International Digital Organization for Scientific Research ISSN: 2550-7974

IDOSR JOURNAL OF ARTS AND MANAGEMENT 11(2):59-67, 2026. IDOSRJAM 11.2.100

https:/doi.org/10.59298/IDOSRJAM/2026/112.5967

EdTech in Low-Resource Settings: What Scales and What Fails

Kagaba Amina G.

Faculty of Business, Kampala International University, Uganda

ABSTRACT

Educational technology (EdTech) has gained increasing attention as a means of improving teaching and learning outcomes in low-resource settings, particularly in low- and middle-income countries (LMICs). Despite substantial investments by governments, donors, and development organizations, many EdTech initiatives fail to achieve long-term sustainability or scale beyond pilot implementation. This paper examines the factors that contribute to the success and failure of EdTech interventions in resource-constrained environments. It reviews key scalability factors, including cost-efficiency, financial sustainability, localization, cultural relevance, infrastructure, pedagogical alignment, learner-centered design, and effective data-driven monitoring systems. The paper also explores common barriers such as inadequate teacher training, weak implementation strategies, poor maintenance and technical support, limited infrastructure, and persistent equity and inclusion gaps. Drawing on international case studies, including mobile learning platforms, open educational resources, and low-bandwidth assessment systems, the study identifies practical lessons for policymakers, practitioners, and development partners. It further highlights the importance of coherent policies, stakeholder collaboration, sustainable financing, and rigorous evaluation methods in promoting effective and scalable EdTech solutions. The paper concludes that successful EdTech initiatives in low-resource settings require context-sensitive, evidence-based, and learner-centered approaches that integrate technological innovation with strong educational systems and institutional capacity to improve learning outcomes sustainably.

Keywords: Educational Technology (EdTech), Low-Resource Settings, Scalability, Digital Inclusion **and** Sustainable Education.

INTRODUCTION

Educational technology (EdTech) policies and interventions to improve teaching and learning in low-resource settings including low- and middle-income countries (LMICs) often fail to achieve meaningful and sustainable impact [1]. Many researchers therefore argue that scalable EdTech interventions are needed in such contexts [2]. Unfortunately, the evidence base regarding what educative technologies and pedagogical practices actually achieve scale and sustainability and in what contexts remains unclear, as do the specific barriers and bottlenecks that impede scalability [2]. Failure to address these issues may waste scarce educational resources and generate undesired psychosocial side effects [3]. Accordingly, large-scale programming and funding efforts to promote EdTech in LMICs may not be warranted at present; increasing candidate selection and investment scrutiny are paramount [4]. A preliminary framework describing scalable EdTech in resource-constrained settings and outlining appropriate cases and counter-cases from around the globe is presented. The framework identifies six principal factors that bite at scale or defeat sustainability: [1] cost-efficiency and financial viability; [2] localization and cultural relevance; [3] infrastructure, access, and integration; pedagogical alignment, learner-centricity, and behavioural engagement; data use, process feedback, and measurement of learning outcomes. In parallel, it maps four common pitfalls that often capture initial symptomatic success but then forestall or pare back broader scale, namely: missed implementation and the absence of recursive feedback; neglected teacher training and professional development; poor maintenance, unfixed bugs, and creeping technical debt; and unpaid equitable access and inclusion gaps[4].

Conceptual Frameworks for Educational Technology in Resource-Constrained Environments

