnographic study	Core
Okai-Ugbaje, S., Ardzejewska, K., & Imran, A. (2022)	Mobile learning framework for resource-constrained HE	Nigeria / low-resource	Framework study	Core
Quraishi, T., Nuristani, M. H., Rasouli, M., & Safi, H. (2024)	Mobile learning integration in Afghan universities	Afghanistan / post-conflict	Empirical study	Core
Sobaih, A. E. E., Hasanein, A. M., & Abu Elnasr, A. E. (2020)	Social media for sustaining academic communication during COVID-19	Developing countries	Empirical study	Core/Contextual
Bauer, S., & Gallagher, M. (2020)	Mobile-accessible HE for refugees through innovative technology	Uganda / refugees	Case study	Core/Contextual
Rabotapi, M., & Matope, S. (2024)	WhatsApp for first-year student adjustment during lockdown	South Africa / COVID-19	Empirical study	Core/Contextual
Valencia-Arias, A., Patiño-Toro, O. N., Neyra-Alemán, K. J., Altuna-Tocto, G. A., Ureta-Medrano, J. C., & Azabache Gutiérrez, P. I. (2024)	Factors affecting mobile learning in post-pandemic developing HE	Peru / post-pandemic	Quantitative study	Core/Contextual
Habib, H. (2023)	Digital transformation strategy for conflict-affected HE	Syria / conflict	Conceptual paper	Contextual
Bajger, T., Khoshnaw, D., Ali, K.A.A., & Mousa, K.M. (2025)	Digital transformation and HE infrastructure rehabilitation in conflict settings	Conflict-affected HE	Empirical study	Contextual
Berestok, O. (2025)	Blended learning in Ukrainian HE during war	Ukraine / wartime	Contextual analysis	Contextual
Malysh, N., Shevchenko, V., & Tkachuk-Miroshnychenko, O. (2025)	Learning in Ukraine in wartime	Ukraine / wartime	Mixed-methods study	Contextual
Holovchak, T., Berezovska, L., & Karkovska, V. (2026)	Addressing HE challenges during prolonged war in Ukraine	Ukraine / prolonged war	Quantitative study	Contextual
Dawadi, S., Goshtasbpour, F., & Kukulska-Hulme, A.	Equitable access to HE learning in low-resource contexts	Kenya & Nepal	Qualitative study	Contextual

(2024)				
Brenya, B. (2024)	Blended learning for educators in emergency situations	Developing countries / emergency	Empirical study	Contextual
Castellanos-Reyes, D., Romero-Hall, E., Vasconcelos, L., & García, B. (2022)	Mobile learning design for emergency situations	Latin America / emergency	Design cases	Contextual
Drolia, M., Sifaki, E., Papadakis, S., & Kalogiannakis, M. (2022)	Mobile learning applications for refugees: SLR	Refugee education	Systematic review	Contextual /Background
Taha, M. H., Husain, N. E., Mukhtar, W. N. O., & Abdalla, M. E. (2024)	Educational continuity and remote medical education during war	Sudan / armed conflict	Contextual analysis	Contextual
Al Mahdi, T. A. S., & Fahal, A. H. (2024)	War impact on medical education and recovery	Sudan / war	Narrative review	Contextual

5.2 Theme 1: Mobile Learning as a Mechanism for Educational Continuity During Disruption

A central finding across the reviewed studies is that mobile learning helps maintain educational continuity during disruptions to conventional systems. In Ukraine, Holubnycha, Soroka, Lytovchenko, Budianska, and Sydiakina (2022) reported that mobile learning technology at the tertiary level enabled students and lecturers to sustain teaching and learning engagement despite the destruction of physical infrastructure and displacement of campus communities during armed conflict. In Zimbabwe, Maphosa, Dube, and Jita (2020) observed that WhatsApp became the primary channel for delivering lectures during the COVID-19 lockdown. Similarly, in South Africa, Motaung and Dube (2020) found that WhatsApp supported e-tutorial participation at a rural university where internet access for formal platforms was unreliable.

These studies, along with others in the sample, suggest that the continuity function of mobile learning is intentional and rooted in the practical characteristics of mobile devices and platforms. Mobile technologies are familiar, relatively low-cost, functional under low-bandwidth conditions, and already integrated into the daily communication practices of students and lecturers (Dunmade et al., 2023; Motaung & Dube, 2020; Van Staden & Nel, 2023). When formal educational infrastructure is disrupted, mobile platforms serve as a continuity infrastructure due to their accessibility.

Disruptions in Sudanese higher education following the April 2023 conflict further reinforce this pattern. Emerging evidence from Sudan illustrates that institutional collapse, displacement, and infrastructure instability have increased reliance on mobile-accessible, remote, and socially mediated educational practices to sustain educational continuity during prolonged disruption (Al Mahdi & Fahal, 2024; Taha et al., 2024).

