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LEARNING FROM COMPARABLE CONTEXTS: DIGITAL MEDIA INTEGRATION AND EDUCATIONAL EQUITY IN PAKISTAN'S SCHOOLS

Abdul Rehman Khan

Development Professional, Researcher, and Educationist – Former Pro Vice Chancellor – BUITEMS

arkhan.uw@gmail.com

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Corresponding Author: *
Abdul Rehman Khan

Abstract
This paper examines digital media integration in Pakistan's school education through comparative analysis of empirical research from Pakistan and international, particularly Global South contexts. While multimedia tools, AI-based platforms, and digital resources can enhance student engagement and academic achievement when embedded within coherent pedagogical frameworks (Ayub & Kiazai, 2021; Fazal, Bandeali, Shezad, & Gul, 2025). Persistent infrastructural gaps, inadequate teacher preparation, and absence of localized content substantially limit benefits for marginalized learners (Sahito, Khoso, & Alishba, 2025). Drawing on successful initiatives from around the globe alongside Pakistani evidence, this analysis demonstrates that effective digital integration requires moving beyond technology procurement toward sustained pedagogical transformation, multilingual content development, and equity-focused policy frameworks. The paper proposes context-sensitive recommendations prioritizing infrastructure investment targeting under-served areas, provincial content localization models informed by India's DIKSHA platform, government-NGO partnerships following Bangladesh's approach, and sustained teacher professional development to align digital transformation with Sustainable Development Goal 4.

INTRODUCTION

Pakistan's school education sector is currently faced with intersecting challenges, including low literacy outcomes, high dropout rates, pronounced gender and regional disparities, and chronic under-resourcing. These deficits now intersect with accelerating digital transformation, as children encounter smartphones and online content from early ages (Munawar, Ahmed, & Abbasi, 2020). This convergence raises critical questions about how media and digital technologies might improve educational quality and equity, and what barriers such integration entails.

Within Pakistan, experimental work in Quetta's public primary schools found multimedia-enhanced Pakistan Studies instruction, significantly improved test scores and motivation compared with traditional methods (Ayub & Kiazai, 2021). Survey research reports 81 percent of private school students perceive digital integration as enhancing learning and communication skills (Hussain, Baig, & Hussain, 2021). However, structural constraints undermine this promise. Digital divides moderate benefits of AI-based and social media resources, curtailing gains where infrastructure remains weak (Fazal et al., 2025). Case studies in Sindh reveal infrastructural inequity, low teacher readiness, and pronounced urban-rural gaps (Sahito et al., 2025). Children's widespread but unsupervised

media use, combined with absence of media literacy education, exposes them to risks while leaving opportunities underexploited (Munawar et al., 2020).

Successful digital integration initiatives across the world, particularly the Global South, offer instructive parallels for Pakistan's challenges. Kenya's Digital Literacy Programme distributed over 1.2 million devices to 99.6 percent of primary schools but achieved limited utilization due to infrastructure gaps, culturally irrelevant content, and inadequate teacher training (ITU, 2020; Notre Dame, 2024). Rwanda's competency-based curriculum reform integrated digital tools while prioritizing teacher capacity and community mobilization (UNSDG, 2024). South Africa's contextualized interventions in rural areas succeeded through mother-tongue content addressing large class sizes and limited resources (Norman, 2023).

Regional experiences from South Asia provide particularly relevant lessons given geographic, linguistic, and developmental proximities. India's DIKSHA platform demonstrates how federal systems can coordinate digital initiatives across linguistic diversity, serving 265 million students in twenty regional languages while maintaining state autonomy (Carnegie Endowment, 2023). Bangladesh transformed primary education by converting seventeen national textbooks into interactive multimedia content reaching 20 million students, including marginalized slum populations, through government-NGO partnerships that scaled successful pilots to national level (BRAC, 2016). These initiatives demonstrate that effective digital integration requires moving beyond technology procurement toward sustained pedagogical transformation, multilingual content development, and strategic partnerships.

This paper examines how media can enhance Pakistan's primary schooling while addressing three questions: (1) How can media improve cognitive, linguistic, and socio-emotional outcomes for primary students? (2) How do infrastructural, pedagogical, and socio-cultural constraints shape effectiveness and equity of media integration? (3) What policy directions are necessary to ensure media catalyze inclusive, high-quality education rather than amplify inequalities? By synthesizing Pakistani evidence with other global experiences, the paper proposes a context-sensitive framework for equitable media integration aligned with Pakistan's public sector structure, linguistic diversity, and development priorities.

