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Using EdTech to Reach the Unreached: Innovative Approaches to Non-Formal Education in Zimbabwe

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ABSTRACT

This qualitative study investigates the use of educational technology (EdTech) to reach marginalized populations through non-formal education (NFE) in Zimbabwe. Grounded in Paulo Freire's Critical Pedagogy and employing an interpretive research philosophy, the study collected data from 50 educators using open-ended questionnaires distributed in November 2025. Thematic analysis of responses reveals four key findings. First, the digital divide is fundamentally economic and infrastructural: high data costs and unreliable electricity are critical barriers, necessitating investment in solar-powered community centers and school-based access points. Second, pedagogical relevance requires radical localization—incorporating indigenous languages, real-life examples and practical, skills-based subjects delivered through low-bandwidth platforms such as WhatsApp and SMS/USSD. Third, sustainability depends on community ownership: projects must transition from foreign funding dependency to locally governed models, with trained community facilitators and traditional leaders ensuring ethical accountability. Fourth, inclusivity demands universal design principles that leverage built-in accessibility features for learners with disabilities, alongside robust data protection frameworks to safeguard against exploitation. The study theorizes a "Freirean EdTech" that positions technology not as a neutral tool but as a site of emancipatory practice, where success is measured by a project's ability to foster critical consciousness, economic agency and collective self-determination. Implications for policy include regulatory interventions to lower data costs, curriculum reforms prioritizing localization, and governance frameworks that embed community oversight. The study concludes that sustainable EdTech in NFE requires moving beyond technological determinism toward socially embedded, ethically governed and culturally responsive approaches.

Keywords: educational technology, non-formal education, digital divide, critical pedagogy, community ownership, zimbabwe, inclusivity, sustainability

BACKGROUND

Education is universally acknowledged as a fundamental human right and a key driver of sustainable development. Yet, despite decades of global commitment, the world continues to confront a profound learning crisis, disproportionately impacting marginalized populations (UNESCO, 2006). In Zimbabwe, education stands at a crossroads of historical achievement and contemporary challenge. While the country has made substantial strides in formal schooling since independence, vast segments of the population remain excluded, particularly through non-formal education (NFE) pathways such as community learning centers, adult literacy programmes, and vocational training. Recognizing this persistent inequity, Zimbabwe's National Non-Formal Education Policy emphasizes the urgent need to expand access and inclusivity in NFE to ensure that lifelong learning opportunities reach marginalized learners.

Globally, the quest for educational inclusivity has spurred the rise of Educational Technology (EdTech), the use of digital tools and platforms to enhance teaching and learning (Selwyn, 2017). EdTech promises to transcend traditional barriers of distance, cost, and scalability, democratizing access to education. However, its implementation in NFE differs significantly across regional contexts, reflecting varied infrastructural and pedagogical realities. In high-income regions such as Europe, robust digital infrastructure has enabled advanced applications of EdTech, including the use of Artificial Intelligence (AI) and Virtual Reality (VR) for personalized and immersive learning. Finland and Estonia's eKool and Wilma systems exemplify these initiatives, supporting digital citizenship and lifelong learning (Bozkurt et al., 2020; UNESCO, 2023). In Asia, innovation often adopts a hybrid model that combines high- and low-tech solutions. India's National Education Policy 2020 introduced platforms like DIKSHA and SWAYAM to strengthen digital learning infrastructure, while localized, low-bandwidth tools such as Hello English and GyanSetu employ smartphone and IVR-based learning to reach populations with limited literacy (Kam et al., 2008; UNESCO, 2023).

In Sub-Saharan Africa (SSA), where the number of out-of-school children and youth exceeds 98 million, EdTech has emerged as both a necessity and a challenge amid structural inequalities like poverty, teacher shortages, and inadequate infrastructure (UNESCO Institute for Statistics [UIS], 2018). This educational exclusion escalates sharply across tiers: approximately 20% of primary school-age children are excluded from the formal system, rising to 33% among lower secondary adolescents, and peaking at 48% for upper secondary youth. Consequently, nearly one out of every two young people across the region is denied access to formal senior secondary education, leaving a vast demographic entirely dependent on non-formal and alternative digital pathways. Despite high mobile phone penetration, access to affordable internet remains limited, reinforcing the digital divide (Krönke, 2020). As Salimi (2025) notes, the World Bank's recent EdTech strategy in SSA has shifted focus from administrative efficiency toward instructional equity and inclusion, leading to a surge of localized, mobile-based innovations. Public-private partnerships have introduced radio education, offline mobile applications, and community-based digital hubs to enhance learning equity (UNESCO, 2023). These interventions reflect a regional reorientation from technology adoption to technological adaptation leveraging contextual solutions to expand access and participation.

Within this regional context, Zimbabwe represents a compelling case of both opportunity and constraint. The nation's rich educational legacy has been undermined by economic instability, infrastructure decline, and widening inequality, particularly in rural areas. A growing cohort of young people who are not in employment, education, or training (NEET) underscores the urgency of alternative learning pathways. In response, Zimbabwe's Education 5.0 framework a national paradigm promoting innovation, industrialization, and learner-centered pedagogy, positions EdTech as a transformative tool for development (RSIS International, 2025). The COVID-19 pandemic further accelerated this digital shift, normalizing platforms such as Moodle, WhatsApp, and Zoom for remote and blended learning (Mweha, 2025). However, implementation challenges persist, particularly in rural and non-formal learning contexts. Studies highlight persistent digital divides, with rural

communities facing unreliable connectivity, inadequate ICT infrastructure, and low digital literacy levels (Chidakwa & Khanare, 2024). Although Education 5.0 encourages blended and project-based learning, Mweha (2025) observed that these pedagogical innovations remain unevenly distributed, especially within under-resourced NFE institutions.

Institutional case studies further reveal the complexity of integrating EdTech in Zimbabwe. At the Zimbabwe Open University (ZOU), the introduction of e-marking faced major setbacks due to limited internet access, a lack of smartphones among students, and digital anxiety among staff (Ngara & Ngara, 2024). Beyond infrastructure, systemic and ethical concerns also emerge. Tarisayi and Manhibi (2025) report that while educators and administrators express optimism about the potential of AI to personalize learning and enhance efficiency, they remain concerned about data privacy, cost implications, and insufficient policy readiness. These issues resonate with global discussions on responsible AI in education, which call for inclusion, transparency, and accountability in digital learning ecosystems. Encouragingly, grassroots efforts in Zimbabwe demonstrate the potential of community-driven EdTech initiatives. Buckler et al. (2025) documented how rural volunteers mobilized during pandemic-related school closures to sustain alternative learning, developing new educational identities and pedagogical capacities despite limited resources. Similarly, Lunga (2024) emphasized the necessity of stakeholder participation, particularly by parents and teachers in early childhood innovation, underscoring the importance of local ownership for sustainable EdTech adoption in NFE.

These local experiences are reinforced by empirical and theoretical insights from the broader educational technology research tradition. Early cognitive research by Greenfield (2009) demonstrated that informal digital environments such as television, video games, and the internet enhance visual-spatial reasoning and multitasking, but may simultaneously reduce learners' reflective capacity and imagination. Her proposal for a "balanced media diet" remains particularly relevant in low-resource contexts, where excessive reliance on one form of technology may hinder holistic cognitive development. Building on this cognitive foundation, Schwier (2010) advanced a theoretical framework that redefined educational technology research around informal learning environments, spaces characterized by learner autonomy, self-direction, and intrinsic motivation. Schwier argued that such contexts embody the creative and participatory potential of EdTech, providing fertile ground for research into how learners construct knowledge beyond formal institutions. Later, Corbeil and Corbeil (2017) empirically operationalized this paradigm through their long-term study of the EdTech Blog, a professional online learning community for graduate students. Their 13-year evaluation showed that 91% of participants viewed the blog as instrumental in fostering collaboration, reflective practice, and professional identity formation, offering empirical proof that informal digital communities can effectively complement formal academic learning.

Together, this growing body of evidence underscores the transformative potential of EdTech in supporting non-formal and informal learning, yet also highlights enduring challenges of accessibility, inclusivity, and sustainability. In Zimbabwe, where the education system grapples with uneven digital readiness and economic instability, the opportunity lies in developing context-specific, mobile-first, and offline-capable models that align with community realities. Existing mobile penetration exceeding 90% (Postal and Telecommunications Regulatory Authority of Zimbabwe [POTRAZ], 2022) provides a unique infrastructural foundation for innovation. As the Global Campaign for Education (2025) notes, initiatives such as solar-powered community learning centers and offline digital libraries have begun to demonstrate scalable potential. However, for EdTech to truly serve marginalized learners in Zimbabwe's NFE sector, interventions must move beyond the technical deployment of tools to address ethical governance, local participation, and pedagogical relevance.

In essence, the global and national trajectories converge on a single imperative: while EdTech offers unprecedented opportunities for expanding educational access, its sustainable impact depends on the integration of technological innovation with social inclusion and contextual design. As both international scholarship (Corbeil & Corbeil, 2017; Greenfield, 2009; Schwier, 2010) and Zimbabwean evidence (Chidakwa

& Khanare, 2024; Ngara & Ngara, 2024; Tarisayi & Manhibi, 2025) reveal, the future of NFE lies in leveraging the cognitive and social affordances of technology to create participatory, equitable, and learner-centered ecosystems that empower the most marginalized populations. To address these dynamics, this study is guided by four core strategic objectives. First, it seeks to build affordable infrastructure to ensure seamless, widespread user connectivity. Second, it aims to deliver relevant, pedagogically sound content tailored specifically to local learning needs. Third, the study focuses on fostering local community ownership to ensure long-term project independence and sustainability. Finally, it establishes a framework to enforce inclusive policies and ethical standards that protect and serve all users equitably.

THEORETICAL DEVELOPMENT

Theoretical Framework

Paulo Freire's Critical Pedagogy theory is the main theory underpinning this study. Critical Pedagogy, developed by Paulo Freire and translated into English in 1970, provides a foundational philosophical challenge to the traditional "banking model" of education, in which students are perceived as passive, empty vessels to be filled with knowledge by the teacher (Harris & Roter 2024). In direct opposition to this, Freire posits that education must be a dialogical and participatory process, starting from the learners' own "thematic universe," their lived experiences, and cultural context. The ultimate aim of this approach is to foster conscientização, or critical consciousness, empowering learners to critically engage with their reality, recognize systems of oppression, and take action to transform their world. This process is encapsulated in the concept of praxis, the essential cycle of reflection and action. As articulated by Aliakbari and Faraji (2011), Freire's work attempts to transform oppressed people from being objects of education into active subjects of their own self-governance and emancipation. This aligns with the view that education should be emancipatory, requiring learners to act in a manner that enables them to transform their societies. Furthermore, this entire framework is understood, as Keesing-Styles (2003) notes, as an academic reaction to the inherent inequalities and oppressive relations of power that exist within conventional schooling systems.