Van Staden and Nel (2023) documented this dynamic through a duo ethnographic account of WhatsApp-based mobile learning environments during an abrupt transition to online learning. Their findings indicate that WhatsApp functioned not only as a communication tool but as a primary learning environment supporting course content delivery, discussion, feedback, and peer support. Similarly, Dunmade, Agboola, Oyelami, and Amodu (2023) found that WhatsApp became the primary platform for postgraduate instruction at a private university in Nigeria during the COVID-19 disruption.

5.3 Theme 2: Infrastructure Instability, Access Constraints and Mobile-First Adaptation

A second theme addresses how infrastructure instability influences the adoption and practice of mobile learning. Okai-Ugbaje, Ardzejewska, and Imran (2022) developed a mobile learning framework for resource-constrained higher education environments in Nigeria, demonstrating that infrastructure instability functions not only as a barrier but also as a generative condition that necessitates and enhances the significance of mobile-first approaches. The framework highlights low-bandwidth content delivery, asynchronous access, and device-sensitive design as essential features of mobile learning in such environments.

In a systematic literature review, Valencia-Arias et al. (2024) identified infrastructure, connectivity, device access, and institutional support as primary factors influencing the adoption of mobile learning in university contexts. Malysh, Shevchenko, and Tkachuk-Miroshnychenko (2025) reported that damaged infrastructure, displacement, and electricity shortages compelled higher education institutions to develop distance and blended learning approaches specifically designed for mobile accessibility. Similarly, Dawadi, Goshtasbpour, and Kukulka-Hulme (2024) observed in Kenya and Nepal that infrastructure conditions fundamentally determined equity of access.

Bauer and Gallagher (2020) demonstrated in the Nakivale refugee settlement in Uganda that offline mobile technology can extend access to higher education for displaced learners lacking stable connectivity. This case exemplifies how mobile-first adaptation, when aligned with infrastructure realities, can effectively reach the most constrained learners.

5.4 Theme 3: WhatsApp and Social Media as Substitute Academic Platforms

The literature consistently indicates that WhatsApp and other social media platforms have emerged as substitute academic infrastructures in higher education contexts experiencing disruption. Sobaih, Hasanein, and Abu Elnasr (2020) documented the use of social media, including WhatsApp, across developing-country higher education settings to sustain formal academic communication during COVID-19. Martínez Rodríguez and Díaz Crespo (2021) through a phenomenological study in Cuban higher education, found that WhatsApp groups served as academic and sociocultural learning spaces where lecturers shared materials, facilitated discussions, and maintained academic community. Van den Berg and Mudau (2022) examined postgraduate students' experiences of WhatsApp groups in South African open and distance e-learning contexts during COVID-19, finding that WhatsApp supported not only content delivery but also academic socialisation, peer learning and emotional support. Rabotapi and Matope (2024) found that WhatsApp facilitated belonging, reassurance, and orientation during lockdown restrictions, functions typically served by face-to-face campus activities.

5.5 Theme 4: Institutional Adaptation and Resilience in Contexts of War, Crisis, and Resource Constraints in Higher Education

A fourth theme addresses how higher education institutions respond to fragile conditions through digital transformation, blended learning, and mobile-accessible strategies. Habib (2023) proposed a conceptual framework for digital transformation in conflict-affected higher education in Syria, emphasising that institutional adaptation necessitates a strategic reconfiguration of institutional perspectives on technology. Bajger, Orel, Řezáč, and Bártová (2025) demonstrated that institutional resilience in conflict-affected higher education depends on both the rehabilitation of physical infrastructure and the development of digital infrastructure.

Holovchak, Berezovska, and Karkovska (2026) contributed additional evidence from Ukraine regarding blended and distance learning strategies implemented as institutional responses to wartime disruption, with mobile accessibility established as a design requirement. Brenya (2024) analysed educator perspectives on blended learning in emergency contexts across developing countries and concluded that institutional support and training are critical enabling factors.

5.6 Theme 5: Displacement, Refugee Higher Education, and Equity-Focused Mobile Access

Although the reviewed literature contains limited refugee-focused studies, it provides important evidence regarding the role of mobile learning in supporting displaced and refugee learners. Bauer and Gallagher (2020) described an innovative technology program in the Nakivale refugee settlement in Uganda that used mobile-accessible, offline digital tools to expand access to higher education for students lacking stable connectivity, electricity, and campus access. Drolia, Sifaki, Papadakis, and Kalogiannakis (2022) conducted a systematic review of mobile learning applications for refugees and determined that most existing research emphasises language learning and school-level education, thereby identifying refugee higher education as a significant gap.

Dawadi et al. (2024) emphasised the significance of institutional design choices for promoting equitable access in low-resource contexts, demonstrating that equity in mobile learning necessitates consideration of data affordability, offline access, device quality, flexible participation, digital literacy support, and gender-specific access patterns.