Literature Review

Digital Integration in Pakistani Primary Schools

Research indicates multimedia tools can enhance engagement and learning when thoughtfully integrated. In Quetta, grade 5 Pakistan Studies classes using multimedia achieved significantly higher post-test scores, particularly for abstract geographical concepts (Ayub & Kiazai, 2021). The researchers argue multimedia functions as a cognitive scaffold supporting deeper conceptual understanding (Ayub & Kiazai, 2021, p. 58).

At secondary level, 81 percent of students in Pakistani private schools agreed digital integration enhanced learning, emphasizing communication skills, accessibility, and independent learning (Hussain et al., 2021). In South Pakistan, surveys of 500 teachers reported multimedia projectors improved teaching effectiveness, though barriers included technical limitations, insufficient training, and institutional resistance (Majeed & Ahmad, 2025).

AI, Social Media, and Informal Learning

AI-based and social media resources are emerging as educational mediators. Analysis of 339 teachers from Pakistani universities identified robust correlations between AI-based personalized learning and academic performance, particularly in rural contexts (Fazal et al., 2025). However, digital divides moderate these benefits, with infrastructural disparities constraining gains in disadvantaged settings (Fazal et al., 2025).

Teacher-focused research shows informal digital learning exerts strongest effects on functional skills, explaining nearly half the variance in competencies (Majeed & Ahmad, 2025). Internationally, German primary students using tablets in physical education adopted roles as "camera child" and "actor," supporting both

learning with media and learning about media (Greve et al., 2020, p. 610).

Media Literacy and Child Development

Children's media practices are shifting rapidly. Islamabad primary students possess easy device access and spend substantial time with media for information and entertainment (Munawar et al., 2020). Researchers argue sustainable empowerment requires integrating media literacy into formal schooling (Munawar et al., 2020). Parents support this approach despite lacking media literacy knowledge themselves (Munawar, Ahmed, & Naseer, 2022).

International research confirms primary media education contributes to both critical literacy and language skills. A Saudi study found media education enhanced English listening and speaking, particularly foundational competencies (Aleedan & Alfadhly, 2024).

Digital Divides and Educational Equity

Digital disparities significantly moderate educational impacts. While AI-based learning and social media resources correlate with academic performance, benefits diminish substantially where device access, connectivity, and digital literacy remain limited (Fazal et al., 2025). Sindh's public schools face unreliable electricity, limited internet, minimal teacher training, and scarce localized content, particularly in regional languages (Sahito et al., 2025). Gender norms and socio-economic constraints further restrict girls' access (Sahito et al., 2025).

Lessons from Global South Digital Initiatives

India's Digital Public Infrastructure: India's DIKSHA (Digital Infrastructure for Knowledge Sharing) platform, launched in 2017, has been adopted by nearly all states and union territories, serving 265 million students across 1.48 million schools (Carnegie Endowment, 2023). DIKSHA provides "energized" textbooks linking QR codes to digital content, online courses with credentials, and assessments. Its success stems from coherence with existing policies, interoperability with other systems, and use of open-source building blocks enabling digital sovereignty (Carnegie Endowment, 2023). The platform's scalability across India's twenty regional languages and sixty educational boards demonstrates how federal systems can coordinate digital initiatives while respecting linguistic diversity.

Bangladesh's Interactive Multimedia Initiative: Bangladesh transformed primary education by converting 17 national textbooks into interactive multimedia content, reaching 20 million students (BRAC, 2016). The government-BRAC partnership established over 5,500 digital classrooms, with teachers reporting that "digital content makes learning happen much faster" (BRAC, 2016). Critically, the initiative built on BRAC's earlier successful computer-aided learning project (2005), demonstrating how pilot programs can inform national scaling. Even in Korail slum's "tab schools," students now access animated lessons, showing potential to bridge socio-economic divides (BRAC, 2016).