This theoretical framework is profoundly relevant to the study of using EdTech to reach unreached populations in Zimbabwe. It provides a vital lens through which to justify, design, and evaluate innovative non-formal education initiatives. Firstly, the Freirean insistence that learning must be situated within the learner's "thematic universe" directly supports the study's focus on the critical need for "local languages and culturally relevant content" in Zimbabwe, rather than importing foreign curricula that represent a form of digital banking model. Secondly and more significantly, Critical Pedagogy offers a robust metric for success that moves beyond quantifying mere literacy or skill acquisition rates. By evaluating EdTech through its ability to foster critical consciousness, the study can assess whether these technologies truly empower the unreached to see themselves as agents of change in their own communities. This shifts the overarching goal of the intervention from simply providing education to fostering a genuinely transformative and emancipatory education, thereby fulfilling the core purpose of transforming learners from objects into subjects of their own future.

LITERATURE DEVELOPMENT

Access to Education for Marginalised Groups

A robust body of global literature converges on the macro-level understanding that achieving Sustainable Development Goal 4 (SDG 4) requires moving beyond mere physical access to address the intersecting social, economic, and contextual barriers that perpetuate educational exclusion (Thompson, 2018; UNESCO, 2020). Research consistently demonstrates that marginalization is fundamentally multidimensional, shaped by the compounding effects of poverty, gender, disability, and geographic isolation (Cameron et al., 2024; Global

Partnership for Education [GPE], 2024; UIS, 2018). However, beneath this broad consensus lies a significant conceptual tension regarding how educational exclusion is framed and measured. While mainstream policy frameworks champion system-wide, data-driven transformations rooted in robust, disaggregated Education Management Information Systems (EMIS) (Mendoza & Heymann, 2022; UNICEF, 2021), a competing perspective cautions that an over-reliance on quantitative data risks flattening the lived, qualitative realities of marginalized groups. This creates an epistemic friction: the institutional drive for standardized, scalable metrics frequently obscures the nuanced, intersecting social vulnerabilities that cannot be easily captured on a digital dashboard. Consequently, while multisectoral interventions that integrate education with health and social protection are widely lauded, literature presents inconsistent evidence regarding their implementation, often failing to reconcile top-down systemic tracking with bottom-up community realities.

A similar inconsistency disrupts the discourse surrounding intervention efficacy. On one hand, extensive systematic reviews argue for the predictable success of balancing demand-side and supply-side interventions (Evans et al., 2021; Snilstveit et al., 2015). On the other hand, implementation data frequently contradicts these idealized models, revealing a stark disconnect between conceptual policy agreement and practical, on-the-ground reality. For instance, the Namibian experience demonstrates that progressive financial mechanisms, such as fee abolition policies, fail to guarantee equity if divorced from contextual realities; despite removing economic barriers, systemic obstacles like inaccessible infrastructure and a lack of specialized support continued to exclude orphans and learners with disabilities (Chakera et al., 2020; Namibia Statistics Agency, 2016). This reveals a profound gap in the literature: macro-level financial and policy interventions are structurally insufficient unless concurrently matched with localized investments in inclusive pedagogical practices and targeted teacher professional development.

Ultimately, the existing literature is polarized by a critical methodological paradox. While macro-level studies advocate for standardized, scalable solutions across fragile states (Acuil & Grob-Zakhary, 2024; GPE, 2024), they rarely account for the friction that occurs when these models are deployed in highly volatile, resource-constrained environments. Scholars often demand scalability, yet scaling a model frequently dilutes the very context-sensitivity required to reach the most vulnerable populations (Koirala, 2025). The literature thus collectively argues that the path to equitable and inclusive education lies in data-driven, context-sensitive policies that address overlapping vulnerabilities through coordinated financing, teacher capacity building, and community engagement, yet it also underscores an urgent need for more longitudinal and implementation-focused research to translate these principles into a sustained reality for the most marginalized learners.

Digital Literacy and Skills Development

The evolution of digital literacy from a narrow focus on technical skills to a multifaceted construct encompassing information evaluation, creation, communication, and safety is well-established in contemporary literature (Hafner, 2019; Son, 2015). In language education, this expanded view has gained substantial traction, with mainstream scholarship widely celebrating the pedagogical value of digital platforms for enhancing English learning (Jerasa & Boffone, 2021; Tour, 2020). Concurrently, these technological affordances have catalyzed the rise of Informal Digital Learning of English (IDLE), conceptualized as self-directed, interest-driven language learning occurring outside the formal classroom (Lee & Dressman, 2018; Zhang & Liu, 2024). While extensive empirical evidence confirms IDLE's positive impact on discrete, receptive language skills like vocabulary and speaking (Lee, 2019; Lee & Drajati, 2019), a critical conceptual tension has emerged within the field regarding the relationship between digital exposure and learning efficacy.

Early, optimistic iterations of IDLE literature frequently operated under the implicit assumption of the digital native myth, conflating a student's technical fluency in social spaces with an innate capacity for autonomous academic inquiry. However, recent critical scholarship exposes a stark disconnect: mere access to digital tools is structurally insufficient for substantive language acquisition. Instead, a profound pedagogical friction exists

between a learner's qualitative use of technology for recreation and their capacity to deploy it strategically for academic purposes (Lai et al., 2014). This mismatch shifts the scholarly debate from a question of technological infrastructure to one of cognitive scaffolding. Autonomous digital environments grant learners immense agency, yet they simultaneously impose a heavy cognitive burden on students who are expected to self-regulate, evaluate input authenticity, and maintain motivation without institutional oversight.

This gap between digital access and strategic application is highly uneven and heavily dependent on localized educational ecologies, revealing significant inconsistencies across international contexts. In China, for instance, undergraduates present a unique behavioral paradox: they possess robust internet access and highly positive attitudes toward digital learning, yet they consistently struggle to apply devices strategically for academic growth (Lee, 2020; Li, 2025). This struggle is deeply exacerbated by a systemic tension; students are forced to navigate open-ended, fluid digital environments while operating within a traditional, rigid, and exam-oriented institutional framework that offers no systematic guidance to cultivate digital literacies (Rao et al., 2024). Conversely, evidence from more centralized or culturally distinct contexts like Iran and Turkey reinforces the baseline finding that high digital literacy amplifies the benefits of IDLE, yet these studies diverge significantly on how structured support should be implemented, often failing to reconcile top-down teacher intervention with the fundamentally organic, unstructured nature of informal learning (Gonen & Kizilay, 2023; Rezai et al., 2024). Furthermore, there remains an unaddressed friction regarding how informal, highly personalized digital spaces can be effectively bridge-built into formal educational outcomes without destroying the very autonomy that makes informal learning potent (Stockwell, 2022). It is precisely this lack of longitudinal, process-oriented understanding regarding how literacy translates into real-world practice that this study aims to investigate.

A more nuanced understanding of this dynamic is provided by Zakir et al. (2025), whose empirical model moves beyond a direct cause-and-effect relationship to illuminate the mediating pathways between digital literacy and academic success. Their research confirms that digital literacy has a direct positive effect on academic performance, but its primary influence is channeled indirectly through three key mediators: digital competence, digital informal learning (DIL), and self-efficacy. This model effectively integrates the broader, "squishy" conceptualization of digital literacy offered by Meyers et al. (2013), who frame it as a holistic integration of skills, critical thinking, and socially situated practices cultivated powerfully in informal settings, and provides a quantitative framework for its operation. The findings of Zakir et al. (2025) crucially complement the qualitative and contextual gaps identified in the IDLE literature. They demonstrate that self-efficacy acts as a critical motivational engine, while digital competence and engagement in DIL are the direct drivers of academic gains. This analysis argues that resolving the gap between perception and practice, as identified by Li (2025), requires integrated pedagogical interventions that simultaneously build foundational digital literacy, foster self-efficacy, cultivate broader competencies and create opportunities for self-directed learning to fully unlock student potential in the digital age.

Personalised Learning and Adaptive Technology

The current body of scholarship on adaptive learning exhibits a profound conceptual tension regarding the role of technology in shifting instructional paradigms. On one side of this debate, optimistic structural frameworks, such as the one advanced by Taylor et al. (2021), position personalized and adaptive learning as inherently transformative, data-driven mechanisms. They argue that algorithmically tailored pathways naturally shift higher education away from passive, teacher-centered delivery and toward scaled, student-centered individualization (Taylor et al., 2021). However, this techno-optimistic view assumes that data-intensive algorithms are inherently neutral and pedagogically sound. It is fundamentally challenged by more critical perspectives, such as those presented in the Cambridge Papers in ELT (2017). The Cambridge framework cautions against uncritical submission to the educational technology hype cycle, arguing that adaptive systems remain in a largely unverified exploratory phase characterized by limited empirical validation. Rather

than working synchronously, these two schools of thought reveal an unresolved ideological divide: the former treats algorithmic scaling as a solution to individualization challenges (Taylor et al., 2021), whereas the latter views it as a premature substitute for robust pedagogical grounding (Cambridge Papers in ELT, 2017).

These conceptual conflicts manifest as stark empirical contradictions across implementation research. Quantitative models and systematic overviews, including the 30-study review conducted by Vorobyeva et al. (2025), establish that machine learning tools and intelligent tutoring systems successfully maximize student engagement and self-regulated learning by aligning content delivery with real-time learner profiles. Yet, even within these data-driven syntheses, significant internal contradictions emerge. While adaptive tools excel at automated content delivery, their actual contribution to higher-order cognitive processing remains deeply contested.

Vorobyeva et al. (2025) explicitly acknowledge that fundamental constructivist principles and metacognitive engagement are routinely neglected or superficialized in execution. This creates an empirical paradox where systems are technically "adaptive" but pedagogically hollow, optimizing for task completion rather than deep cognitive restructuring. Furthermore, the literature exhibits severe domain asymmetry: empirical data is heavily concentrated within general education and language learning platforms, leaving a distinct empirical vacuum regarding how these adaptive dynamics function within technical STEM or data science contexts (Vorobyeva et al., 2025). A final, critical oversight in prior studies is the assumption of universal technological infrastructure and homogenous institutional readiness. The foundational frameworks outlined by Taylor et al. (2021) and the systematic categorizations of Vorobyeva et al. (2025) are predominantly built upon Western-centric educational ecosystems where data connectivity, hardware access, and institutional digital literacy are taken for granted. This uncritical global generalization completely breaks down when applied to resource-constrained environments.