5.7 Theme 6: Pedagogical, Social and Emotional Functions of Mobile Learning

In addition to content delivery, the reviewed studies demonstrate that mobile learning in fragile higher education contexts fulfils significant pedagogical, social, and emotional roles. Van den Berg and Mudau (2022) reported that WhatsApp groups at the postgraduate level supported academic socialisation, peer interaction, and the development of an intellectual community. Similarly, Rabotapi and Matope (2024) observed that WhatsApp facilitated a sense of belonging and reassurance among students during lockdown, helping first-year students navigate the transition to higher education under crisis conditions.

Van Staden and Nel (2023) emphasised that WhatsApp-based learning environments fostered lecturers' presence and accessibility, thereby supporting student motivation and engagement during periods of disruption. Dunmade et al. (2023) found that WhatsApp-mediated postgraduate instruction in Nigeria sustained academic communities and doctoral supervision relationships despite physical separation. Malysh et al. (2025) observed that mobile communication tools in Ukrainian higher education during wartime provided academic content, psychological support, and social connection for students experiencing displacement and uncertainty. These social and emotional aspects of continuity are frequently overlooked in accounts of mobile learning that focus solely on technical or adoption-related factors.

5.8 Theme 7: Gaps in Theory, Governance and Long-Term Mobile Learning Strategy

The final theme addresses the limitations of existing research and identifies remaining gaps. First, the literature is predominantly composed of short-term empirical studies, most of which were conducted during or immediately after the COVID-19 pandemic. There is a notable absence of longitudinal evidence regarding how mobile learning practices evolve, consolidate, or dissolve as contextual factors change. Second, theoretical engagement with mobile learning in fragile higher education remains limited. Many studies prioritise perceptions, adoption rates, and usability, rather than employing theoretical frameworks that explain how mobile learning is interpreted, embedded, or strategically positioned. Okai-Ugbaje et al. (2022) provide a notable exception.

Third, governance and institutional strategies for mobile learning in fragile contexts remain underdeveloped. Mobile learning often emerges as an individual or departmental initiative rather than as part of a formally supported institutional strategy. Valencia-Arias et al. (2024) indicate that institutional support and infrastructure investment are among the weakest predictors of sustained use of mobile learning. Fourth, certain stakeholder groups are underrepresented in the literature. The perspectives of lecturers, institutional leaders, IT staff, and administrative personnel in fragile higher education contexts are less visible than those of students. Additionally, the experiences of women students, older students, students with disabilities, and students in protracted conflict or displacement situations are insufficiently documented.

Table 4. Thematic Synthesis Matrix

Theme	Key Studies	Core Insight	TFT Domain
1. Mobile learning as continuity infrastructure	Holubnycha et al.; Maphosa et al.; Motaung & Dube; Dunmade et al.; Van Staden & Nel	Mobile learning sustains teaching, communication and support when conventional systems are interrupted	Nature of Technology
2. Infrastructure instability and mobile-first adaptation	Okai-Ugbaje et al.; Dawadi et al.; Valencia-Arias et al.; Malysh et al.; Bauer & Gallagher	Mobile learning emerges as a practical response to poor connectivity, data cost, electricity instability and device constraints	Technology-in-Use
3. WhatsApp and social media as substitute academic platforms	Sobaih et al.; Van den Berg & Mudau; Dunmade et al.; Rabotapi & Matope; Martínez Rodríguez & Díaz Crespo	WhatsApp becomes an academic platform for lectures, tutorials, seminars, communication and student support	Technology-in-Use / Platform Improvisation
4. Institutional adaptation and resilience	Habib; Bajger et al.; Berestok; Malysh et al.; Holovchak et al.	Mobile and digital learning are part of broader institutional responses to war, crisis and disruption	Technology Strategy
5. Displacement, refugee HE and equity-oriented access	Bauer & Gallagher; Drolia et al.; Dawadi et al.	Mobile-accessible and offline technologies can support displaced learners but require equity-sensitive design	Nature of Technology / Technology-in-Use
6. Pedagogical, social and emotional functions	Van den Berg & Mudau; Rabotapi & Matope; Van Staden & Nel; Dunmade et al.	Mobile learning supports belonging, reassurance, lecturer presence and peer support, not only content delivery	Nature of Technology
7. Gaps in theory, governance and long-term strategy	Okai-Ugbaje et al.; Maphosa et al.; Van Staden & Nel; Valencia-Arias et al.	The literature remains fragmented, short-term and weakly connected to institutional governance and strategy	Technology-in-Use / Technology Strategy

6. Discussion

6.1 Reframing Mobile Learning in Fragile Higher Education

The findings of this review reinforce the central argument that mobile learning in fragile higher education contexts should be conceptualised as a continuity infrastructure, rather than solely as a flexible or innovative pedagogical tool. In war-affected, COVID-19-disrupted, low-resource, and displacement settings, mobile learning consistently represents the most accessible means of educational connection when conventional systems are unavailable (Bauer & Gallagher, 2020; Holubnycha et al., 2022; Motaung & Dube, 2020). Smartphones, WhatsApp, and mobile-accessible platforms facilitate not only content delivery but also academic communication, peer interaction, emotional support, and institutional engagement (Rabotapi & Matope, 2024; Van den Berg & Mudau, 2022; Van Staden & Nel, 2023).