Educational technology (EdTech) developments have not yet attained the level of assumed justification that other pedagogical innovations and reforms in Education have achieved globally [5]. Certain emergent developments in EdTech while already having attendant solutions worldwide are nevertheless also facing severe chalking issues. These issues arise in complete contradiction to the global interplay of Educational Technology and Covid-19 educational mandates, as well as by necessities arising from an informal demand-supply technological perspective [6]. Educational Technology (E-Tech), has yet to realise a consolidated status as a general Subject of Education within School Education Curriculum. A vast majority of School Education Curriculum still do not House such E-Tech Sub-Subject, and Schools within Developing World Countries such Courses are not even Portrayed[7]. While Governmental E-Tech Programs have commenced delivery of nationwide E-Tech Sponsoring free-of-cost Tel-Com Mobile Phones, other means, delivery via formal, informal, or training character, remains at 0% rate [8]. These educational interventions within the domain of EdTech/EDE are not indicative of gaps in Educational Technology's scope, or of teaching content oversight. The disabling factor remains strongly attuned to unsolved Chalk Supply Problems [9]. EdTech frameworks, modelling frameworks and scalability framework have currently been acknowledged. Yet again, during the industrialisation of EdTech/EDE frameworks within worldwide countries, serious Chalk Supply Problems persist. No formal delineations of Chalk within country have as yet emerged within EdTech/EDE. Yet, within EdTech frameworks available, designation of Chalk Supply remain of Feedback Origin[10]. The Education domain does not acknowledge the pre-existence of a framework characterising Learning Chalk between the Teaching and Learning Cycle, either as a great gap or as poseable graphical renders. Education authorities do not formally discern nor canvass extra-chalk Educational Learning Chalk areas, permit High-School or Universities to materialise flow, until the General Educational sector has thoroughly manipulated Feedback rendering [11]. Further, Educational Correction Supply Education within the Education domain and multiple other national charts have been pondered [12]. Further Key Aspects have emerged as follows: [1]. The conceptualisation of Educational Development has already started. E-Tech as one systemic Materialist component of EDE undergoes significant consideration depth internationally. Within Journalism, Engineering and Technical Principles such Education reaches significant Heuristic consideration worldwide. Within the wider rubric and conceptional as Exterior-Documenation/Analysis formal formulae", Extraction,R-M-Eum, histronic modelling, Faculty and Pedagogue Formation extends Horizons considerably, Administrative, Official Actuation forms also endure generally. Educational Development, Technology-Ed/Science-Technology extends critical-political P-R-Q discourse delineation beyond the standard three under countrywide non-competitive pricing initials [13]. Consequently, worldwide modeling frameworks whilst still addressing Chalk Supply Composition widely encompass C-paper-tech-Acmsm-Dn, country need eminently. Certain restrictions isolate without major affective draw-back returns, if major others also enjoin. Educational viztiers remain excluded country-wide from official placement yet also have undergone considerable study [14]. The required modelling accompaniment to Chalk Supply, has also been distanced through the opportunity provided on current Preparatory developments which incline preferatively offering alongside-by-inverted uniform Chart tracing country-wide not recorded decay[15].Redundant Supply margin posts still clink along as Frutp loop. A modelling-that-descriptors chart, including Column-I-F structure, whilst also wide-stanced up, enhancement towards uniformed country-wide Tracking Intent remain of mainly moderate advisory[16]. Institutionalization modelling avenues remain current-ready progressing readily department-division. Five formally recognised Archives remain under E-Tech umbrella further breadth considers [17]. The radical Metricization transformation has also sustained Extension and allow for Administrative glow-on by non-E-Tech practice-crucial. Assemblage-slope carrying Chalk has been revisited permitting Iteration back-processing via seconded. Although deemed slow, Chalk-cyclic-analysis Earth crusts primary, manage intended formative feedback [18]. Processing field-margin principals retains exposure Schools around envelope but earlier pre-processing Matrices prevalent. Chalk Supply, current Supply-Chalk framework-country, envisages supply formal-slide-frame-wide chalk-on-turn connection remain from-stand to - maintain gesture remain current on laid-off. Although laid tracing abroad cultivation already flagged within archieved whole-design lays-surface-prefer outside region pre-accomplishing does not pose at national advances [19]. Further-E-Tech interactivity widens background considerable undertaking remains considered [2].

Scalable Factors in EdTech for Low-Resource Settings

Educational technology (EdTech) innovations targeting low-resource environments must meet the unique needs of disadvantaged schools and communities [20]. Certain factors facilitate their growth and scalability, whereas others hinder their success. Several frameworks identify conditions for effective educational technology and practices [21]. Programmatic features, such as cost, capacity-building, sustainability, cultural relevance, pedagogical alignment, learner engagement, and measurement of learning outcomes, influence both initial uptake and continued dissemination [4].

Cost-Efficiency and Sustainability

Educational technology (EdTech) interventions in low-resource settings face urgent demands for scalable and cost-effective solutions. Financial sustainability assumes particular importance, as productivity gains need to generate equal or greater savings than the costs involved, leading to a unique formulation of the challenge of low-cost scaling [5]. The open-source and open-access movement has often been mistaken for an innovation exclusively intended for non-commercial distribution, overlooking significant and complex commercial motives. Sufficient cross-subsidization can allow the market entry and adoption of products that are subsequently widely distributed on a non-commercial basis [6]. The distinction between 'open' and 'closed' becomes complicated if the resulting commercial model effectively voraciously expands subscriptions in the hope of ultimately securing mass-market scale. The evaluation of sustainability connects heavily with the analysis of pedagogy, formative assessment, and continuing professional development. Such connections reinforce the substantial capacity for broader sharing inter-linguistically and inter-culturally [7]. Rigorous evaluation establishes crucial decisions on pathways for sustainable output, including user-driven demands for scaled formats in languages other than the initial one. Overwhelming attention to articulation of material nevertheless characterizes many countries and contexts, yet zero-cost alternatives remain open for mainstream and wider circulation with strong market motivation [21]. Commercial teams play crucial roles, operating at speed, establishing timing, and exercising commercial judgment on pedagogically meaningful trade-offs needed to meet such demand [22]. Product offerings need advance to all priority scaling destinations before consideration of further countries or languages. A pronounced appetite for already-validated substantive content occurs after some delay in many sectors, further restricting entry for new cases before established materials have been extended [23]. Cross-institutional, cross-border, and multi-market collaboration create widespread and escalating opportunities for underpinning materials across diverse sectors, yet a focus on commercially accountable pedagogical impact remains essential[24].