As Mangwaya and Ngara (2026) argue, the actual pedagogical utility of AI-driven adaptive platforms in developing regions is entirely dependent on underlying structural realities. In these contexts, persistent disruptions such as erratic internet connectivity, severe infrastructure deficits, and low teacher readiness negate the real-time responsive capacity of data-driven algorithms (Mangwaya & Ngara, 2026). This structural barrier is further exacerbated by an acute regulatory vacuum. As Pasipamire et al. (2025) point out, while Western implementations focus on optimizing algorithmic feedback loops, higher education institutions in developing nations face severe challenges regarding localized AI governance, lack of national policy frameworks, and wide digital divides that risk turning personalized technologies into instruments of educational exclusion. The Cambridge Papers in ELT (2017) highlight a lack of rigorous, independent evaluations, and Vorobyeva et al. (2025) point to ethical and data privacy concerns that accompany AI-driven personalization. Collectively, one can point out that future research should integrate pedagogical theory with algorithmic design, ensure educator professional development, and address inclusivity through equitable access to technology. Integrating pedagogical theory directly into algorithmic design is essential because data-driven educational systems otherwise risk optimizing for the wrong metrics. Left alone, standard machine learning algorithms are designed to maximize mechanical efficiency, such as fast completion times, surface-level engagement clicks, or correct multiple-choice selections. The scholars are of the view that synthesis of these perspectives reveals both optimism and caution: while adaptive and AI-enhanced personalized learning promise transformative potential, their impact will depend on aligning technological innovation with sound educational design and empirical validation

Mobile Learning and M-learning

Informal learning, characterized as a lifelong process of acquiring knowledge from daily experiences, has been fundamentally transformed by the proliferation of mobile devices. Early conceptualizations positioned mobile learning (m-learning) as a mere extension of e-learning, but it is now recognized as a distinct field defined by

learning that occurs when the learner is not in a fixed, predetermined location (O'Malley et al., 2005). This inherent mobility is crucial for informal education, as it enables learning to be seamlessly interwoven with the fabric of everyday life. The core strength of m-learning in these settings is its support for "situated learning," where instruction is accessed and applied within a relevant context, such as using a smartphone for an audio guide in a museum (Korucu & Alkan, 2011). Furthermore, it facilitates "seamless learning," allowing educational activities to continue across different devices and scenarios, thereby empowering individuals to engage in spontaneous, "life-wide" learning as needs and interests arise.

Beyond simple content delivery, m-learning is framed as a powerful tool for empowerment and contextual learning. Its application supports complex, collaborative processes, effectively "bridging official and casual learning" by allowing learners to access resources that reinforce formal instruction or satisfy immediate curiosity. This is evident in the "learning in the time of need" advantage, where mobile devices serve as immediate portals for problem-solving (Korucu & Alkan, 2011). The technology also fosters the formation of communities of practice and peer-support networks outside formal structures, reinforcing a shift towards a learner-centric model where individuals take greater responsibility for their own learning journey. This potential for personalization and collaboration highlights the transformative role m-learning can play in supporting lifelong learning.

However, a critical analysis reveals significant challenges that temper this optimistic portrayal, particularly in developing contexts. Research highlights that infrastructural limitations such as unreliable electricity, poor internet connectivity, and the high cost of data are not minor obstacles but fundamental barriers to adoption (Maketo, 2018). These constraints severely limit the anytime, anywhere ideal, making learning activities prone to interruption or prohibitively expensive. One can point out that this issue is compounded by a lack of access to suitable mobile devices and a critical gap in digital literacy training for both learners and facilitators. Consequently, while the theoretical pedagogical advantages of m-learning are well-established, its practical success is deeply intertwined with broader socioeconomic and technological infrastructures, and a significant gap remains in addressing the digital divide to ensure equitable access and effective use in informal learning environments.

Community-Based Learning and Social Learning

Community-Based Learning (CBL) and social learning are deeply intertwined concepts within informal education, both rooted in experiential and collaborative paradigms. CBL is fundamentally defined as an educational approach that integrates academic instruction with community engagement, using real-world contexts to promote experiential learning, civic responsibility, and meaningful social transformation (Nchaga, 2025). This process inherently relies on social learning mechanisms, as it fosters relationships between students, educators, and community members, creating a collaborative environment where knowledge is co-created. The theoretical foundation for this is often social capital theory, which posits that the networks of relationships within a community are a valuable asset, and CBL actively builds this capital by connecting community intellectuals and students to combat multifaceted challenges collaboratively (Nchaga, 2025). The social learning outcomes are clear: participants develop enhanced social skills, a stronger sense of social responsibility and an understanding of diversity through direct interaction (Afzal & Hussain, 2020). This aligns with the core principle that learning is not an isolated activity but a social process embedded within a community context, a notion championed by Dewey and evident in the "collaborative partnerships" that are central to CBL frameworks.

Despite their synergies, a nuanced difference exists in the primary focus of CBL and the broader concept of social learning in these settings. CBL is often purposefully structured with dual objectives: student development and tangible community benefit, such as addressing local needs or generating applicable knowledge (Nchaga, 2025; Owens & Wang, 1996). Its success is frequently measured by outcomes like skill

development, civic engagement, and community transformation. Social learning, while a critical process within CBL, can be a more organic outcome of any collaborative informal activity, not all of which are designed with explicit service or community development goals. For instance, the social skills and increased political efficacy documented by Afzal and Hussain (2020) emerge from the structured reflection and mentorship within a CBL program, whereas social learning can occur in any informal group dynamic, from a youth club to an online forum, without a formal "community improvement" agenda. Thus, CBL can be viewed as a specific, intentional pedagogical application that leverages social learning processes to achieve defined civic and academic ends.

A significant gap in the current literature revolves around the scalability and sustainability of the rich social learning environments that CBL creates. While sources like Nchaga (2025) identify logistical constraints and assessment difficulties as barriers and Owens & Wang (1996) discuss the practical challenges of time, liability, and transportation, there is less critical analysis of how to institutionalize these programs beyond isolated, often grant-funded initiatives. Furthermore, the role of digital technology in mediating social learning within CBL remains underexplored. Nchaga (2025) suggests leveraging digital technologies as a future direction, but current research provides few models for how online platforms can effectively build the deep, trust-based mentor relationships and collaborative problem-solving that are hallmarks of successful in-person CBL.

Sustainability and Scalability of Educational Technology Initiatives

The discourse surrounding the expansion of educational technology (EdTech) in informal learning environments reveals a fundamental conceptual tension between structural fidelity and local adaptation. A dominant paradigm, rooted in systemic transformation models like Coburn (2003), posits that authentic scalability requires profound multi-dimensional shifts: a depth of alteration in instructional practices, long-term sustainability, lateral spread to new contexts, and a decisive transition of ownership from developers to the adopting institution. Within this framework, an initiative cannot merely exist as a transient project; it must become an integrated organ of the host organization’s culture and daily operations to endure (Niederhauser et al., 2018). However, this systemic ideal frequently collides with the chaotic, voluntary, and highly fluid realities of informal educational spaces. Proponents of evolutionary scaling, such as Clarke and Dede (2009), introduce a competing perspective by arguing that rigid adherence to original implementation frameworks is counterproductive. Instead, they champion a "design for scalability" that permits constant adaptation, mutation, and local reinvention to match fluctuating community resources (Clarke & Dede, 2009).

This creates an unresolved ideological friction: Coburn’s (2003) model demands a level of systemic control and cultural assimilation that informal settings lacking the mandatory structures of formal schooling rarely possess, while Clarke and Dede’s (2009) emphasis on local reinvention risks diluting the core efficacy of the digital innovation entirely. A foundational element for achieving this endurance and growth is the strategic alignment of the technology with the organization's mission and the cultivation of robust organizational capacity. When an EdTech initiative is perceived as a core component of the institution's strategic goals, such as enhancing community engagement in a library or deepening inquiry in a museum, it is far more likely to secure the leadership support and resource allocation necessary for long-term sustainability (Niederhauser et al., 2018). This should be coupled with a commitment to continuous professional development that moves beyond one-time training to foster a community of practice, building the self-efficacy of staff and facilitators, which is strongly linked to persistent use of technology (Lysenko et al., 2022). Furthermore, the choice of a resilient and cost-effective technology model, potentially supported by diversified funding streams, is essential to withstand the fluctuating financial realities common in the informal education sector.

The scholars opine that critical evaluation exposes stark inconsistencies between the theoretical preconditions for sustainability and the empirical capacity of informal institutions. The literature heavily asserts that long-term endurance relies on aligning technology with the organization's core strategic mission

such as community engagement in libraries or inquiry-based learning in museums, thereby securing institutional leadership and continuous resource streams (Niederhauser et al., 2018). Yet, this strategic alignment model assumes a baseline of institutional stability that is often non-existent in the informal sector. While some studies demonstrate that continuous professional development and the cultivation of organic communities of practice successfully elevate staff self-efficacy and technology persistence (Lysenko et al., 2022), they overlook a severe structural paradox. Informal spaces are notoriously defined by transient volunteer labor, high staff turnover, and fluctuating, unpredictable funding models. Consequently, the heavy investments in professional development advocated by Lysenko et al. (2022) often evaporate as trained personnel cycle out of the institution, creating an empirical contradiction where the very strategies designed to build long-term capacity instead generate localized institutional exhaustion and financial strain.

This systemic friction is acutely amplified when Western-centric scaling models are unthinkingly superimposed onto resource-constrained or marginalized environments. Traditional frameworks assume a resilient, cost-effective digital infrastructure and the availability of diversified funding streams to buffer financial volatility. These assumptions completely disintegrate in under-resourced informal sectors, such as community-led hubs in developing regions. In these contexts, the "shift in ownership" demanded by mainstream literature becomes an unfunded mandate; local organizations are forced to absorb maintenance and data costs they cannot afford, transforming a potentially empowering tool into a structural burden. Furthermore, the emphasis on local adaptation often ignores rigid digital divides. Without explicit framework adaptations designed for low-bandwidth or offline capabilities, trying to scale high-functioning EdTech models in peripheral environments inevitably leads to "implementation fracture," where the tool is abandoned not due to lack of staff willingness or mission alignment, but due to absolute infrastructure incompatibility. Ultimately, the most sustainable and scalable EdTech initiatives in informal learning are those that are co-designed with the community and informed by iterative evaluation. Deep collaboration with learners, families, and local leaders fosters a sense of ownership, making the community a key partner in the initiative's survival and adaptation (Ito et al., 2013). This process of local adaptation, or reinvention, is a key driver for successful spread, as it ensures the innovation resonates with new contexts (Rogers, 2003). Grounding this entire cycle in a research-informed approach of continuous data collection and iterative design allows organizations to demonstrate value, refine their methods, and build a compelling evidence base that supports both scaling to new sites and securing the ongoing investment required for sustainability (Niederhauser et al., 2018; Penuel et al., 2011).