This reframing is significant because it shifts the focus of inquiry regarding mobile learning in fragile contexts. When mobile learning is viewed merely as an enhancement to formal systems, research typically addresses adoption rates, user satisfaction, and learning outcomes. However, if mobile learning is regarded as a continuity infrastructure, the primary concerns become reliability, equity, institutional recognition, stakeholder interpretation, and the conditions necessary to

support and sustain informal mobile practices (Okai-Ugbaje et al., 2022). The evidence reviewed consistently indicates that the latter perspective is more appropriate for fragile higher education environments.

A notable gap in the reviewed literature is the limited yet emerging evidence from Sudan, despite the substantial disruptions to Sudanese higher education institutions resulting from the escalation of armed conflict in 2023.

University closures, displacement of students and faculty, electricity instability, and internet disruptions have severely undermined the continuity of education in Sudanese higher education. The fragmentation of institutional infrastructure has further exacerbated the challenges of maintaining stable teaching and learning processes during periods of conflict (Taha et al., 2024).

6.2 Infrastructure Fragility and the Logic of Mobile-First Adaptation

In contrast to conventional e-learning models, which typically assume stable infrastructure, continuous connectivity, and institutionally managed learning management systems, mobile learning in fragile higher education contexts operates amid constraint, instability, and disruption. In these settings, mobile-accessible platforms serve not merely as optional pedagogical enhancements but as adaptive mechanisms that maintain educational relationships, communication, and institutional connection when formal systems are weakened or inaccessible (Bauer & Gallagher, 2020; Okai-Ugbaje et al., 2022; Taha et al., 2024).

The reviewed studies indicate that mobile-first adaptation in higher education is driven less by pedagogical preference and more by practical necessity. In contexts characterised by unstable electricity, intermittent internet access, inaccessible campuses, and prohibitive data costs, mobile devices and mobile-first platforms provide the most viable means of sustaining educational continuity (Al Mahdi & Fahal, 2024; Dawadi et al., 2024; Malysh et al., 2025). Their adoption is not due to pedagogical superiority over formal learning management systems, but rather to their practical accessibility when formal alternatives are unavailable (Motaung & Dube, 2020; Van Staden & Nel, 2023).

These findings have significant implications for the design of digital learning strategies in fragile contexts. Strategies based on ideal infrastructure conditions often fail to support the students most in need. In contrast, strategies tailored to actual infrastructure realities, such as compressed content, asynchronous formats, low-bandwidth platforms, and flexible participation, are more likely to sustain educational continuity under prevailing conditions (Dawadi et al., 2024; Okai-Ugbaje et al., 2022).

6.3 WhatsApp, Informality and Platform Improvisation

The widespread use of WhatsApp in the reviewed literature exemplifies a broader trend of platform improvisation within fragile higher education environments. Although WhatsApp was not designed for educational purposes and lacks assessment tools, gradebook functions, organised content repositories, and institutional integration, it consistently emerges as the de facto academic platform where formal systems are unavailable or inaccessible (Dunmade et al., 2023; Martínez Rodríguez & Díaz Crespo, 2021; Van Staden & Nel, 2023). This form of improvisation introduces several risks. The use of personal messaging applications in academic settings raises significant privacy and data protection concerns. Communication boundaries become blurred when lecturers and students interact on platforms also used for personal relationships. Additionally, message overload, distraction, unequal participation, and lack of content organisation can undermine pedagogical quality (Dunmade et al., 2023; Van den Berg & Mudau, 2022). However, the reviewed studies demonstrate that WhatsApp-based learning can be effectively structured when lecturers establish clear rules, organised channels, defined communication hours, and explicit pedagogical objectives (Motaung & Dube, 2020; Rabotapi & Matope, 2024; Van Staden & Nel, 2023). Consequently, institutional recognition and guidance are necessary for the effective use of WhatsApp in academic contexts (Okai-Ugbaje, 2022).

6.4 Transitioning from Emergency Improvisation to Institutional Strategy

A key finding of this review is that mobile learning in fragile higher education contexts often remains limited to emergency improvisation, rather than evolving into an institutionally supported strategy. Lecturers and students typically develop mobile practices independently, frequently lacking coordination, quality assurance, technical support, or policy guidance (Dunmade et al., 2023; Van Staden & Nel, 2023). As a result, outcomes are fragmented and unequal: students in certain departments or faculties may benefit from structured mobile learning experiences, while others receive only informal and inconsistent communication (Dawadi et al., 2024; Okai-Ugbaje, 2022).

Transitioning from improvisation to strategy necessitates institutional recognition of mobile learning as a legitimate and significant element of educational continuity. This shift involves developing policies for mobile-first teaching, establishing guidelines for WhatsApp and social media use, providing training and support for lecturers, implementing equity-oriented access measures, and integrating mobile learning into formal continuity and resilience planning (Bajger et al., 2025; Holovchak et al., 2026; Okai-Ugbaje et al., 2022). Evidence from (Bajger et al., 2025; Holovchak et al., 2026) indicates that institutions undertaking this transition, even partially, are better equipped to maintain the quality of teaching and learning during extended disruptions.