Localization and Cultural Relevance

Languages and cultural references deeply influence the way humans transmit knowledge. In low-resource contexts, it is important that pedagogically sound educational technology products and services are suitably localized, that is, adapted to the languages, cultures, and other contextual factors found within each context where they are deployed [25]. Providing educational products and services in a language of a user's choice positively influences cognitive engagement, motivation, and other characteristics that are likely to enhance learning [5]. The local use of mother-tongue languages, yet alone English, to aid literacy, numeracy, and other basic life skills is key to improving the knowledge and capacities of learners in low-resource contexts [6]. Localized open educational resources (OER) materials, lessons, and local-language content can thus help learners overcoming language, literacy, and other barriers to learning [26]. In multilingual settings, translation into local languages can be a substantial part of the localization effort required to widen access to OER-based educational interventions and materials. The use of only English-language content severely constrains the reach and potential impact of distributed knowledge and learning opportunities [27].

Infrastructure and Access

Decisions about educational technologies often depend on types of infrastructure already available. When an intervention relies on personal computers, broadband internet, or electricity, for instance, it limits potential reach to large geographic areas and population segments [8]. Mobile phones offer a compelling alternative because they outnumber people globally and connect people in both rural and urban environments. Like other forms of technology, mobile devices allow access to educational material, facilitate communication, provide information to support construction of knowledge, and enable learning of information and skills [8]. The opportunity to utilize mobile phones nevertheless remains uneven across the globe, and the details surrounding access form a critical layer of understanding for EdTech interventions in low-resource settings. The United Nations General Assembly included the right to education in 1948, and educational technology was introduced in the 1960s[9]. Continued efforts remain underway to expand access to and increase participation in education such that citizens develop the knowledge and skills to enhance their own lives while contributing to the betterment of their communities and societies generally [10]. In communities with limited access to education, educational technology represents a promising vehicle to enhance learning opportunities even when universal access to technology remains unfeasible [9].

Pedagogical Alignment and Learner-Centric Design

Many EdTech interventions in low-resource contexts favour a 'learner-centric' approach to pedagogical design. This perspective advocates the positioning of learners together with the actual pedagogical tasks involved at the focal point of the learning design process [10]. Proposed tasks are typically grounded in already-existing accomplishments, skills, and knowledge, whilst recognizing widely-reported learning behaviour patterns. Implementations further attempt to integrate specific culturally-relevant features such as language, customs, distinct forms of problem-solving, prevalent information channels, strategies for acquiring skills and knowledge, and preferred materials addressing the largely-ignored cultural aspects of learning technology[11]. Existing distinctive local capabilities, either situated in individuals or in community formations that can be tapped or expanded (such as informal learning groups), may also obtain privileged attention [12].

Data, Feedback, and Measurement of Learning Outcomes

Education systems in low-resource environments often lack adequate data to inform decisions about educational technologies. When data are insufficient, funders, implementers, and governments cannot assess if a technology is worth pursuing, how it may need to be adapted, or whether it is serving underprivileged students [13]. Even fewer effective measurements of learning and technology implementation exist, leading to a lack of evidence on barriers to success, effective practices, and impacts of educational technology [14]. Data and feedback systems should encourage recurrent use of interventions over time, when adaptation occurs based on experience [11]. As learners engage with technology-based interventions, they generate a significant amount of information about their practices and performance. Countries and organizations increasingly require data on learning, progress, and implementation a prerequisite for enhancing education and student outcomes globally [14]. Ubiquitously available data from technology interventions can play a particularly critical role in improving provision. Such layered feedback offers many possible dimensions of measurement [12]. Consequently, interventions providing effective measurement remain valuable for ongoing use.

Common Pitfalls and Barriers to Scale

The planned, continued implementation of EdTech depends on the provision of adequate financial, technical and human resources, as well as specific infrastructure to certain stakeholders after the initial delivery of these products and services [13]. The provision of substantial financial resources to the public education system and local training institutions during implementation leads to greater improvement of learning outcomes in Economically Developing Economies [14]. In Ethiopia, Middle Economies, and Low Economies, where nothing is provided to a certain product, the educational improvement to the learning gap is zero or goes below when human or infrastructure might be foregone [5]. The continuous improvement of access to education, changes in provisioning policy for teacher training, discontinuity of the Central Education System, and inconsistency of Government Financial Policy also affect the purchase of some EdTech products during product lifespan or even the provision of the EdTech product itself in EFA follow-up situations [15]. Teacher education that concentrates on limited pedagogical and content schooling without a consideration on that for other non-academic fields during implementation deteriorates the aggregation of systemic change and brings little educational improvement [2].