Kenya's Digital Literacy Programme: Launched in 2016, Kenya's initiative distributed over 1.2 million devices to 99.6 percent of primary schools, connected 22,927 schools to power, and laid 6,000 kilometers of fiber network (ITU, 2020). Teachers report improved learning behaviors, reduced absenteeism, and enhanced engagement (World Bank, 2015). However, device usage remained below 40 percent due to unreliable infrastructure, culturally irrelevant content with unfamiliar accents, inadequate teacher training, and concerns about device security (Notre Dame, 2024).

Rwanda's Integrated Approach: Rwanda combined competency-based curriculum reform with digital tools, prioritizing instruction quality, high-impact materials, and community mobilization (UNSDG, 2024). UN technical assistance supported integration of refugee and migrant children through online platforms and cash grants, demonstrating alignment of digital initiatives with equity goals.

South Africa's Contextualized Interventions: Rural South Africa interventions succeeded through content contextualized to learners' linguistic profiles, including mother-tongue languages (Norman, 2023). This personalized design addressed challenges of large classes,

limited resources, and undertrained teachers, particularly relevant for developing contexts.

Regional Collaborative Models: Pacific island nations (Cook Islands, Samoa, Solomon Islands, Vanuatu) implemented regional e-learning platforms (2020-2024) with shared recurrent costs while allowing country customization, demonstrating sustainable collaborative approaches (UNESCO, 2024). Samoa has operated educational radio since the 1940s, offering 15-minute lessons across subjects and grades (UNESCO, 2024).

International research extends these findings beyond South Asian contexts. In Saudi Arabia, a mixed-methods study of schools found that media education programs significantly enhanced students' English language skills alongside media literacy competencies, with particular gains in listening comprehension of short sentences and oral production of single words (Aleedan & Alfadhly, 2024). This demonstrates that structured media activities can serve dual pedagogical purposes, developing both critical media literacy and foundational language skills. Similarly, research in German schools documented how students using tablets and video editing applications in physical education classes adopted creative roles as "camera child" and "actor," engaging in iterative recording, refining, and presenting their work to peers (Greve et al., 2020, p. 610). The study concluded that digital media can simultaneously support learning *with* media (enhancing embodied movement experiences) and learning *about* media (developing understanding of digital production and data representation) when pedagogy intentionally foregrounds both dimensions.

Findings from Saudi Arabia and Germany complement Pakistani evidence by demonstrating that media's educational benefits extend across diverse cultural and economic contexts when implementation prioritizes pedagogical design over technology provision. The Saudi focus on structured media activities for language development offers particular relevance for Pakistan's multilingual classrooms, where English remains a medium of instruction alongside regional languages (Aleedan & Alfadhly, 2024). The German example of students adopting creative production roles challenges assumptions that digital media necessarily promote passive consumption, instead showing how thoughtfully designed activities can foster active engagement, collaboration, and critical reflection on digital representation (Greve et al., 2020).

For Pakistan, these international examples suggest that media integration must be accompanied by explicit pedagogical frameworks guiding teachers in designing activities that develop both subject-area competencies and critical digital literacies. These experiences highlight that successful digital integration requires contextualized content, sustained teacher support, reliable infrastructure, and policy coherence. India's multilingual platform and Bangladesh's slum-based initiatives offer particularly relevant lessons for Pakistan's diverse linguistic landscape and equity challenges.

Theoretical Framework

This analysis adopts socio-constructivist and critical media education frameworks. From Vygotsky's (1978) socio-constructivist perspective, learning is socially mediated knowledge construction through interaction with peers, teachers, and tools. Media function as cognitive and social tools that; i) provide cognitive scaffolding through multimodal representations assisting comprehension of abstract concepts (Ayub & Kiazai, 2021; Greve et al., 2020); ii) support collaborative, project-based learning through new roles and iterative product refinement (Greve et al., 2020); and iii) extend informal learning beyond school through social media and mobile applications (Fazal et al., 2025; Majeed & Ahmad, 2025)

Critical media education emphasizes media are not neutral but embedded in power relations and commercial logics that can deepen inequalities when access is uneven (Muneeb, Mehmood, & Mehboob, 2020; Shah, Riaz, & Mukhtar, 2019). This requires a) media literacy education enabling critical analysis of messages, representation processes, and privacy issues (Aleedan & Alfadhly, 2024; Munawar et al., 2020); b) equity-oriented policies recognizing infrastructural disparities, linguistic barriers, and gendered norms shape who

benefits (Fazal et al., 2025; Sahito et al., 2025); and c) this dual framework foregrounds both pedagogical potentials and structural constraints requiring attention for inclusive benefits.