6.5 Theoretical Implications: Insights from a Technological Frames Perspective

Analysis of the reviewed findings through the Technological Frames Theory (TFT) reveals significant patterns. Students in fragile contexts generally perceive mobile learning as technology in use, viewing it primarily as a practical survival tool for maintaining access and connection when formal systems are unavailable (Holubnycha et al., 2022; Maphosa et

al., 2020; Van Staden & Nel, 2023). Lecturers often regard mobile learning as an additional workload or a means of informal communication, using mobile platforms out of necessity rather than as a comprehensive pedagogical strategy (Dunmade et al., 2023; Holovchak et al., 2026; Van den Berg & Mudau, 2022). Institutional leaders, as represented in the literature, typically frame mobile learning within the context of technology strategy, recognising it as a crisis response but seldom integrating it into long-term planning (Bajger et al., 2025; Habib, 2023; Okai-Ugbaje et al., 2022). These misalignments in stakeholder frames help explain why mobile learning practices remain informal and unsupported despite widespread use, why lecturers experience overload from mobile communication without institutional recognition, and why students encounter unequal mobile learning experiences across departments (Dawadi et al., 2024; Sobaih et al., 2020). Addressing these discrepancies requires intentional efforts to align stakeholder perspectives, including professional development to reframe mobile learning for lecturers, institutional communication positioning it as a strategic resource for continuity, and student consultation to identify access barriers and unmet support needs (Holovchak et al., 2026; Okai-Ugbaje et al., 2022).

6.6 Future Research Agenda

This review identifies several key priorities for future research on mobile learning within fragile higher education contexts:

- Longitudinal studies tracking mobile learning practices across multiple semesters or years of disruption are necessary to understand how these practices evolve, consolidate, erode, or become embedded.
- Multi-stakeholder studies that examine mobile learning from the perspectives of students, lecturers, institutional leaders, and IT staff would substantially advance understanding of frame alignment and misalignment.
- Research focused on higher education in contexts of prolonged conflict and post-conflict recovery is required to differentiate the dynamics of COVID-19 disruption from those associated with extended war, displacement, and reconstruction. Theoretically grounded research employing frameworks such as Technological Frames Theory (TFT), resilience theory, or sociotechnical systems theory would enhance the explanatory power of mobile learning research in fragile higher education.
- Equity-focused research investigating the differential experiences of women, displaced learners, students with disabilities, learners in rural or remote locations, and students in protracted crises is necessary.
- Governance and policy research examining how institutions in fragile contexts develop, implement and evaluate mobile learning policies would provide practical guidance for institutional leaders and policymakers. Geographically expanded research addressing under-studied fragile contexts, including Yemen, Sudan, Myanmar, the Democratic Republic of Congo, and Central America, would substantially enrich and test the generalisability of the current evidence base.
- Future research should prioritise empirical investigations of mobile learning practices, stakeholder experiences, and institutional adaptation within conflict-affected Sudanese higher education environments.

7. Practical Implications

The findings have practical implications for higher education institutions operating in fragile, conflict-affected, displaced, and low-resource contexts. Mobile learning should be recognised as an integral component of institutional continuity infrastructure, rather than solely as an informal emergency response. When campuses are inaccessible, electricity is unstable, connectivity is weak, and students or staff are displaced, mobile-accessible platforms may serve as the most reliable means of sustaining teaching, communication, and learner support. This also implies that mobile learning strategies must be designed around real access conditions. Institutions should prioritise low-bandwidth materials, asynchronous participation, compressed files, flexible submission routes and offline options where possible. WhatsApp and similar mobile-first platforms should not be ignored, because they are often already used by students and lecturers; however, their use requires simple guidance on privacy, communication boundaries, group management, academic conduct and data protection.

Mobile learning should also be addressed as an equity and governance issue. Device ownership alone does not ensure participation, as students may lack data, electricity, appropriate devices, safe study spaces, or digital confidence. Institutions should therefore support lecturers, consult with students, involve IT staff, and integrate mobile learning into continuity planning, quality assurance, and digital transformation strategies.

8. Practical Recommendations

The findings of this review indicate that mobile learning in fragile higher education contexts should be regarded as a core component of educational provision rather than a temporary or informal response. In environments affected by war, displacement, emergencies, limited resources, and infrastructure instability, mobile-accessible technologies can play a central role in maintaining educational continuity. The following recommendations are intended for higher education institutions, educators, and policymakers operating in fragile or resource-constrained settings.