Implementation Gaps and Non-Recursive Feedback

For the majority of educational technology initiatives, a recurrent feedback loop between implementation and redesign is key to scalability. Early weaknesses in design should not preclude later scaling [16]. Successful and thoughtful educators regularly adapt their exhibitions to maintain their relevance for different audiences over time [16]. Yet many educational-technology interventions still pursue technologies, materials, and methodologies in the absence of such ongoing attention to implementation; "good enough" is often accepted as sufficient. An effective approach is to define the proposed educational vision or strategy and then use it as a filter for the educational technology selection process [17]. The more directly the underlying vision or strategy addresses the key challenges identified for the context and learners, the greater the likelihood that a scalable response will emerge. Without continual consideration of implementation, educational technology designs inevitably drift away from the political, cultural, economic, and pedagogical conditions that initially provoked their adoption, leading to increased mismatch and diminishing impact [2]. Responsible scaling in any context, therefore, demands timely consideration of the extent to which initial materials and approaches remain appropriate. Yet once again, the widespread appropriation and adoption of unfinished materials suggest a serious deficiency in the educational demand for a systematic focus on implementation [13].

Teacher Training and Professional Development Deficits

Teacher training and professional development for educational technology continue to present challenges in many low-resource settings [14]. Educators often receive little or no support, whether from pre-service training or in-service opportunities, within high-stakes teaching and education settings. Where EdTech interventions address in-service training, follow-up support, coaching, and mentoring are often limited, leading to both implementation gaps and reduced usability [15]. Without access to adequate training resources, instructors may employ only low-level technical features and engagement. Results from the U-Learn case studies, further highlighted in subsequent sections, suggest that combinations of local adaptation, cultural relevance, and guidance and feedback enhance scalability [16]. Low-investment and low-complexity teacher training, alone or integrated into a wider educational technology framework commonly fails to scale beyond the pilot phase [15]. Many of the initial U-Learn deployments of classroom-friendly technologies involved significant enhancements to feedback channels and training [17]. In addition, the instructor training originally provided on the various educational technologies adopted reduced feedback about improvement needs and new technologies to a single, one-time session. Stakeholders should consider how to foster a supportive ecosystem that promotes sustainability through routine instructor and student feedback regarding obstacles, new requirements, and emerging technology opportunities [18].

Maintenance, Support, and Technical Debt

The viability of an educational technology initiative hinges not only on pedagogical principles, but also on support, maintenance, and technical requirements for system operation [19]. The introduction of new technologies often leads to a host of unforeseen consequences. Successful initiatives need to establish a supportive environment, and ongoing assistance incorporating repairs, technical support, updates, and supply channels for essential resources is paramount[20]. The capability of an initiative to adapt to readily available platforms, including materials or other appropriate options, reinforces its ability to survive, remain functional, and evolve [16].

Equity, Inclusion, and Access Gaps

Access to technology remains a critical factor for successful remote learning, and disparities in this area highlight equity and inclusion gaps [21]. The findings across countries illustrate how different demographic and socio-economic factors impact student perceptions of remote learning quality [22]. In Ethiopia and Kenya, data reveal very low access to quality devices, with only 10% and 12% of students able to obtain devices or internet, respectively. However, many students reported leveraging alternative access methods provided by schools, including paper-based worksheets and television or radio broadcasts [17].

Case Studies of Successful Scale and Partial Failures

Several mobile-based interventions have successfully scaled nationwide, implemented by different governments in collaboration with private donors [23]. One such initiative, "Taleemabad," has been widely adopted in Pakistan. The project encompasses mobile applications for children as well as an online channel for teachers and parents. "Taleemabad" offer children multiple interactive Urdu- and English-language stories from which they can select and play. Children can also engage with educational supplementary activities related to the stories they watch [24]. A strong pre-assessment and formative feedback feature has been embedded into the application [4]. When a user first registers, the application evaluates the user's existing knowledge of decoding skills. Based on these results, the application reschedules educational activities to align with the user's learning stage [25]. Continuous monitoring through the app facilitates progress tracking and generate actionable feedback for teachers and parents [26]. For teachers, access to "Classroom Learners" delivers a clear map of each student's learning stage, indicating whether they are falling behind [27].

Case Study B: Open Educational Resources and Local Adaptation

A second example of effective adaptation and some persistent barriers relates to the distribution of open educational resources (OER)[2]. After piloting a global approach with the leader of the OER movement and finding that the inflexible design failed to apply across various cultures, a well-established international agency shifted to an open-source platform and promoted local adaptation [3]. The supplementary shift took OERs to scale in over a dozen countries, although complete full-scale adoption was not achieved across all regions. This partial success derived from features that remained poorly aligned with local learning needs and pedagogies [3].