Methods

This paper employs systematic literature review methodology to synthesize empirical evidence on digital media in school education. The review followed established procedures for educational research synthesis (Gough, Oliver, & Thomas, 2017).

Systematic searches were conducted in Google Scholar, ERIC, and regional databases using terms: "digital media," "educational technology," "school education," "Pakistan," "Global South," "developing countries. Searches covered 2015-2025 to capture recent developments. Studies were included if they: (1) focused on school, primary education or comparable levels; (2) examined digital media, multimedia, or educational technology integration; (3) provided empirical data from Pakistan or comparable Global South contexts.

Initial searches yielded 156 sources. After removing duplicates and applying inclusion criteria, 20+ studies were retained for detailed analysis. These included Pakistan-specific studies, from other Global South contexts, and international comparative studies. Thematic synthesis was employed, following procedures outlined by Thomas and Harden (2008). Initial coding identified recurring themes, which were then organized into analytical categories addressing research questions. Cross-case analysis compared Pakistani evidence with Global exemplars to identify transferable lessons and context-specific challenges.

Limitations: This review relies on published literature, potentially excluding unpublished evaluations or grey literature. The rapid evolution of digital technologies means recent innovations may not yet appear in peer-reviewed literature.

Findings

Pedagogical Benefits in Classrooms

Evidence indicates multimedia enhances teaching when deployed within coherent frameworks. Quetta's multimedia-supported Pakistan Studies lessons improved achievement and motivation, with teachers noting video lessons clarified difficult concepts and made learning enjoyable (Ayub & Kiazai, 2021). Private school surveys suggest digital integration improves communication, accessibility, and independent learning across educational levels (Hussain et al., 2021).

International research demonstrates tablets and video applications create new learning roles and encourage iterative performance improvement (Greve et al., 2020). Reviews report digital tools, when aligned with curricular objectives, enhance engagement, comprehension, and critical thinking (Dei, 2024).

For Pakistan, carefully designed multimedia lessons in Pakistan Studies, science, and languages can overcome textbook limitations and support student-centered learning.

Language Development and Literacy

Media supports language acquisition through structured activities. Saudi research demonstrates media education enhances English listening and speaking, particularly foundational competencies (Aleedan & Alfadhly, 2024). University-level research suggests Pakistani students rely heavily on digital media for reading and research, implying schooling must prepare learners for these practices (Mugheri, 2020).

Research on social media's impact on English vocabulary among Pakistani youth reveals predominantly informal gains (Maryam, Younis, Nawaz, Younas, & Khudai, 2025), underscoring the necessity for teacher-guided, curriculum-aligned media use ensuring exposure contributes to academic competencies rather than exclusively informal registers.

Teacher Competence as Decisive Factor

Teacher digital competence determines integration success. Pakistani educators hold divergent perspectives. Some view digital media as new tools for traditional purposes, while others advocate fundamental pedagogical transformations (Muneeb et al., 2020; Khan, Abdul R., 2025). Informal digital learning and

competencies substantially predict functional skills, indicating self-directed learners are better equipped to leverage technology (Majeed & Ahmad, 2025). However, AI remains underutilized, suggesting knowledge gaps (Majeed & Ahmad, 2025).

Kenya's experience confirms this pattern. Despite distributing devices to nearly all primary schools, usage remained below 40 percent partly due to rushed, inadequate teacher training (Notre Dame, 2024). Teachers reported: "The training was rushed. It was my first time using a computer. By the end, I was more confused" (Notre Dame, 2024). This underscores professional development in digital pedagogy. It is not that merely basic ICT skills are essential but continuous professional development is also required.

Infrastructure and Connectivity Challenges

Digital divides constitute central challenges. Although AI-based learning and social media correlate with academic performance, digital inequalities substantially moderate effects (Fazal et al., 2025). Rural communities with limited devices, connectivity, and literacy derive fewer benefits (Fazal et al., 2025).

Schools, particularly in rural Pakistan, lack reliable electricity, internet, and adequate devices. Localized content remains scarce, particularly in regional languages (Sahito et al., 2025). Kenya's experience mirrors these challenges: "The power and internet here is very poor... I have to travel Sunday afternoon to a nearby town to download materials. This costs time and money" (Notre Dame, 2024).