METHODOLOGY

Research Process

Saunders et al. (2019) introduced the Research Onion framework, which is chosen for its methodical and cohesive approach to research design. It leads the researchers through a logical progression of choices from general philosophical presumptions to particular data collection methods. By requiring that each decision be logically consistent with the one before it, its tiered structure, which progresses from research philosophy to approach, methodological choice, strategy, time horizon, and finally, techniques and procedures, ensures methodological rigour.

By peeling away the outer layers, the final choice of data collection techniques is justified, avoiding arbitrary decisions and instead producing a transparent, defendable research methodology where all components work together to successfully answer the research question. **Figure 1** below shows a research onion framework.

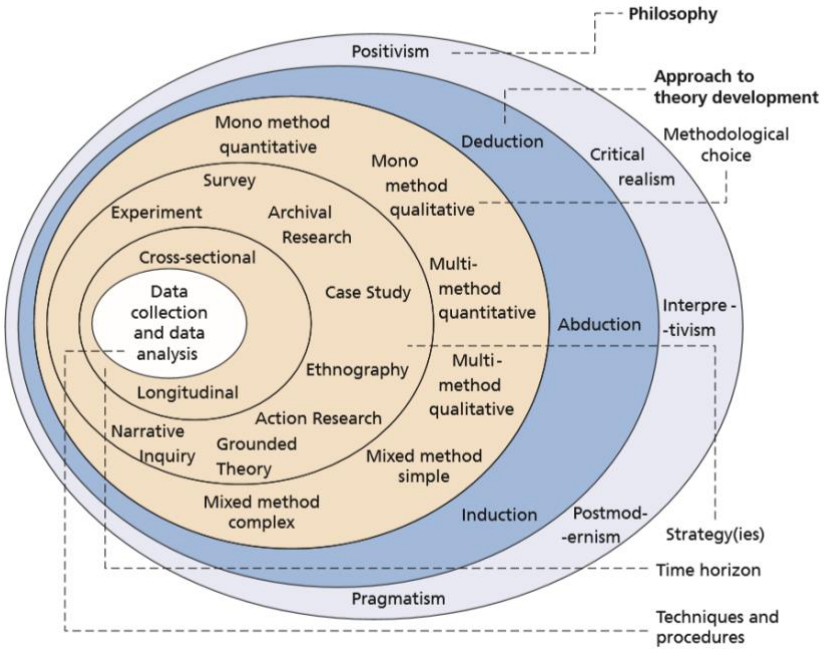

Figure 1. Research Onion Framework (Source: Saunders et al., 2019)

Research Philosophy

Research philosophy refers to a system of beliefs and assumptions about how knowledge is developed and understood (Saunders et al., 2019). Interpretivism, a key philosophical stance, emerged in early- and mid-twentieth-century Europe through the works of German, French, and occasionally English thinkers, drawing from hermeneutics, phenomenology, and symbolic interactionism (Crotty, 1998). It developed as a critique of positivism but takes a subjectivist perspective, emphasizing the socially constructed nature of knowledge through culture and language. Interpretivism views reality as complex, rich, and shaped by multiple meanings, interpretations, and experiences, as well as the dynamic interplay of processes and practices (Saunders et al., 2019). This perspective acknowledges that research is value-bound, with researchers being inseparable from what they study, making the process inherently subjective. Furthermore, interpretivists highlight the significance of language, culture, and history in shaping our understanding and experiences of social and organizational worlds (Crotty, 1998). To align with this philosophy, an inductive approach is often adopted to develop theories grounded in the specific context of the research.

Methodological Choice

Fundamentally anchored within an interpretive philosophy, this study adopts a mono-method thematic qualitative approach to systematically capture and analyze the meanings participants ascribe to their experiences within their natural settings (Denzin & Lincoln, 2018). Immersing the researcher in the context to establish trust and uncover deep, latent realities, this design utilizes a single, semi-structured data collection instrument to ensure a highly focused and detailed exploration. To translate these rich, subjective accounts into rigorous academic findings, the collected data is directly processed using a thematic analysis. This coupling maintains absolute ontological and epistemological consistency; rather than merely counting responses, thematic analysis allows the researcher to decode repeating patterns and latent themes across the text, moving past superficial descriptions to construct a conceptually robust, context-specific framework.

Time Horizon

A cross-sectional time horizon, often referred to as a "snapshot," is well-suited for the study "Using EdTech to Reach the Unreached: Innovative Approaches to Non-Formal Education in Zimbabwe," as it allows for the examination of this issue at a single point in time. This approach is particularly appropriate because it provides a comprehensive overview of how educational technologies are currently being utilized to address the challenges faced by marginalized and disadvantaged learners in non-formal education settings. By capturing data from a specific moment, the study can analyze the effectiveness, accessibility, and impact of these innovative approaches on learners and educators alike. Additionally, the cross-sectional design is practical for assessing the immediate state of EdTech adoption and its role in addressing educational inequalities, offering timely insights and recommendations for stakeholders in Zimbabwe's non-formal education system.

Research Instrument Design and Measures

The study employed qualitative research, and data were gathered from respondents using an open-ended questionnaire. Researchers opted for open-ended questionnaires because they gather qualitative data in text format. Researchers further adopted open-ended questionnaires because they facilitated a more in-depth exploration of respondents on the EdTech innovative approaches to non-formal education in Zimbabwe. The instrument was structured into two general sections: Section one investigated demographic data of respondents, and the second section examined questions on artificial intelligence and curriculum development. Research questions adopted generally addressed the research objectives of this study.

Sampling, Data Collection, and Ethics

Teachers in Zimbabwe's Government Schools were the targeted population, and researchers collected primary data online using Google Forms from 50 facilitators. The sample size was determined through data saturation were researchers stopped data collection when new themes were no longer emerging from respondents. Questionnaires were distributed online on the 9th of November 2025, and data were extracted on the 20th of November 2025. The questionnaire was distributed via teachers' WhatsApp groups targeting teachers in Mashonaland West since the researchers belong to this province. Ethical aspects were generally considered in the study process. Consequently, respondents were generally required to complete a consent form in writing prior to their involvement in the study. Researchers further abided by ethical standards by ensuring that participation was voluntary. Respondents were not coerced into participating and were further permitted to withdraw from the study at any time.

Data Analysis

Qualitative data were analysed using thematic analysis. After data collection researchers proceeded with data analysis, and the researchers familiarized themselves with the data. Researchers identified data that was relevant. Codes were then organized into potential themes. Themes were identified, and they were refined and confirmed.

Lastly, common themes were finalized and defined, clearly describing everything captured by the theme. Therefore, using thematic analysis, qualitative data were systematically organized and interpreted with the agenda of uncovering key themes that align with the study's objectives and research questions. Common themes emerging from the data were then reported on an objective-by-objective basis.

RESULTS

Demographics of Respondents

Gender of participants

Table 1 below indicate gender of respondents who participated in the study. Results in **Table 1** clearly show that more male educators participated in the research study than females. Males who participated in the study constituted 64%, while female participants constituted 36%. The findings from the study may indicate that more male educators dominate the education field than female educators.

Age of respondents

Results in **Table 2** clearly show that 10 respondents were aged between 25 and 30 years. A total of 15 respondents were aged between 31 and 35 years. While 8 respondents were aged between 36 and 40 years. **Table 2** below illustrates the age of educators who participated in the study.

Infrastructure and Economic Accessibility

From the findings, it is clear that the digital divide in Zimbabwe is in essence, an economic and infrastructural issue rather than one of technology and equipment. The findings that highlight high data costs as a "critical barrier" resonate with literature on digital inequality that asserts that affordability is the first gatekeeper to internet access in resource-constrained settings (Hilbert, 2011; van Dijk, 2020). As R10 asserts,

> *"The most effective first step is lowering data cost and designing apps that do not require a strong internet connection."*

This finding reinforces the importance of policy actions to address data as a public utility, yet it also suggests a shift in design thinking towards lightweight, low-bandwidth applications, a strategy that can help alleviate exclusion in cases where market-based pricing remains unaffordable. To address infrastructural poverty, innovative solutions must be developed beyond traditional notions of connectivity. The enthusiastic support for solar-powered community centers suggests an awareness of the interconnectedness of power and internet access, where R2 states approvingly:

> *"They solve the dual problem of power and internet access."*

This integrated approach is also consistent with the notion of "digital enclaves" (Graham, 2010), where shared and resilient infrastructure offers a stable "point of access" in an environment where electricity is unreliable

Table 1. Gender of participants (n=50)

	Male	Female	Total
Number of Participants	32	18	50
Total	32	18	50

Source: Research Data (2025)

Table 2. Ages of respondents (n=50)

Age	Number
25 – 30	10
31 – 35	15
36 – 40	8
41 – 45	10
46 and above	7

Source: Research Data (2025)

and mobile network access is expensive. The centers also reflect the values of appropriate technology and community-based digital inclusion, a strategy that researchers have argued is a more sustainable approach to digital inclusion than a focus on device distribution.

Institutional spaces such as schools are increasingly viewed as essential nodes in the social infrastructure necessary to bridge the digital divide. R8 advocates that

> *"Schools should have facilities where children can do their school work (to bypass home connectivity issues),"*

This, in essence, suggests that educational institutions are the anchors through which after-hours access is facilitated. This is reminiscent of the idea of "social infrastructure," as discussed by Klinenberg (2018), where public facilities are designed to promote public resilience through the provision of essential public services to the public. By having access to power, the internet, and workspaces within educational institutions, the inequality in the distribution of resources in households is effectively addressed. However, the infrastructure is not evenly distributed, and peripheral areas are likely to be left behind if public investment is not made.