8.1 Recognise Mobile Learning as Part of Continuity Planning

Evidence from (Motaung & Dube, 2020; Van Staden & Nel, 2023) demonstrates that students and lecturers already utilise WhatsApp and other mobile-accessible platforms to sustain teaching, communication, and support when formal

systems are unavailable. Higher education institutions should formally recognise these mobile practices within educational continuity planning. Institutions are advised to document existing mobile-first practices, identify effective strategies under constraint, and integrate suitable mobile-learning approaches into emergency preparedness and academic continuity plans. An effective continuity strategy should combine formal learning management systems with mobile-accessible alternatives that can operate during system outages.

8.2 Design for Low-Bandwidth and Intermittent Access

Evidence from (Dawadi et al., 2024; Okai-Ugbaje et al., 2022) consistently identifies electricity instability, weak connectivity, and high data costs as significant barriers to participation in mobile learning in fragile contexts. Consequently, mobile learning strategies should be designed to accommodate unstable infrastructure by employing low-bandwidth formats, small file sizes, compressed documents, audio explanations, asynchronous discussions, and offline options. Courses should also incorporate flexible deadlines and alternative submission routes for students affected by connectivity failures, power outages, or displacement.

8.3 Support Lecturers in Mobile-Friendly Pedagogy

Findings from (Dunmade et al., 2023; Holovchak et al., 2026; Van Staden & Nel, 2023) indicate that lecturers are central to sustaining mobile learning during periods of disruption, yet often assume this responsibility without adequate institutional support. Institutions should offer guidance on mobile-friendly teaching methods, such as structuring WhatsApp learning groups, managing discussions, providing feedback, moderating participation, and preventing message overload. Additionally, institutions should explicitly recognise the increased workload associated with mobile communication, as it frequently extends teaching responsibilities beyond standard working hours.

8.4 Develop Guidelines for WhatsApp and Social Media Use

The consistent finding that WhatsApp functions as a substitute academic platform, as documented by (Martínez Rodríguez & Díaz Crespo, 2021; Rabotapi & Matope, 2024; Sobaih et al., 2020) underscores the need for institutional guidance. Given that WhatsApp blurs the boundaries between personal and academic spaces, institutions should develop context-sensitive guidelines addressing privacy, consent, group rules, communication hours, file sharing, student participation, academic tone, assessment boundaries, and data protection. Clear guidelines can maintain WhatsApp's accessibility while mitigating risks associated with informality, overload, and privacy concerns.

8.5 Address Equity and Access Barriers

Evidence from (Bauer & Gallagher, 2020; Drolia et al., 2022) demonstrates that device ownership alone is insufficient to ensure equitable participation in mobile learning. Institutions should therefore address mobile learning as an equity issue. Recommended responses include providing data subsidies, zero-rated learning resources, device-loan schemes, offline learning packs, flexible participation options, and digital literacy support. In refugee and displaced contexts, institutions must also consider learner mobility, documentation barriers, gendered access, safety, and psychosocial support.

8.6 Integrate Mobile Learning with Institutional Strategy

As demonstrated by the contrasting cases in this review, contexts in which mobile learning was integrated into institutional strategy exhibited greater educational resilience than those relying on individual improvisation. Evidence from (Bajger et al., 2025; Habib, 2023; Holovchak et al., 2026) suggests that institutions aligning mobile learning with digital transformation plans, quality assurance, and crisis-response mechanisms are better positioned to sustain educational quality during prolonged disruption. Mobile learning should be embedded within academic policy, infrastructure investment, and resilience planning, rather than left to individual lecturers' improvisation.

8.7 Build Multi-Stakeholder Coordination

The TFT analysis in this review demonstrates that mobile learning is more sustainable when the perspectives of students, lecturers, IT staff, and institutional leaders are understood and aligned. Institutions should establish channels for feedback and coordination among these groups. Students can identify access barriers, lecturers can report pedagogical and workload challenges, IT staff can advise on technical feasibility, and leaders can integrate these insights into institutional planning. This multi-stakeholder approach transforms mobile learning from an emergency workaround into a collectively recognised and governed continuity mechanism.

Table 5. Summary of Practical Recommendations

Recommendation	Purpose
Recognise mobile learning as part of continuity planning	Move mobile learning from informal emergency use to supported institutional practice
Design for low-bandwidth and intermittent access	Ensure participation under electricity, connectivity and data constraints
Support lecturers in mobile-friendly pedagogy	Improve teaching quality and reduce lecturer overload
Develop WhatsApp and social media guidelines	Reduce privacy, communication and informality risks
Address equity and access barriers	Prevent mobile learning from reproducing exclusion
Integrate mobile learning with institutional	Link practice to policy, quality assurance and resilience

strategy	planning
Build multi-stakeholder coordination	Align student, lecturer and institutional technological frames

representation of research published in Arabic, French, Ukrainian, Spanish, Portuguese and other languages, which may contain significant evidence from fragile higher education contexts. This linguistic restriction is particularly consequential for the present review's scope: Arabic-language research covers Yemen, Syria, Iraq and Sudan; French covers much of Francophone sub-Saharan Africa; and Portuguese covers Mozambique, Angola and Guinea-Bissau. These are precisely the regions experiencing the most acute and prolonged forms of educational fragility. The English-only criterion may therefore systematically exclude the evidence most relevant to the review's central concerns, and future reviews should, where possible, incorporate multilingual searches or collaborative translation strategies.