Content Relevance and Cultural Adaptation

Content relevance emerges as critical. Kenya's digital content, while aligned with national curriculum, proved culturally irrelevant to rural learners. A teacher reported: "My students are struggling with understanding the content [due to unfamiliar accents]. Here, there is a way we talk and understand each other" (Notre Dame, 2024).

South Africa's success with mother-tongue content and contextualized interventions demonstrates the importance of linguistic and cultural adaptation (Norman, 2023). Pakistan's multilingual context similarly requires content reflecting regional cultures, histories, and languages (Sahito et al., 2025), particularly in ECE and primary level schools (Khan, Abdul R., 2025)

Sustainability and Maintenance

Long-term sustainability requires addressing ongoing costs beyond initial procurement. Kenya's experience shows governments often inadequately consider total costs of maintenance, data management, content development, and teacher support (UNESCO, 2024). Pacific regional models demonstrate sustainable approaches through shared costs while allowing customization (UNESCO, 2024).

Discussion

Situating Pakistan Within Global South Experiences

Pakistan's digital integration challenges mirror patterns across Global South contexts but require context-specific responses. Like Kenya, Pakistan faces infrastructure gaps and teacher readiness issues. However, Pakistan's linguistic diversity, federal structure, and greater population density present distinct challenges requiring tailored approaches.

Kenya's device distribution achieved near-universal coverage but struggled with utilization, demonstrating infrastructure alone proves insufficient. Rwanda's integrated approach linking digital tools with curriculum reform and community mobilization offers instructive parallels for Pakistan's competency-based curriculum initiatives.

India's DIKSHA platform offers particularly relevant lessons for Pakistan's federal structure and linguistic diversity. DIKSHA's success across twenty regional languages demonstrates how digital public infrastructure can accommodate provincial variation while maintaining national coordination (Carnegie Endowment, 2023). Pakistan's provincial autonomy in education, established through the 18th Constitutional Amendment, creates similar needs for platforms enabling both federal coordination and provincial customization.

Bangladesh's experience with interactive multimedia content reaching even slum schools demonstrates feasibility of serving marginalized populations (BRAC, 2016). The government-NGO partnership model that scaled BRAC's pilot to national level offers insights for Pakistan.

South Africa's mother-tongue content success directly addresses Pakistan's multilingual reality. With Urdu, English, Sindhi, Pashto, Punjabi, and Balochi among primary instruction languages, localized content development becomes imperative, not optional.

From Technological to Pedagogical Focus

Evidence suggests successful integration requires shifting from technology-centered to pedagogy-centered approaches. Kenya's challenges partly stemmed from purchasing technology before establishing pedagogical frameworks and teacher capacity. As UNESCO (2024) notes, purchasing technology for non-pedagogical reasons is a common mistake.

Pakistan must avoid this pattern by establishing clear pedagogical objectives before procurement, ensuring technology serves learning goals rather than becoming ends themselves. This means prioritizing low-cost, high-impact tools like projectors and offline content over expensive devices requiring extensive infrastructure.

Teacher Development Beyond Training

Kenya's "rushed" training experiences highlight that one-time workshops prove insufficient. Successful teacher development requires ongoing support, informal learning communities, and sustained professional engagement (Majeed & Ahmad, 2025). Rwanda's continuous professional development model integrated into broader curriculum reform demonstrates more sustainable approaches (UNSDG, 2024).

Pakistan's teachers already engage in informal digital learning through social media platforms (Majeed & Ahmad, 2025). Formalizing these networks while providing ongoing support could prove more effective than isolated training sessions.

Policy Implications and Recommendations

Evidence from Global and Pakistan's contexts converges on five priority areas for effective, equitable digital integration in primary education. First, infrastructure investment must systematically prioritize under-served schools before device procurement. Kenya's experience demonstrates distributing devices to schools lacking reliable power proves counterproductive, with teachers reporting inability to charge devices and download materials due to poor connectivity (Notre Dame, 2024). Pakistan should map infrastructure gaps by district, prioritizing schools in Khyber Pakhtunkhwa, Sindh, Balochistan, Gilgit-Baltistan and rural Punjab, partner with provincial energy departments for solar power solutions in off-grid schools and establish connectivity through mobile networks. This sequencing, i.e. infrastructure before devices, represents a fundamental lesson from Kenya's challenges.