Content Relevance and Pedagogical Adaptation

The findings of this section, therefore, highlight an overarching theme among respondents that was echoed throughout this study: a crucial determinant of the efficacy of educational technology (EdTech) in non-formal education (NFE) settings is its departure from generic, Western-oriented approaches to more localized approaches to pedagogy. Such a view is supported by an increasing body of literature that seeks to address issues of cultural relevance, linguistic diversity, and knowledge systems in EdTech transfer between the Global North and Global South, where often Western-oriented approaches to EdTech transfer have been criticized for being uninformed and uncritical (Unwin, 2017; Selwyn, 2021). R20's focus on "incorporating local languages and real-life examples" directly aligns with the notion of culturally responsive pedagogy, which suggests that learners learn more effectively when exposed to content that is relevant to their linguistic and cultural experiences (Gay, 2010). In a Zimbabwean context where multiple languages are spoken, failing to account for local languages would mean failing to account for some of the populations that NFE seeks to reach. By prioritizing content that is more localized, EdTech can be seen to transition from a tool of external imposition to one of empowerment. Beyond linguistic and cultural alignment, respondents stressed the importance of content that offers immediate economic utility, framing learning as a pathway to tangible livelihood improvement. R15 articulates this clearly:

> *"Focus on practical subjects that train skills... like textile design."*

The emphasis on vocationally related subjects such as textile design, agribusiness, or ICT communication resonates with competency-based and skills-based education, especially in a non-formal setting, where such education is often prized for its direct applicability to income generation (McGrath & Powell, 2016). This approach also resonates with the capability approach, which argues, following Sen (1999), that education can be a means to enhance individuals' substantive freedom and ability to act economically. For those in contexts where formal education may not necessarily open doors to employment, such a skills-based EdTech intervention can be seen to offer a quicker return on investment for those who bear the costs of data and time spent on learning. The emphasis on economic utility also speaks to a pragmatism born out of the high opportunity costs faced by these marginalized learners. The pedagogical adaptation, therefore, extends not just to the content itself, but also to the tools and mechanisms through which such learning can be made possible. WhatsApp and SMS/USSD were seen as the most accessible technologies, given their lower data costs, widespread use, and ability to function even on lower-end mobile phones. This preference aligns with the concept of "appropriate technology" (Chambers, 1983; Toyama, 2015), which advocates for tools that match the existing infrastructure, literacy levels, and economic constraints of users. While sophisticated

learning management systems may offer advanced features, they remain inaccessible to many if they require smartphones, high-speed internet, or digital literacy. Moreover, the utilization of popular communication channels will enable EdTech programs to attain near-universal coverage, thus circumventing barriers of device ownership or skill sets. This approach is further supported by literature on m-learning in Africa, which has shown across all studies that WhatsApp acts as an effective medium of learning, feedback, and community engagement (Olawale et al., 2025). Finally, the data indicate that contextualized, pragmatic EdTech is perceived as an enabler of improved quantitative educational outcomes. R40 observes that;

"EdTech provides a platform to improve local pass rates and upgrade the learning environment."

This means that technology adaptation is not an end unto itself, but rather a means to an end, one that improves both academic performance and the educational climate. This approach is consistent with the notion of "transformative technology integration" (Warschauer, 2003), which holds that technology's promise is fulfilled only to the extent that it is situated within a supportive pedagogical, institutional, and social context. With respect to NFE, the strategic use of localized content and practical curricula may help to legitimize NFE as a viable alternative form of educational engagement, especially for those institutions that often struggle with limited resources and a heterogeneous student population. However, researchers have also noted that if these factors are not carefully managed, even well-intentioned EdTech initiatives may actually exacerbate existing social inequalities (Hodgkinson-Williams & Arinto, 2017). The findings here suggest that respondents are acutely aware of this, prioritizing relevance and accessibility as foundational to any sustainable EdTech effort in Zimbabwe's non-formal education landscape.

Sustainability through Community Ownership

This data shows the critical weakness in EdTech strategies, as they often fail to survive the pilot stage because of over-reliance on external sources and lack of local ownership. R15 clearly states the problem of sustainability in EdTech strategies as follows:

"The primary measure of success is the project's ability to operate without foreign funding."

This statement echoes the arguments presented in the literature on technology for development (ICT4D), where researchers have often lamented the "project cycle" approach, where projects are designed to meet the interests and timelines of the donors rather than ensuring a smooth institutionalization (Unwin, 2017; Toyama, 2015). Projects that are primarily donor-funded may lack the financial and structural requirements to ensure that the project remains operational after the cessation of the funding. The need for "buy-in" at the local level is also a reflection of a broader understanding that technology can only be successful if there is ownership at the community level. However, respondents were keen to stress that investment in human capacity, i.e., training local community members to act as facilitators, has a greater bearing on success than does the technology itself. This resonates with the idea of "intermediaries" in digital inclusion, whereby local intermediaries act to link technological provision and use (Bailur & Masiero, 2012). This is because they have local knowledge, linguistic ability, and social networks, which outside implementers do not. R22 also points to the significance of building governance on existing social structures:

"Local leaders and elders should be responsible for setting and enforcing ethical standards."

This is supported by the literature on participatory development, which suggests that the alignment of technology programs with traditional governance mechanisms can have positive effects on issues related to accountability, cultural suitability, and engagement (Chambers, 1997; Klinenberg, 2018). When local leaders are invested in the success of the project, they are more likely to mobilize resources, mediate potential conflicts, and ensure that the project is responsive to changing needs.

Despite optimism about community-centered models, respondents offered a grounded assessment of the operational risks, citing "*Theft and overuse*" (R50) and "*Vandalism*" (R30) as primary concerns. Such risks, therefore, highlight the vulnerability of shared resources in a resource-constrained environment, whereby resources such as computers, solar, or even a tablet device can be stolen or, in other instances, wear out if not properly maintained. Studies by scholars on community technology centers have also acknowledged such risks, whereby such resources can deteriorate if proper ownership, maintenance, and security measures are not put in place (Sey & Ortoleva, 2014). However, such risks, as also acknowledged by such studies, can be averted if proper community governance structures are put in place from the outset. The emphasis on trusting ethical standards to local leaders (R22) highlights a governance structure whereby such resources can be owned collectively, hence reducing the chances of such resources being misused, while serving their purpose in education. Therefore, such risks and findings highlight that the sustainability of EdTech in non-formal education does not necessarily depend on technological advancement, but rather on developing local ownership, independence, and culturally-based accountability structures.

Inclusivity and Ethical Governance

The data indicate a foundational need for equity, which is based on the concept of inclusion, particularly in relation to the inclusion of marginalized groups, including persons with disabilities, as well as the ethical protection of personal data. In the data, the respondents clearly challenged the stigma of the concept, which posits, among other things, that "disability means inability." This is in line with the critical approach to the concept of disability, which posits that the inability lies not in the person but in the environment in which they are located, which has failed to provide the appropriate technology to facilitate movement (Ellis & Goggin, 2015; Goggin & Newell, 2002). R35 clearly posits:

> *"Disability is not inability... Projects should use feedback mechanisms that are accessible to all learners."*

This statement highlights the need for universal design in EdTech interventions, where accessibility is not an afterthought but an integral part of the design. The respondent, by advocating for feedback mechanisms that are accessible, is highlighting the need for full participation across the entire learning cycle, including evaluation and governance.

One interesting dichotomy arises when considering the most appropriate means for achieving accessibility, with some respondents supporting the use of specialized applications, while others suggest that native features such as screen readers and voice-to-text tools should be leveraged. This dichotomy mirrors discussions in the broader field of accessible technology, weighing the benefits and limitations of using specialized tools compared to more ubiquitous options, with native features benefiting from updates and widespread testing, and users being more accustomed to them, compared to specialized tools, which may lack development support and present compatibility problems (Lazar et al., 2021; W3C, 2018). This preference for native features also mirrors the principles of universal design for learning, which highlights the importance of flexibility and providing multiple means of engagement, representation, and action (CAST, 2018). By adopting widely available accessibility features, EdTech initiatives can reduce the risk of creating fragmented, tool-dependent ecosystems while ensuring that learners with disabilities are not excluded due to the failure to procure or maintain specialized software.

The issues of data protection, as well as the perpetuation of harmful stereotypes, underscore the ethical considerations in the implementation of EdTech. Moreover, the call to ensure governance under the auspices of the "Ministry of IT" underscores the need for regulatory control in the standardization of data protection mechanisms, which is in line with the emerging literature on data justice, which posits the need to protect the data of marginalized groups from exploitation (Dencik & Cable, 2017; Taylor, 2017). The explicit warning to "ensure content does not reinforce harmful stereotypes" underscores the threat of the perpetuation of social

hierarchies in the creation of digital content, which may otherwise aim to challenge these social orders. In this regard, R10 redefines inclusion in the following ways:

> *"What is meaningful participation? Community members help choose the topics and skills to be taught."*

This approach emphasizes meaningful participation as a matter primarily concerned with decision-making power, rather than simple access. The cumulative effect of these studies suggests a system that balances formal regulation with participatory power, one that ensures technology is a tool for empowerment rather than surveillance, and inclusion is defined by power rather than access to the educational agenda.

DISCUSSION

The empirical findings fundamentally challenge the technocentric assumption that physical device access constitutes the primary barrier to educational technology (EdTech) adoption. When participants characterize exorbitant data costs as a critical barrier (R10), they shift academic attention from hardware availability to the rigid economic macrostructures dictating actual usability. This reframing demonstrates that marginalized learners are actively priced out of connectivity markets by systemic market failures rather than technological deficiency. By positioning data affordability as the true determinant of inclusion, the data explicitly aligns with Paulo Freire's Critical Pedagogy theory, the foundational lens of this study. Within a Freirean framework, access without the structural power to economically sustain it functions as a modern form of paternalism. Stommel (2014) contends that when technology distribution ignores the material realities of marginalized groups, it reinscribes existing class divisions rather than serving as an instrument of equity. By unmasking data costs as an exclusionary capitalist barrier, participants reject Freire's banking concept of education, which treats technology as a neutral container used to deposit standardized information into passive recipients. Instead, implementing targeted data subsidies and low-bandwidth designs serves as a primary, liberating intervention.

This economic interpretation gains empirical grounding through participants' advocacy for decentralized, solar-powered community hubs (R2, R8). While state strategies routinely isolate energy and connectivity into bureaucratic silos, participants articulate a systemic paradigm: sustainable EdTech requires simultaneous solutions fusing renewable energy, data affordability, and shared physical infrastructure. This participant-driven concept of appropriate infrastructure prioritizes resilience and collective feasibility over state-of-the-art sophistication, standing in productive tension with Western literature favoring individualized device ownership. Instead, it validates Toyama's (2015) assertion that technology merely amplifies underlying human and institutional capabilities, representing a localized expression of Freirean praxis action directed at transforming oppressive material conditions. Simultaneously, the findings reveal that localizing content is an absolute pedagogic imperative for learner retention. Demanding "local languages and real-life examples" (R20) reflects a problem-posing education that originates within the student's immediate socio-historical reality. This reality drives the overwhelming preference for low-tier communication channels like WhatsApp, SMS, and USSD over sophisticated, data-intensive platforms. Practically, these lightweight applications tolerate volatile connectivity; theoretically, their dominance proves that contextual appropriateness trumps innovation. As Williamson et al. (2020) note, marginalized communities routinely reject surveillance-heavy institutional platforms in favor of agile, low-bandwidth tools. This selectivity reframes digital inclusion from passive presence to explicit decision-making authority over the educational agenda (R10), directly dismantling the Eurocentric assumption that standardized digital curricula inherently signify superior quality.