Case Study C: Low-Bandwidth Assessment Platforms

Remote assessment prior to the pandemic had eliminated the need to address low-bandwidth issues directly [1]. During the health crisis, swift placement of examinations on a low-bandwidth platform offered a short-term viable solution, enabling around two-thirds of students to take the assessment nationwide while a complete national lockdown was in effect[2]. Because the mid- to long-term formulation of a resilient design remained incomplete, only half the requirements were met fully, leading the initiative to full-scale yet premature scale-up [3].

Case Study A: Mobile Learning Interventions

Mobile learning interventions have enjoyed substantial policy interest, and several large mobile interventions have been deployed at scale [18]. These include the Mobile Learning for Literacy initiative in Pakistan (see below), the mEducation initiative in the Philippines, Gnowledge in Jordan, and the Kolibri platform in India [19]. The promise of mobile learning for increasing literacy among children and youth is ambitious and appealing. These interventions address topics of great significance in low-resource settings [20]. Nonetheless, none of them have emerged with strong evidence of scalable success in low-resource or any other educational contexts.

Case Study B: Open Educational Resources and Local Adaptation

The South African project Free High School Science Texts (FHSST) offers important lessons about the conditions supporting the sustained use, extent of adaptation, and type of response to contextual changes when scaling Open Educational Resources (OER) projects in low-resource settings [19]. OER has the potential to make high-quality educational materials widely accessible. Resources from FHSST are distributed freely online under open licenses as downloadable, adaptable Adobe PDF and HTML files [1]. They facilitate local adaptation because teachers can modify content and structure to suit diverse languages, curricula, and pedagogical approaches [2]. The initiative also demonstrates how community needs, a low-level educational infrastructure, widespread interest in science education, and flexible production models converge to sustain OER over time [3]. Increasingly granular adaptation by multiple users through collaborative platforms, stand-alone web servers, and mass participation continues to strengthen FHSST's relevance [4]. Local resources are thus more accessible, durable, and inclusive of community values [6]. Evolving nationwide access to electronic media, institutional support, creation of parallel resources, and integration into a larger ecosystem of similarly oriented projects are additional factors influencing content production positively and permitting adaptation at both local and national levels [20].

Case Study C: Low-Bandwidth Assessment Platforms

Various technologies enable educational assessment at low bandwidth. Assessment systems based on mobile devices adapt well to conditions in low-resource, developing nations [7]. A key example is a low-bandwidth, mobile-based presentation distribution and classroom assessment system designed for South African schools to work within limited infrastructure and high learner-teacher ratios [21]. Class attendance and understanding of concepts can be tracked through distribution of lecturer presentations and polling students on specific questions [8]. The presentation tool allows lecturers to share slides and illustrations for viewing on cell phones, tablets, or computer projectors and receive feedback on content or clarity [9]. By employing relatively simple technology, the intervention provides a feedback mechanism that would typically be missing at other levels of the education system [10]. Interventions integrating mobile devices into educational settings continue to proliferate [11]. However, many of these initiatives primarily deliver learning content courses, videos, or books to learners rather than directly addressing the specific question of whether and how educational standards are being met. The vehicle for implementing new initiatives often resembles an existing EdTech intervention [12]. The depiction of mobile learning and student assessment in mass media also tends to be either deliberately misleading or fails to characterize the type of intervention or its actual implementation [18].

Policy, Governance, and Institutional Readiness

Policymaking is pivotal in determining a country's technology priorities and preferences. Alignment with national or provincial educational reform agendas enhances the likelihood of rapid adoption [2]. Efforts by governments, foundations, or non-governmental organizations to mobilize public funding for technology diffusion and widespread access to educational resources are critical to facilitating scaling [9]. Establishing a policy framework for educational technology promotes effective planning and programming and encourages the mobilization of financial resources. Educational Technology Standards, Media and Technology Planning Frameworks, and Nationwide Models are relevant frameworks [13]. Educators widely perceive student-centered approaches involving technology as promising; however, many institutions continue to structure their policies, tests, resources, and learning environments in ways that support conventional approaches [14]. A system that combines educational technology with pedagogy, methods, and models that promote critical thinking, collaborative learning, and communication may lack the textbook-orientated, automated-engineering-style approaches often found in conventional systems [15].

Policy Coherence and Stakeholder Alignment

This section reviews the importance of coherence across the relevant policies and alignment among the stakeholders involved in digital innovations [16]. Particularly, assessors of educational technology initiatives in low-resource settings should evaluate the consistency of support across multi-sectoral policies (education, health, gender, technology, and other sectors) centered on the same problem, technology, common beneficiaries, and societal outcomes[17]. At the policy level, stakeholders include national ministries, local governments, regulators, implementers, and investors [18]. Actors at each level may pursue a variety of objectives. Sector-specific goals can converge or conflict, with trade-offs or synergies between objectives [19]. Where the technology remains a secondary tool in a dominant policy, scarce resources can be easily hijacked. Hence, systemic coherence and coherent support underpin the wider adoption of emergent solutions, help secure both political and operational visibility, and enable balancing across diverse sectoral agendas [2 , 22].