Second, multilingual content development requires provincial coordination informed by India's DIKSHA model. DIKSHA's success across twenty regional languages while maintaining national coherence demonstrates feasibility of coordinating diverse linguistic contexts within federal structures (Carnegie Endowment, 2023). Pakistan should establish provincial content development teams producing materials in Sindhi, Pashto, Punjabi, and Balochi particularly at ECE and primary school levels (Khan, Abdul R., 2025). The government should partner with local educators ensuring cultural relevance and appropriate linguistic registers, and pilot content in representative schools before wider dissemination. India's open-source approach enabling state customization while maintaining interoperability offers a practical template for Pakistan's provincial autonomy framework established through the 18th Constitutional Amendment.

Third, teacher professional development must shift from one-time training toward sustained, practice-based support. Kenya's "rushed" training left teachers confused and unable to effectively use devices (Notre Dame, 2024). Bangladesh's phased approach building on earlier pilots demonstrates

more sustainable models (BRAC, 2016). Pakistan should create district-level digital learning support centers, which can provide ongoing assistance. The education departments should formalize existing teacher networks on WhatsApp and Facebook for peer support and resource sharing. The state should also integrate digital pedagogy into pre-service teacher education curricula. This approach recognizes that informal digital learning already significantly predicts Pakistani teachers' functional skills (Majeed & Ahmad, 2025), suggesting formalization and support of existing practices may prove more effective than imposed training.

Fourth, equity-focused implementation requires explicitly targeting gender and urban-rural disparities through differentiated interventions. Bangladesh's success reaching even slum populations demonstrates feasibility of serving marginalized communities through strategic partnerships (BRAC, 2016). Pakistan should establish community-based digital learning hubs in underserved areas providing shared access, create safe spaces and targeted programs supporting girls' digital learning, and monitor gender-disaggregated data on access, usage, and outcomes. The government-NGO partnership model that enabled Bangladesh to scale from pilots to national coverage offers relevant lessons for Pakistan.

Fifth, policy coordination must align federal and provincial digital education policies with broader media policy frameworks. Fragmented initiatives waste resources and create incompatibilities. Pakistan should establish inter-ministerial coordination mechanisms linking education, ICT, and media sectors, and develop coherent digital education policy integrating school ICT initiatives with public media programming. India's coherence between DIKSHA and existing educational policies contributed significantly to adoption and sustainability (Carnegie Endowment, 2023), demonstrating importance of policy alignment rather than parallel initiatives.

Conclusion

Media and digital technologies hold promise for transforming Pakistan's school education, but this promise remains conditional upon equity-focused implementation. Evidence from Pakistan and around the globe demonstrates multimedia, AI-based platforms, and digital resources can enhance engagement and achievement when integrated purposefully (Ayub & Kiazai, 2021; Fazal et al., 2025). Kenya, Rwanda, and South Africa offer instructive parallels, highlighting both possibilities and pitfalls of large-scale digital integration.

Yet the same evidence warns against technocentric approaches prioritizing hardware over pedagogy and equity. Kenya's near-universal device distribution achieved limited utilization due to infrastructure gaps, culturally irrelevant content, and inadequate teacher support.

International research from contexts as diverse as Saudi Arabia and Germany further confirm that pedagogically grounded media integration can enhance both academic learning and critical digital competencies across varied educational settings (Aleedan & Alfadhly, 2024; Greve et al., 2020).

Pakistan must learn from these experiences, prioritizing; 1) systematic infrastructure investment before device procurement; 2) culturally relevant, multilingual content development; 3) sustained teacher professional development; 4) explicit equity targets addressing gender and regional disparities; and 5) policy coordination across federal, provincial, and sectoral boundaries.

Successful digital transformation requires viewing technology not as substitute for teachers or comprehensive reform, but as pedagogical tools that, when equitably integrated within supportive environments, can enhance engaged, critical, inclusive learning. Aligning media integration with Sustainable Development Goal 4 demands approaching digital transformation not merely as technological challenge but as opportunity to reimagine school education around equity, quality, and holistic development for all learners, regardless of socio-economic background, geographic location, or gender identity.

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