The most sobering dimension of the data concerns the structural vulnerability of donor-dependent models. Participants invert conventional evaluation frameworks by defining success strictly through an initiative's "ability to operate without foreign funding" (R15), reflecting historical exhaustion with cyclical "pilot-itis" where projects collapse post-grant cycle. To counter this, participants reject parallel institutions, advocating instead

for leveraging traditional leadership (R22) as the primary social accountability mechanism. While explicit anxieties regarding "theft and vandalism" (R30, R50) ground these narratives in material risk, participants frame these not as barriers to community ownership, but as governance challenges best solved through endogenous social capital (Ostrom, 1990). Ultimately, these findings advance an emancipatory reconceptualization of digital inclusion: meaningful participation is not simple access, but power over educational agendas. Structuring curricula around community choice (R10) allows learners to function as active subjects of their own historical transformations. This critical redefinition of equity extends to universal design; the participant preference for native, operating-system-level accessibility tools (R35) reflects a pragmatic distrust of fragmented, tool-dependent software ecosystems that break down without external maintenance (Rose & Meyer, 2002). Finally, calls for regulation under a "Ministry of IT" to prevent content that "reinforces harmful stereotypes" position ethical governance as the ultimate boundary of inclusion. Giroux (2020) emphasizes that digital capitalism frequently deploys technology as an ideological machinery that disables critical thought. Without ethical governance frameworks protecting local knowledge systems, EdTech risks automating exclusion. Rigorous regulation is therefore positioned not as a bureaucratic constraint, but as the mandatory condition required for technology to operate as a genuinely liberatory instrument.

IMPLICATIONS

Theoretical Implications

The results obtained in this study contribute several important theoretical implications, especially in developing Paulo Freire's Critical Pedagogy in relation to educational technology in non-formal education in the Global South. Firstly, this study empirically affirms Paulo Freire's Critical Pedagogy critique of the "banking model" of education, in that, when EdTech interventions fail to localize their content, they, in fact, reinforce the existing power relationships that Critical Pedagogy aims to subvert. The respondents' emphasis on "incorporating local languages and real-life examples" (R20) and "textile design" (R15) operationalizes Paulo Freire's notion that education should begin from the learners' "thematic universe." Hence, this study contributes to theory development in that EdTech, if left unproblematic, becomes a "digital banking model" where technology becomes an extension of the existing banking model, further subjugating already marginalized learners. Secondly, this study extends Paulo Freire's concept of conscientização, in that community ownership and local governance become critical factors in developing critical consciousness. The notion that "local leaders and elders should be responsible for setting and enforcing ethical standards" (R22) and that success can be assessed through a project's "ability to operate without foreign funding" (R15) implies a notion of emancipation in EdTech-enabled NFE, whereby there is a reclaiming of a sense of decision-making power. This, in turn, resituates praxis or the cycle of reflection and action, not merely as a cognitive process, but one that is socially governed and materialized. Thirdly, this research adds to the broader theoretical discussion around digital literacy and informal learning by, through the voice of respondents, illustrating how the relationship between technology and empowerment is mediated through social structure and ethical governance, a notion that mirrors and extends the mediating pathways model proposed by Zakir et al. (2025), whereby digital competence, self-efficacy, and informal learning are also socially mediated and contingent on community facilitation and trust-based community structures. Finally, the findings challenge prevailing EdTech theories that privilege technological sophistication over social embeddedness, arguing instead for a theoretical synthesis that positions sustainable digital inclusion as fundamentally a matter of political economy, cultural relevance, and participatory governance, theorizing a "Freirean EdTech" that prioritizes dialogical, community-anchored, and emancipatory uses of technology.

Practical Implications

The findings have several implications for policymakers, practitioners, and EdTech developers working within Zimbabwe's non-formal education sector. Firstly, the findings underscore an urgent imperative for policymakers, particularly within Zimbabwe's Ministry of IT and Ministry of Education, to address internet connectivity and access to electricity as public goods rather than market commodities. One of the implications is for policymakers to regulate data costs, an action identified by R10 as "the most effective first step" and invest in solar-powered centers to address the "dual problem of power and internet access" (R2). These centers should be located within or adjacent to schools, leveraging existing social infrastructure as proposed by R8, to enable after-hours access for learners without home internet. Secondly, curriculum designers and EdTech developers must pivot decisively to address issues of localization. Localization involves developing content in local languages, providing real-life examples from Zimbabwean contexts, and prioritizing practical, skills-based subjects such as textile design, agribusiness, and ICT communication for their economic utility. The widespread preference for WhatsApp and SMS/USSD over sophisticated learning management systems indicates that interventions should adopt a "mobile-first, low-bandwidth" design philosophy that aligns with the technological realities of marginalized communities. Thirdly, sustainability planning needs to transition away from donor-dependent pilot approaches and instead focus on community-based governance systems. In this respect, it would be essential for EdTech advocates to invest in the training of community members to act as facilitators and empower traditional leaders to ensure effective ethical standards and resource management, thus promoting the "buy-in" concept for sustainability, which was seen as an essential requirement for sustainability. In this respect, dealing with issues of theft and vandalism, as indicated in R30 and R50, would be addressed through establishing ownership standards at the outset. Fourthly, issues of inclusivity would be addressed through embracing universal design principles. Rather than investing in developing applications for EdTech, it would be more effective for EdTech advocates to leverage existing accessibility features, such as screen readers and voice-to-text capabilities, to ensure that learners with disabilities are not disenfranchised. Last but not least, there is a need for governance systems to address data protection issues, ideally under regulatory authority, to protect marginalized learners from exploitation. In this respect, it is possible to propose an effective model for EdTech rollouts.

Limitations

It is important to point out that this study has a few limitations, such as the fact that the study was conducted among educators in Mashonaland West Province, and even though saturation was reached with 50 participants, the study might not fully represent the views and experiences of the actual beneficiaries, i.e., the learners and facilitators from the other nine provinces in Zimbabwe. The study might also be seen to lack a critical perspective from the actual beneficiaries, i.e., the learners, and how they might perceive and experience EdTech, compared to how they are perceived by educators. Although this study has adopted a critical perspective from Critical Pedagogy, its findings might be seen to be contextual and applicable to Zimbabwe and its socio-economic and political conditions, and might not be generalized to other countries in Sub-Saharan Africa.

CONCLUSION

This study examined the innovative use of educational technology to reach the marginalized through non-formal education in Zimbabwe with a focus on Paulo Freire's Critical Pedagogy and an interpretive approach with a qualitative design and 50 educators. This study's findings indicate the digital divide is a crisis of economic and infrastructural exclusion, with high costs of data and lack of consistent power being critical barriers that require investment in solar-powered community centers and access points. Relevance of the pedagogy was found to be non-negotiable and required localization with indigenous languages and examples,

and a focus on skills with WhatsApp as a low-barrier access point. Sustainability of non-formal education with educational technology was found to depend on ownership with training of local educators and traditional leaders as ethical custodians and a shift from donor dependency to locally managed and financially sustainable models. Ethical governance and inclusion required the use of universal design principles to include the disabled and the development of robust data protection policies to avoid exploitation. This study's findings collectively contribute to the theorization of a 'Freirean EdTech' with a focus on dialogical engagement and governance rather than technological determinism. The study concludes that for EdTech to genuinely reach the unreached in Zimbabwe's non-formal education sector, interventions must be deliberately designed as sites of emancipation where technology serves not to transmit knowledge from above but to cultivate critical consciousness, economic agency, and collective self-determination from within communities themselves.

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REFERENCES

Acuil, A. D., & Grob-Zakhary, R. (2024, March 26). *South Sudan: Rebuilding a nation through the power of learning*. Global Partnership for Education. https://www.globalpartnership.org/blog/south-sudan-rebuilding-nation-through-power-learning

Afzal, A., & Hussain, N. (2020). Impact of community service learning on the social skills of students. *Journal of Education and Educational Development, 7*(1), 55-70. https://eric.ed.gov/?id=EJ1259929

Aliakbari, M., & Faraji, E. (2011). Basic principles of critical pedagogy. *2nd International Conference on Humanities, Historical and Social Sciences, 17*, 77–85. https://www.researchgate.net/publication/266224451_Basic_Principles_of_Critical_Pedagogy

Bailur, S., & Masiero, S. (2012). The complex position of the intermediary in telecenters and community multimedia centers. *Information Technologies & International Development, 8*(1), 27-42. https://www.researchgate.net/publication/277714916_The_Complex_Position_of_the_Intermediary_in_Telecenters_and_Community_Multimedia_Centers

Bozkurt, A., Jung, I., Xiao, J., Vladimirschi, V., Schuwer, R., Egorov, G., Lambert, S., Al-Freih, M., Pete, J., Olcott, Jr., D., Rodes, V., Aranciaga, I., Bali, M., Alvarez, A. J., Roberts, J., Pazurek, A., Raffaghelli, J. E., Panagiotou, N., de Coëtlogon, P., Shahadu, S., Brown, M., Asino, T. I., Tumwesige, J., Ramírez Reyes, T., Barrios Ipenza, E., Ossiannilsson, E., Bond, M., Belhamel, K., Irvine, V., Sharma, R. C., Adam, T., Janssen, B., Sklyarova, T., Olcott, N., Ambrosino, A., Lazou, C., Mocquet, B., Mano, M., & Paskevicius, M. (2020). A global outlook to the interruption of education due to COVID-19 pandemic: Navigating in a time of uncertainty and crisis. *Asian Journal of Distance Education, 15*(1), 1-126. https://doi.org/10.5281/zenodo.4636440

Buckler, A., Twiner, A., & Power, T. (2025). "I had to adjust my character so I was able to help": How community volunteers in rural Zimbabwe developed as educators in a context of crisis and school closures. *Journal of Educational Change, 26*(4), 631-655. https://doi.org/10.1007/s10833-025-09535-2

Cambridge University Press. (2017). *2017 ELT international catalogue*. Cambridge University Press. https://issuu.com/cambridgeupelt/docs/2017_international_catalogue_high_r