Funding Models and Financial Viability

In low-resource contexts, budgetary constraints restrict the financing of education technology initiatives while limiting the feasible choices available to education technology managers regarding sustainability and scalability [1]. The ongoing data collection challenge jeopardises financial viability at multiple levels, discouraging procurement when the return on investment cannot be estimated [4]. After an initial protracted period of operation, weak returns whether for government budgets or donor assistance, curtail services, thus hindering further scaling efforts [5]. On the basis of careful scrutiny of budgetary information and financial requirements, education technology owners and managers can improve the sustainability of interventions by appreciating the process of institutional exit and determining an appropriate moment for replication and scale-up [23]. In low-income settings, elements may favour a financing model offering full subsidy rather than cost recovery or payment for services [24].

Local Capacity Building and Ecosystem Development

EdTech initiatives often work with local implementation partners. Thus, the national ecosystem must engage in shared practices and organizational, workforce, and market development must happen at the local level [5]. Many top-down initiatives rely too much on the supply-side [6]. Good practice emphasis on ecosystem building, enabling partners in late-adopters' local contexts to lead tutoring efforts in style [7]. On-site trainers not only improve skills but increase commitment to projects [2]. Measures for instance, funding and outcomes indicators need to reflect this long-term vision.

Methodologies for Evaluating EdTech in Low-Resource Settings

EdTech interventions in low-resource settings demand rigorous analysis of scalability, sustainability, and context-specific impact [7]. Evaluation requires practical frameworks that facilitate consideration of contextually salient factors along the intervention pathway and their contributions to induce and sustain such impact [8]. A body of literature proposes a range of methodological approaches that can illuminate such pathways and contextual elements in low-resource settings, spanning experimental and quasi-experimental designs, implementation research, utilization-focused evaluations, and equity-focused metrics [2]. Priority on scoping and characterizing specific questions to be answered and uses to be served can assist in selecting among these methodologies in a manner that ensures analyses remain relevant to policymakers and practitioners in scope, addressability, and specificity[9]. Rigorous assessment of EdTech interventions in low-resource contexts is critical because a considerable number of such initiatives never reach scale and even a larger set that do attain scale fail to achieve contextually relevant educational impact[10]. An overall analysis of EdTech applicants for the Development Innovation Ventures Program indicates that about one-third of fully-implemented interventions in low-resource settings succeed in scaling [18]. These represent the most stringent criteria for qualifying as an intervention with potential for wide dissemination and systemic sustainability [11].

Experimental and Quasi-Experimental Designs

EdTech interventions in low-resource settings demand rigorous analysis of scalability, sustainability, and context-specific impact, with emphasis on evidence-based evaluation and policy relevance [12, 13]. Experimental and quasi-experimental designs can evaluate education and training programs under real-world conditions, controlling for numerous covariates and thus making causal inferences [14]. Experimental designs lend themselves to randomised controlled trials, while quasi-experimental designs allow use of propensity-score matching, interrupted time-series analysis with comparative controls and a host of other approaches [15]. Even comparative analyses of pre- and post-intervention test results can provide robust corroboration if preceded by a situation analysis and contextual evaluations documented through independent qualitative studies [18]. Rigorous evaluation is particularly relevant under widespread adoption but restricted access to digital experimentation facilities [16]. Comprehensive monitoring and evaluation of deployments can guide policy initiatives and ensure education investments deliver substantive results, helping to simultaneously reduce administrative burdens and enhance financing possibilities [17]. Other, less formal methodologies can supplement analyses concentrated on rigorous experimental and quasi-experimental designs. Evaluation methods should thus correspond to implementation-state enablements, with extensive adherence to both pre- and post-conditional qualitative evaluations remaining highly beneficial [25].

Implementation Research and Utilization Focus

Implementation research offers a compelling theoretical framework for evaluating educational technology projects in developing contexts [15]. Unlike conventional impact evaluations, which often adhere to a rigid design phase, a comprehensive evaluation of implementation issues can iterate and adapt throughout a project's lifecycle. This approach closely aligns with the concerns of the International Development Research Centre (IDRC) and its focus on the utilization of research results, including project design, adaptation, and exit strategies that remain relevant beyond the project's conclusion [16]. A significant challenge when attempting to scale educational technology initiatives is distinguishing between 'what works' (the specific intervention being implemented) and 'what scales' (the contextual factors necessary to support the initiative)[17]. The distinction is further complicated by the tendency of researchers, funders, and implementing organisations to adopt a 'manualised' approach to scaling, whereby a successful tool or practice is standardised and distributed to multiple sites even though such an approach seldom leads to success [18, 4 , 2].