Second, the geographic distribution of the included studies is uneven. South Africa, Ukraine and Nigeria together account for a large share of the included studies. This concentration reflects the research output and English-language publishing capacity of those national contexts, but means that evidence from other major fragile higher education contexts, including Yemen, Sudan, Myanmar, Haiti, the Democratic Republic of Congo and much of Central America, is absent. Findings should therefore be treated as provisional rather than universally generalisable.

Third, access to subscription-based databases was limited. The search strategy addressed this through multiple complementary open-access and publisher-specific sources, but gaps in database coverage remain possible. Fourth, the classification of contextual studies means that not all evidence directly addresses mobile learning. While this broader approach is necessary for understanding fragile conditions in higher education, it introduces heterogeneity into the synthesis.

Fifth, the methodological diversity across the 24 included studies, ranging from small qualitative case studies to large-scale quantitative surveys, complicates direct comparison of findings. Thematic synthesis addresses this through interpretive rather than aggregative analysis, but readers should be aware that the evidence base varies in rigour and transferability. Sixth, the COVID-19 literature dominates the sample. COVID-19-related disruption shares features with other forms of fragility but also differs in important ways from prolonged armed conflict, forced displacement and post-conflict reconstruction. Caution is required when generalising COVID-19 findings to other fragile contexts. Specifically, COVID-19 disruption was typically time-limited, occurred within intact institutional structures, and allowed learners to remain in known physical locations with predictable return to normalcy. Prolonged armed conflict, forced displacement and post-conflict reconstruction involve

9. Contributions

9.1 Conceptual Contribution

This review offers a conceptual contribution by introducing mobile learning as a continuity infrastructure. Rather than viewing mobile learning in fragile higher education solely as a flexible learning enhancement, this perspective positions it as a sociotechnical mechanism that sustains educational relationships, processes, and institutional connections that might otherwise be disrupted. This reframing shifts the focus from adoption and effectiveness to reliability, equity, and institutional recognition.

9.2 Theoretical Contribution

The review provides a theoretical contribution by identifying the Technological Frames Theory (TFT) as a productive analytical lens for understanding how mobile learning is interpreted, enacted, and strategically positioned in fragile higher education contexts. The three TFT domains, nature of technology, technology-in-use, and technology strategy, offer a coherent framework for explaining why mobile learning often remains informal and unsupported despite its widespread use, and why misalignments among students, lecturers, and institutions lead to fragmented mobile learning outcomes.

9.3 Methodological Contribution

The review offers a methodological contribution by developing a classification system that distinguishes core, core/contextual, and contextual studies within a fragmented literature. This system enables the synthesis to utilise a broader evidence base than a narrowly defined mobile learning review, while maintaining analytical clarity regarding the level and type of evidence each study provides.

9.4 Practical Contribution

The review delivers a practical contribution by translating its findings into seven specific recommendations for higher education institutions, educators, and policymakers operating in fragile and constrained settings. These recommendations address continuity planning, infrastructure-sensitive design, lecturer support, platform governance, equity, institutional strategy, and multi-stakeholder coordination. Collectively, they offer an actionable framework for transitioning from emergency improvisation to a supported infrastructure for mobile learning continuity.

10. Limitations

Several limitations of this review should be acknowledged. First, the literature on mobile learning in fragile higher education is dispersed across multiple labels and databases. Despite the broad search strategy, some relevant studies may not have been retrieved. The reliance on English-language publications limits the

simply about studying what technologies are used. It is about understanding how stakeholder groups come to recognise, govern and invest in mobile learning as legitimate infrastructure, and what conditions enable or prevent that recognition. This is a governance and interpretive question as much as a technological one, and it demands research methods and theoretical commitments adequate to its complexity.

Mobile learning, however, as a continuity infrastructure, is not sufficient to address all challenges. It cannot rebuild campuses destroyed by conflict, restore faculty displaced by war, or reverse the educational inequalities resulting from poverty, displacement, and institutional collapse. Evidence from Sudan, Ukraine, Afghanistan, and the Nakivale refugee settlement underscores that mobile learning operates at the margins of feasibility, and these margins are often extremely limited. Nevertheless, infrastructure is most critical at the margins. For example, a bridge that remains usable during flooding does not resolve the flood itself, but it maintains community connections until conditions improve, thereby enabling recovery. Similarly, mobile learning in fragile higher education sustains essential connections among students, knowledge, institutions, and educators, which are necessary for recovery following disruption.