Cameron, L., Pon, C., D'Angelo, S., & Cooper, K. (2024). *Supporting children's access and retention in education in emergency, fragile and conflict-affected contexts: GPE KIX scoping study working paper*. https://www.gpekix.org/knowledge-repository/supporting-childrenseducation-emergency-contexts

CAST. (2018). Universal design for learning guidelines version 2.2. CAST. https://udlguidelines.cast.org

Chakera, S., Haffner, D., & Harrop, E. (2020). *Structured pedagogy: For real-time equitable improvements in learning outcomes*. UNICEF Eastern and Southern Africa Region. https://www.unicef.org/esa/media/7511/file/ESA-Structured-Pedagogy-2020.pdf

Chambers, R. (1983). *Rural development: Putting the last first*. Routledge. https://doi.org/10.4324/9781315835815

Chambers, R. (1997). *Whose reality counts? Putting the first last*. Intermediate Technology Publications. https://www.cabidigitallibrary.org/doi/full/10.5555/19971801093

Chidakwa, N., & Khanare, F. P. (2024). The Fourth Industrial Revolution: Overcoming digital divides in Zimbabwean rural learning ecologies. *Futurity Education*, *4*(2), 125-147. https://futurity-education.com/index.php/fed/article/view/269

Clarke, J., & Dede, C. (2009). Design for scalability: A case study of the River City curriculum. *Journal of Science Education and Technology, 18*(4), 353–365. https://doi.org/10.1007/s10956-009-9156-4

Coburn, C. E. (2003). Rethinking scale: Moving beyond numbers to deep and lasting change. *Educational Researcher, 32*(6), 3–12. https://doi.org/10.3102/0013189X032006003

Corbeil, J. R., & Corbeil, M. E. (2017). The EdTech Blog: Learning beyond the classroom through social spaces for informal learning. *Issues in Information Systems, 18*(4), 57–64. https://doi.org/10.48009/4_iis_2017_57-64

Crotty, M. (1998). *Foundations of social research: Meaning and perspective in the research process*. Routledge. https://doi.org/10.4324/9781003115700

Cunliffe, A.L. (2010). Retelling tales of the field: In search of organisational ethnography 20 years on. *Organizational Research Methods, 13*(2), 224–239. https://doi.org/10.1177/1094428109340041

Dencik, L., & Cable, J. (2017). Digital Citizenship and Surveillance| The Advent of Surveillance Realism: Public Opinion and Activist Responses to the Snowden Leaks. *International Journal of Communication, 11*, 763–781. http://ijoc.org/index.php/ijoc/article/view/5524

Denzin, N. K., & Lincoln, Y. S. (Eds.) (2018). *The SAGE handbook of qualitative research* (5th ed.). Sage Publications. https://www.sagepub.com/shop/buy-a-book/the-sage-handbook-of-qualitative-research-5-242504

Ellis, K., & Goggin, G. (2015). Disability, locative media, and complex ubiquity. In U. Ekman, J. D. Bolter, L. Diaz, M. Sondergaard, & M. Engberg (Eds.), *Ubiquitous computing, complexity and culture* (pp. 272-287), Routledge. https://doi.org/10.4324/9781315781129

Evans, D. K., Acosta, A. M., & Yuan, F. (2021, October 19). *Girls' education at scale. Center for Global Development*. https://www.cgdev.org/publication/girls-education-scale

Gay, G. (2010). *Culturally responsive teaching: Theory, research, and practice* (2nd ed.). Teachers College Press. https://eric.ed.gov/?id=ED581130

Giroux, H. A. (2020). *On critical pedagogy* (2nd ed.). Bloomsbury Publishing. https://www.torrossa.com/it/resources/an/5210445

Global Campaign for Education. (2025). *GCE EdTech Report*. https://campaignforeducation.org/images/downloads/f1/1825/edtechreportfinalisedweb.pdf

Goggin, G., & Newell, C. (2002). *Digital disability: The social construction of disability in new media*. Rowman & Littlefield. https://doi.org/10.5771/9780742577015

Gonen, S. I. K., & Kizilay, Y. (2023). Taking the picture of informal digital learning of English (IDLE) in a higher education Turkish context. *Turkish Online Journal of Distance Education, 24*(3), 178-191. https://eric.ed.gov/?id=EJ1397171

Graham, S. (2010). *Disrupted cities: When infrastructure fails*. Routledge. https://doi.org/10.4324/9780203894484

Greenfield, P. M. (2009). Technology and informal education: What is taught, what is learned. *Science, 323*(5910), 69–71. https://doi.org/10.1126/science.1167190

Hafner, C. A. (2019). Digital literacies for English language learners. In X. Gao (Ed.), *Second handbook of English language teaching* (pp. 899-918). Springer. https://doi.org/10.1007/978-3-030-02899-2_46

Harris, D. B., & Roter, D. L. (2024). Profound love and dialogue: Paulo Freire and liberation education. *HLRP: Health Literacy Research and Practice, 8*(3), e118-120. https://doi.org/10.3928/24748307-20240613-02

Hilbert, M. (2011). Digital gender divide or technologically empowered women in developing countries? A typical case of lies, damned lies, and statistics. *Women's Studies International Forum, 34*(6), 479-489. https://doi.org/10.1016/j.wsif.2011.07.001

Hodgkinson-Williams, C., & Arinto, P. B. (Eds.). (2017). *Adoption and impact of OER in the Global South*: *African minds*. International Development Research Centre & Research on Open Educational Resources. https://doi.org/10.5281/zenodo.1005330

Ito, M., Gutiérrez, K., Livingstone, S., Penuel, B., Rhodes, J., Salen, K., Schor, J., Sefton-Green, J., & Watkins, S. C. (2013). *Connected learning: An agenda for research and design*. Digital Media and Learning Research Hub. http://eprints.lse.ac.uk/48114/

Jerasa, S., & Boffone, T. (2021). BookTok 101: TikTok, digital literacies, and out-of-school reading practices. *Journal of Adolescent & Adult Literacy, 65*(3), 219-226. https://doi.org/10.1002/jaal.1199

Kam, M., Agarwal, A., Kumar, A., Lal, S., Mathur, A., Tewari, A., & Canny, J. (2008). Designing e-learning games for rural children in India: a format for balancing learning with fun. *Proceedings of the 7th ACM conference on Designing interactive systems, 7*, 58-67. https://doi.org/10.1145/1394445.1394452

Keesing-Styles, L. (2003). The relationship between critical pedagogy and assessment in teacher education. *Radical Pedagogy, 5*(1), 1-23. https://radicalpedagogy.icaap.org/content/issue5_1/03_keesing-styles.html

Klinenberg, E. (2018). *Palaces for the people: How social infrastructure can help fight inequality, polarization, and the decline of civic life*. Crown. https://assetbucketpublic.7169.prh.com/9781/524/761/172/sales-assets/9781524761172_9781524761172_EducatorGuide_1.pdf

Koirala, S. (2025). Systemic reforms for equitable education in Nepal: Bridging policy promises and persistent inequalities. *Nepal Public Policy Review, 5*(1), 173-204. https://doi.org/10.59552/nppr.v5i1.93

Korucu, A. T., & Alkan, A. (2011). Differences between m-learning (mobile learning) and e-learning, basic terminology and usage of m-learning in education. *Procedia - Social and Behavioral Sciences, 15*, 1925–1930. https://doi.org/10.1016/j.sbspro.2011.04.029

Krönke, M. (2020, June). *Africa's digital divide and the promise of e-learning* (Policy Paper No. 66). Afrobarometer. https://www.afrobarometer.org/wp-content/uploads/2022/02/pp66-africas_digital_divide_and_the_promise_of_e-learning-afrobarometer_policy_paper-14june20.pdf

Lai, C., Zhu, W., & Gong, G. (2014). Understanding the quality of out-of-class English learning. TESOL Quarterly, 49(2), 278-308. https://doi.org/10.1002/tesq.171

Lazar, J., & Goldstein, A., Taylor, A. (2021). *Ensuring digital accessibility through process and policy*. Morgan Kaufmann. https://dl.acm.org/doi/abs/10.5555/2815674

Lee, J. S. (2019). Informal digital learning of English and second language vocabulary outcomes: Can quantity conquer quality? *British Journal of Educational Technology, 50*(2), 767-778. https://doi.org/10.1111/bjet.12599

Lee, J. S. (2020). The role of informal digital learning of English and a high-stakes English test on perceptions of English as an international language. *Australasian Journal of Educational Technology, 36*(2), 155-168. https://doi.org/10.14742/ajet.5319

Lee, J. S., & Drajati, N. A. (2019). Affective variables and informal digital learning of English: Keys to willingness to communicate in a second language. *Australasian Journal of Educational Technology, 35*(5), 168-182. https://doi.org/10.14742/ajet.5177

Lee, J. S., & Dressman, M. (2018). When IDLE hands make an English workshop: Informal digital learning of English and language proficiency. *TESOL Quarterly, 52*(2), 435-445. https://doi.org/10.1002/tesq.422

Li, Y. (2025). Exploring digital literacy in informal digital learning of English among Chinese undergraduate students. *Higher Education Studies, 15*(3), 293-302. https://doi.org/10.5539/hes.v15n3p293

Lunga, P. (2024). Parent-teacher partnerships to enhance education for sustainable development: Early childhood development education learning centres in Zimbabwe. *Journal of Education*, *95*, 91-111. https://doi.org/10.17159/2520-9868/i95a05

Lysenko, L., Abrami, P. C., & Wade, C. A. (2022). Sustainability and scalability of digital tools for learning: ABRACADABRA in Kenya. *Canadian Journal of Learning and Technology, 48*(1), 1-29. https://eric.ed.gov/?id=EJ1362758

Maketo, L. (2018). Mobile learning Zimbabwe-lecturers' perceptions. *International Association for the Development of the Information Society, 2018*, 230-234. https://eric.ed.gov/?id=ED590396

Mangwaya, E., & Ngara, R. (2026). Harnessing artificial intelligence to foster critical thinking in Zimbabwean tertiary education. *International Journal of Research and Innovation in Social Science, 10*(2), 2958-2964. https://doi.org/10.47772/IJRISS.2026.10200219

McGrath, S., & Powell, L. (2016). Skills for sustainable development: Transforming vocational education and training beyond 2015. *International Journal of Educational Development*, 50, 12–19. https://doi.org/10.1016/j.ijedudev.2016.05.006

Mendoza, M., & Heymann, J. (2022). Implementation of inclusive education: A systematic review of Studies of Inclusive Education Interventions in Low- and Lower-Middle-Income Countries. *International Journal of Disability, Development and Education, 71*(3), 299–316. https://doi.org/10.1080/1034912X.2022.2095359