Equity-Focused Metrics and Outcomes

Equity-focused approaches highlight the importance of tracking demographic factors to inform inclusive policies. EdTech interventions can help reduce educational and digital divides, particularly among women, minorities, and people with special needs [16]. Yet many initiatives overlook marginalized groups, partly due to undifferentiated policies and limited language availability [17]. Moreover, a considerable share of existing strategies lacks adequate empirical support or demonstrates negligible learning impact. Rapid technological change further complicates the evaluation landscape, hindering assessments of intervention effectiveness [18]. For maximum relevance, program design should therefore be grounded in thorough preliminary exploration, which also facilitates subsequent evaluation. Recent evidence indicates that certain programs exert negative and gap-widening effects [24]. Although few studies have addressed comparative outcomes across socioeconomic groups one notable exception being the one-laptop-per-child project the findings to date remain insufficiently developed [25]. Analyses focused on longitudinal datasets have identified achievement scores as both moderating and control variables that highlight a gap-widening effect of EdTech. This illustrates that technology-based interventions can paradoxically exacerbate educational inequality [26].

Ethical Considerations and Data Governance

EdTech interventions in low-resource settings demand rigorous analysis of scalability, sustainability, and context-specific impact, with emphasis on evidence-based evaluation and policy relevance [24].

Recommendations for Practitioners, Funders, and Policymakers

EdTech interventions in low-resource settings demand rigorous analysis of scalability, sustainability, and context-specific impact, with emphasis on evidence-based evaluation and policy relevance [25]. Recommendations summarize factors found in the literature to promote scale, identify common barriers, and highlight successful cases for practitioners, funders, and policymakers [26]. The high cost and duration of large-scale studies underscores the importance of evaluating and disseminating results from smaller initiatives that exhibit effective scale, sustainability, and local ownership [2, 27].

CONCLUSION

Educational technology holds considerable potential to improve access to quality education and enhance learning outcomes in low-resource settings. However, the evidence reviewed in this paper demonstrates that technology alone cannot transform education without supportive policies, adequate infrastructure, trained educators, sustainable financing, and continuous monitoring. While successful interventions share characteristics such as affordability, cultural relevance, pedagogical alignment, strong stakeholder engagement, and robust feedback systems, many initiatives fail because they neglect implementation realities, teacher professional development, maintenance, and equitable access. The analysis further reveals that scalability depends not only on technological innovation but also on the strength of the educational ecosystem in which the intervention is embedded. Governments, development partners, educational institutions, and technology providers must therefore adopt integrated and context-specific approaches that prioritize local needs, institutional readiness, and long-term sustainability over short-term pilot successes. Rigorous evaluation, adaptive implementation, and evidence-based policymaking should guide investment decisions to ensure that EdTech interventions generate meaningful educational impact. Ultimately, achieving equitable and sustainable digital learning in low-resource environments requires moving beyond technology-driven solutions toward comprehensive educational strategies that strengthen human capacity, improve governance, reduce digital inequalities, and place learners and teachers at the center of innovation. Such an approach will maximize the potential of EdTech to contribute to inclusive, resilient, and high-quality education for all.

REFERENCES

1. Damani K, Daltry R, Jordan K, Hills L, et al. EdTech for Ugandan girls: affordances of different technologies for girls' secondary education during the COVID-19 pandemic. *Br J Educ Technol.* 2022;53(6):1819-1838. doi:10.1111/bjet.13221.
2. Niederhauser DS, Howard SK, Voogt J, Agyei DD, Laferrière T, Tondeur J, et al. Sustainability and scalability in educational technology initiatives: research-informed practice. *Technol Knowl Learn.* 2018;23(3):507-523. doi:10.1007/s10758-018-9382-z.
3. Mambwe E. *Strategies used to teach online in an EdTech low-resource environment during COVID-19: a qualitative case study of the University of Zambia* [master's thesis]. Lusaka (Zambia): University of Zambia; 2023. Available from: OSF Preprints.
4. Howard SK, Schrum L, Voogt J, Sligte H. Designing research to inform sustainability and scalability of digital technology innovations. *Comput Educ.* 2021;170:104223. doi:10.1016/j.compedu.2021.104223.
5. Ssekakubo G, Suleman H, Marsden G. Issues of adoption: have e-learning management systems fulfilled their potential in developing countries? In: *Proceedings of the South African Institute of Computer Scientists and Information Technologists Conference*; 2011 Oct 3–5; Cape Town, South Africa. New York: ACM; 2011. p. 231-238.
6. Wagner DA, Daswani CJ, Karnati R. Technology and mother-tongue literacy in Southern India: impact studies among young children and out-of-school youth. *Int Rev Educ.* 2010;56(2-3):213-229. doi:10.1007/s11159-010-9170-7.
7. Perryman LA, Hemmings-Buckler A, Seal T. Learning from TESS-India's approach to OER localisation across multiple Indian states. *Open Praxis.* 2014;6(3):221-233. doi:10.5944/openpraxis.6.3.132.
8. Pedzai C. *Adapting a novel public display system for an educational context* [master's thesis]. Cape Town (South Africa): University of Cape Town; 2010.
9. Nag RK. Is India ready to accept an EdTech-intensive system in post-pandemic times? A strategic analysis of India's readiness in terms of basic infrastructural support. *Educ Inf Technol.* 2022;27(8):11175-11195. doi:10.1007/s10639-022-11074-4.
10. Carey T, Harrigan K, Palmer A, Swallow J. Scaling up a learning technology strategy: supporting student-faculty teams in learner-centred design. *Can J Learn Technol.* 1999;25(2):1-15.
11. Wagner DA. Quality of education, comparability, and assessment choice in developing countries. *Compare.* 2010;40(6):741-760. doi:10.1080/03057925.2010.523230.