For nearly two decades, research on mobile learning in higher education has primarily focused on innovation, engagement, and flexibility within well-resourced environments. This review contends that the most urgent and consequential frontier for the field lies in universities operating under bombardment, lecture groups relying on shared data bundles, doctoral supervisors mentoring across international displacement, and students persisting in their educational pursuits despite conflict. Understanding mobile learning in these challenging contexts with rigorous methodology, theoretical depth, and sustained commitment is not a peripheral issue for the field; it is its central concern.

This argument leads to four key commitments. First, the concept of continuity infrastructure should shift from a descriptive framework to a design and governance standard; mobile learning continuity must be systematically planned, resourced, and evaluated alongside other educational infrastructures. Second, institutional resilience in fragile higher education cannot rely solely on individual lecturer improvisation; it requires robust institutional frameworks, coordinated multi-stakeholder efforts, and policy environments that recognise mobile-first educational ecosystems as legitimate, albeit imperfect, realities. Third, the mobile-first fragile higher education ecosystems documented in this review, from South African townships to Ukrainian cities under air raid, Afghan universities navigating post-conflict uncertainty, and Ugandan refugee settlements, reflect not a failure of educational ambition, but a form of institutional tenacity warranting serious scholarly and policy attention. Fourth, the future research agenda informed by Technological

physical danger, institutional collapse, loss of documentation, involuntary mobility and absence of return timelines. These differences mean that mobile learning practices developed under COVID-19 conditions may not translate straightforwardly to conflict and displacement settings. Future research should explicitly disaggregate these disruption types rather than treating them as interchangeable forms of educational fragility.

11. Conclusion

This thematic systematic literature review examined the study, implementation, and experience of mobile learning as a mechanism for educational continuity and institutional adaptation in fragile higher education contexts. Drawing on 24 studies from conflict-affected, COVID-19-disrupted, low-resource, refugee, and displacement settings across four continents, this review extends beyond cataloguing technologies and their uses. It reframes the central question regarding mobile learning in these environments.

The primary finding of this review is not simply that mobile learning is effective or preferred by students, nor that specific tools such as WhatsApp are useful. Rather, in fragile higher education contexts, mobile learning constitutes the essential infrastructure for educational survival. When campuses close due to conflict, lecturers are displaced, electricity is rationed, and institutional systems collapse, smartphones and messaging groups become fundamental to education rather than supplementary. This distinction is critical for how the field conceptualises, researches, funds, and governs mobile learning in contexts of sustained disruption.

The seven thematic patterns identified mobile learning as continuity infrastructure, infrastructure instability and mobile-first adaptation, WhatsApp and social media as substitute academic platforms, institutional adaptation and resilience, equity-oriented access for displaced and refugee learners, pedagogical and social functions of mobile learning, and gaps in theory, governance, and long-term strategy collectively describe a fragile higher education ecosystem compelled to adopt mobile-first operations out of necessity rather than strategic planning. For institutions, systems, and donors, the critical insight is that this mobile-first reality is already established. The pertinent question is not whether to implement mobile learning in fragile higher education, but whether to support and sustain it.

The review's theoretical contribution reinforces this argument. Technological Frames Theory reveals that mobile learning in fragile higher education is not a neutral technical resource that stakeholders adopt or reject. It is an object of interpretation: students frame it as survival, lecturers as overload, institutions as risk. These divergent frames and the misalignments among them determine whether mobile learning remains an informal coping mechanism or becomes an institutionally supported layer of educational resilience. The TFT agenda for future research is therefore not

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- Frames Theory must be pursued with urgency. The interpretive, governance, and frame-alignment questions it raises are not abstract theoretical puzzles; their answers will determine whether mobile learning practices that currently sustain fragile higher education systems become the foundation for long-term resilience or, as is often the case, remain invisible, unsupported, and unrewarded acts of educational survival.

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[34]. Appendix A
Data Extraction Form

A structured form was utilised to extract data from each of the 24 included studies. This form was applied consistently across all core, core/contextual, and contextual studies. Fields were completed during full-text assessment and subsequently verified against the source documents.

Field	Description / Example
Author(s)	Full author names as listed in the source
Year	Year of publication
Title	Full title of the article, chapter or report
Source / Journal	Journal name, publisher or database
Country / Region	Country or region of the study context
Context Type	Conflict / COVID-19 / Refugee / Low-resource / Emergency / Displacement / Post-conflict
Research Focus	Central question or aim of the study
Methodology	e.g. quantitative survey, qualitative case study, systematic review, conceptual framework
Sample	Number and type of participants, or corpus of studies
Mobile Learning Platform / Practice	WhatsApp / smartphone / mobile app / social media / mobile-accessible LMS / blended-distance

Key Findings Relevant to This Review	Main findings related to mobile learning, continuity, access, barriers or institutional adaptation
Classification	Core / Core-Contextual / Contextual / Contextual-Background
DOI / URL	Verified DOI or stable URL

If information for a specific field could not be determined from the available abstract or full text, the entry was recorded as 'Not reported' and documented in the search log. Studies missing data in more than three fields were excluded at the eligibility stage due to insufficient bibliographic information. This criterion resulted in the exclusion of two out of twenty-four records.