Meyers, E. M., Erickson, I., & Small, R. V. (2013). Digital literacy and informal learning environments: An introduction. Learning, *Media and Technology, 38*(4), 355–367. https://doi.org/10.1080/17439884.2013.783597

Mweha, M. (2025). *Digital learning innovations in Zimbabwe: A desk review of technological tools, pedagogical strategies, and accessibility challenges in the context of Education 5.0*. *International Journal of Research and Innovation in Social Science, 9*(07), 6280–6311. https://doi.org/10.47772/IJRISS.2025.907000501

Namibia Statistics Agency. (2016). Namibia Inter-Censal Demographic Survey Report. https://nsa.org.na/document/2016-namibia-intercensal-demographic-survey-nids/

Nchaga, A. M. (2025). Exploring community-based learning: Opportunities and challenges. *Research Output Journal of Arts and Management, 4*(1), 46-42. https://doi.org/10.59298/ROJAM/2025/414652

Ngara, R., & Ngara, M. M. (2024). Innovation for Social Transformation: E-Marking Challenges Faced by Students. A Case Study of Zimbabwe Open University. *European Journal of Contemporary Education & E-Learning*, *2*(3), 107–116. https://doi.org/10.59324/ejceel.2024.2(3).09

Niederhauser, D. S., Howard, S. K., Voogt, J., Agyei, D. D., Laferriere, T., Tondeur, J., & Cox, M. J. (2018). Sustainability and scalability in educational technology initiatives: Research-informed practice. *Technology, Knowledge and Learning, 23*(4), 507–523. https://doi.org/10.1007/s10758-018-9382-z

Olawale, B. E., Omodan, B. I., & Saddiq, K. (2025,). X-raying the enablers and barriers of e-learning in higher education institutions: A systematic review. *Frontiers in Education, 10*, Article 1526076. https://doi.org/10.3389/feduc.2025.1526076

O'Malley, C., Vavoula, G., Glew, J. P., Taylor, J., Sharples, M., Lefrere, P., ... & Waycott, J. (2005). *Guidelines for learning/teaching/tutoring in a mobile environment*. MOBIlearn project deliverable. https://hal.science/hal-00696244/

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge University Press. https://doi.org/10.1017/CBO9780511807763

Owens, T. R., & Wang, C. (1996). Community-based learning: A foundation for meaningful educational reform. *Service Learning, General 37*. https://digitalcommons.unomaha.edu/slceslgen/37

Pasipamire, N., Chigwada, J., & Maturure, R. (2025). Exploring the use and impact of artificial intelligence in higher education in Africa. *Journal of Pedagogical Sociology and Psychology*, *7*(3), 108–131. https://doi.org/10.33902/jpsp.202532046

Penuel, W. R., Fishman, B. J., Cheng, B. H., & Sabelli, N. (2011). Organizing research and development at the intersection of learning, implementation, and design. *Educational Researcher, 40*(7), 331–337. https://doi.org/10.3102/0013189X11421826

Postal and Telecommunications Regulatory Authority of Zimbabwe [POTRAZ] (2022). *Abridged postal & telecommunications sector performance report: Fourth quarter 2022*. https://www.techzim.co.zw/wp-content/uploads/2023/04/Q4-2022-Abridged-Sector-Performance-report-pdf.pdf

Rao, D., Lee, C., Fdilat, Y., Bouziane, A., & Dressman, M. (2024). Across four nations: Comparing the discourses of adolescents' digital literacy. *Journal of Adolescent & Adult Literacy, 68*(2), 94-104. https://doi.org/10.1002/jaal.1338

Rezai, A., Soyoof, A., & Reynolds, B. L. (2024). Ecological factors affecting students' use of informal digital learning of English: EFL teachers' perceptions. *Teaching and Teacher Education, 145*, Article 104629. https://doi.org/10.1016/j.tate.2024.104629

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Simon and Schuster. https://books.google.com.tr/books/about/Diffusion_of_Innovations_5th_Edition.html?id=9U1K5LjUOwEC&redir_esc=y

Rose, D. H., & Meyer, A. (2002). *Teaching every student in the digital age: Universal design for learning*. Association for Supervision and Curriculum Development. https://eric.ed.gov/?id=ED466086

Salimi, F. (2025, April 10). *The World Bank and EdTech in Sub-Saharan Africa: Evolving priorities, persistent gaps*. NORRAG. https://www.norrageducation.org/the-world-bank-and-edtech-in-sub-saharan-africa-evolving-priorities-persistent-gaps/

Saunders, M. N. K., Lewis, P., & Thornhill, A. (2019). *Research methods for business students* (8th ed.). Pearson. https://www.researchgate.net/publication/240218229_Research_Methods_for_Business_Students

Schwier, R. A. (2010). Focusing educational technology research on informal learning environments. *Contemporary Educational Technology, 1*(1), 90–92. https://doi.org/10.30935/cedtech/5965

Selwyn, N. (2017). *Education and technology: Key issues and debates* (2nd ed.). Bloomsbury Academic. https://cir.nii.ac.jp/crid/1971993809727280011

Selwyn, N. (2021). *Education and technology: Key issues and debates* (3rd ed.). Bloomsbury. https://www.bloomsbury.com/uk/education-and-technology-9781350145566/

Sen, A. (1999). *Development as freedom*. Oxford University Press. https://global.oup.com/academic/product/development-as-freedom-9780198297581?lang=en&cc=no

Sey, A., & Ortoleva, P. (2014). All work and no play? Judging the uses of mobile phones in developing countries. *Information Technologies & International Development, 10*(3), 1–17. https://itidjournal.org/index.php/itid/article/view/1280/487.html

Snilstveit, B., Stevenson, J., Phillips, D., Vojtkova, M., Gallagher, E., Schmidt, T., Jobse, H. Geelen, M., Pastorello, M. G., & Eyers, J. (2015). Interventions to improve learning outcomes and access to education in low- and middle-income countries: a systematic review. *3ie Systematic Review*. https://doi.org/10.23846/SR10029

Son, J.-B. (2015). *Digital literacy*. https://drjbson.com/ Retrieved from https://drjbson.com/projects/dl/

Stockwell, G. (2022). *Mobile-assisted language learning: Concepts, contexts and challenges*. Cambridge University Press. https://assets.cambridge.org/97811084/70728/frontmatter/9781108470728_frontmatter.pdf

Stommel, J. (2014, November 17). *Critical digital pedagogy: A definition*. Hybrid Pedagogy. https://hybridpedagogy.org/critical-digital-pedagogy-definition/

Tarisayi, K. S., & Manhibi, R. (2025). Revolutionizing education in Zimbabwe: Stakeholder perspectives on strategic AI integration. *Journal of Learning and Teaching in the Digital Age*, 10(1), 87–93. https://doi.org/10.53850/joltida.1493508

Taylor, D. L., Yeung, M., & Bashet, A. Z. (2021). Personalized and adaptive learning. In J. Ryoo & K. Winkelmann (Eds.), *Innovative learning environments in STEM higher education* (pp. 17–26). SpringerBriefs in Statistics. https://doi.org/10.1007/978-3-030-58948-6_2

Taylor, L. (2017). What is data justice? The case for connecting digital rights and freedoms globally. *Big Data & Society, 4*(2), 1–14. https://doi.org/10.1177/2053951717736335

Thompson, P. S. (2018). *Leave no one behind in practice: Education*. Institute of Development Studies. https://www.scribd.com/document/718433730/Working-Aid-Education-FR

Tour, E. (2020). Teaching digital literacies in EAL/ESL classrooms: Practical strategies. *TESOL Journal, 11*(1), Article e00458. https://doi.org/10.1002/tesj.458

Toyama, K. (2015). *Geek heresy: Rescuing social change from the cult of technology*. PublicAffairs. https://archive.org/details/geekheresyrescui0000toya

UNESCO. (2006). *Literacy for life – Global monitoring report 2006*. UNESCO Publishing. https://www.cedefop.europa.eu/cs/news/literacy-life-global-monitoring-report-2006

UNESCO Institute for Statistics. (2018). *Global education monitoring report 2018: Learning to learn*. http://uis.unesco.org/

UNESCO. (2020). *Global education monitoring report: Inclusion and education – All means all*. UNESCO. https://doi.org/10.54676/JJNK6989

UNESCO. (2023). *Africa emerges as the hotbed for EdTech*. UNESCO Courier. https://courier.unesco.org/en/articles/africa-emerges-hotbed-edtech

UNICEF. (2021). *How are children progressing through school? An education pathway analysis*. https://data.unicef.org/wp-content/uploads/2021/09/Education-Pathway-analysis-report-2021.pdf

Unwin, T. (2017). *Reclaiming information and communication technologies for development*. Oxford University Press. https://doi.org/10.1093/oso/9780198795292.001.0001

van Dijk, J. (2020). *The digital divide*. Cambridge. https://www.wiley.com/en-sg/shop/cultural-studies-general/the-digital-divide-p-9781509534456

Vorobyeva, K. I., Belous, S., Savchenko, N. V., Smirnova, L. M., Nikitina, S. A., & Zhdanov, S. P. (2025). Personalized learning through AI: Pedagogical approaches and critical insights. *Contemporary Educational Technology, 17*(2), Article ep574. https://doi.org/10.30935/cedtech/16108

W3C. (2018). Web content accessibility guidelines (WCAG) 2.1. World Wide Web Consortium. https://www.w3.org/TR/2018/REC-WCAG21-20180605/

Warschauer, M. (2003). *Technology and social inclusion: Rethinking the digital divide*. MIT Press. https://doi.org/10.7551/mitpress/6699.001.0001

Williamson, B., Eynon, R., & Potter, J. (2020). Pandemic politics, pedagogies and practices: Digital technologies and distance education during the coronavirus emergency. *Learning, Media and Technology*, *45*(2), 107–114. https://doi.org/10.1080/17439884.2020.1761641

Zakir, S., Hoque, M. E., Susanto, P., Nisaa, V., Alam, M. K., Khatimah, H., & Mulyani, E. (2025). Digital literacy and academic performance: the mediating roles of digital informal learning, self-efficacy, and students' digital competence. *Frontiers in Education, 10*, Article 1590274. https://doi.org/10.3389/feduc.2025.1590274

Zhang, Y., & Liu, G. (2024). Revisiting informal digital learning of English (IDLE): A structural equation modeling approach in a university EFL context. *Computer Assisted Language Learning, 37*(7), 1904-1936. https://doi.org/10.1080/09588221.2022.2134424