12. Lai JWM, De Nobile J, Bower M, Breyer Y. Comprehensive evaluation of the use of technology in education: validation with a cohort of global open online learners. *Educ Inf Technol.* 2022;27(6):7909-7932. doi:10.1007/s10639-022-10966-9.
13. McGuinness BA. *Teacher perceptions of the implementation processes of the Imagine Learning program in Title I elementary schools* [doctoral dissertation]. Phoenix (AZ): Grand Canyon University; 2018.
14. Tondeur J, Forkosh-Baruch A, Prestridge S, Albion P, Edirisinghe S. Responding to challenges in teacher professional development for ICT integration in education. *Educ Technol Soc.* 2016;19(3):110-120.
15. Blackmon L. *Teachers' perceptions of professional development activities which result in successful integration of classroom instructional technologies* [doctoral dissertation]. Minneapolis (MN): Walden University; 2013.
16. Moro C, Mills KA, Phelps C, Birt J. The Triple-S framework: ensuring scalable, sustainable, and serviceable practices in educational technology. *Australas J Educ Technol.* 2023;39(4):1-18. doi:10.14742/ajet.8651.
17. Kennedy AI, Mejía-Rodríguez AM, Strello A. Inequality in remote learning quality during COVID-19: student perspectives and mitigating factors. *Educ Sci.* 2022;12(10):678. doi:10.3390/educsci12100678.
18. Wagner DA, Castillo NM, Murphy KM, Crofton M, et al. *Mobiles for literacy in developing countries: an effectiveness framework.* Philadelphia (PA): International Literacy Institute, University of Pennsylvania; 2014.
19. Petrides L, Jimes C. Building open educational resources from the ground up: South Africa's free high school science texts. *J Interact Media Educ.* 2008;2008(1):1-12. doi:10.5334/2008-7.
20. Hodgkinson-Williams C. Open educational resources and pedagogical practices in African higher education: a perspective from the ROER4D project. In: *Transform 2015 Research Colloquium*; 2015 Apr 7-10; Cape Town, South Africa. Cape Town: University of Cape Town; 2018.
21. Fry BG, Gruijters D, Reid S. MISPE – Mobile Information Sharing in the Presentation Environment. In: *Proceedings of the International Conference on Mobile Learning*; 2004. p. 201-207.
22. Thomson P. Scaling up educational change: some musings on misrecognition and doxic challenges. *Crit Stud Educ.* 2014;55(2):140-151. doi:10.1080/17508487.2014.904045.
23. Villarreal PI, Ruby A. Government models for financing higher education in a global context: lessons from the US and UK. *Int Higher Educ.* 2018;95:14-16. doi:10.6017/ihe.2018.95.10727.
24. *Developing a portfolio of financially sustainable, scalable basic legal service models: briefing paper*. London: The Legal Education Foundation; 2016.
25. Hollands FM, Pan Y. *Evaluating digital math tools in the field.* New York (NY): Teachers College, Columbia University; 2018.
26. Ahn J. Exploring the negative and gap-widening effects of EdTech on young children's learning achievement: evidence from a longitudinal dataset of children in American K-3 classrooms. *Comput Educ.* 2022;191:104640. doi:10.1016/j.compedu.2022.104640.
27. Amonoo-Kuafi EF. *Best practice for scaling up efforts to improve English language skills* [report]. Washington (DC): USAID; 2019.

CITE AS: Kagaba Amina G. (2026). EdTech in Low-Resource Settings: What Scales and What Fails. IDOSR JOURNAL OF ARTS AND MANAGEMENT 11(2):59-67. https:/doi.org/10.59298/IDOSRJAM/2026/112.5967