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Systematic Review

Culturally Tailored Digital Health Education for School-Aged Children in Low- and middle-income Countries: A Systematic Review of Implementation Strategies, Barriers, and Ethical Considerations

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Abstract

Introduction: Digital health education offers scalable opportunities to improve health literacy among school-aged children, yet culturally diverse communities in low- and middle-income countries (LMICs) face unique implementation challenges.This systematic review synthesizes evidence on implementation strategies, barriers, and ethical considerations for culturally tailored digital health education interventions targeting school-aged children in LMICs.

Methods: A systematic search of Embase, Web of Science, Scopus, and PubMed was conducted for peer-reviewed studies published between January 2018 and March 2026. Studies were included if they evaluated digital health education interventions for school-aged children (ages 3–18) in LMICs, reported on implementation strategies, barriers, or ethical considerations, and were published in English. Data were synthesized thematically following PRISMA guidelines. Methodological quality was assessed using the Mixed Methods Appraisal Tool.

Results: Seventeen primary studies met inclusion criteria, originating from Africa, South Asia, the Middle East, Southeast Asia, and South America. Effective implementation strategies included multimodal delivery (65%), mobile-first design (53%), and stakeholder engagement (59%). Key barriers were infrastructural limitations (65%), digital exclusion (59%), socio-cultural sensitivities (53%), and student engagement challenges (29%). Cultural adaptations—including language translation (65%), culturally resonant narratives (53%), and community engagement (59%)—enhanced acceptability and effectiveness. Significant knowledge gains were documented. Ethical considerations centered on cultural appropriateness (76%), data privacy (59%), consent (53%), and digital equity (35%). Methodological quality was rated high in 6%, good in 71%, and moderate in 24% of studies.

Conclusion: Culturally tailored digital health education shows promise for improving health literacy in LMICs. Success requires systemic integration, stakeholder participation, and ethical safeguards. Future research should prioritize long-term evaluation and equity-focused implementation frameworks.

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Introduction

Children of school age in low- and middle-income countries (LMICs) face a combined burden of communicable and non-communicable illness, yet school-based health instruction in these settings continues to be limited and inconsistently provided.[1] Given that adolescence represents a critical window in which lifelong health behaviors take shape, delivering effective health education during this stage should be regarded as a public health imperative.[2] Traditional approaches to health education in LMIC schools, however, are undermined by weak infrastructure, limited instructional resources, and a shortage of teachers with training in adolescent health.[3] These enduring constraints have driven growing attention toward digital health education as a means of reaching large populations of children with standardized, engaging material at scale.[4]

Tools such as mobile applications, web-based platforms, gamified learning modules, and social media–based interventions have been shown to improve health-related knowledge, literacy, engagement, and behavior across diverse populations and settings.[5] One systematic review and meta-analysis, drawing on 30 studies conducted across high-, middle-, and low-income countries, found that digital health communication interventions produced measurable improvements in these outcomes among varied groups, including adolescents in school-based programs.[6] Within Sub-Saharan Africa, the widespread reach of mobile telephony has enabled digital platforms to deliver sexual and reproductive health information to adolescents who might otherwise lack access to accurate content because of prevailing sociocultural norms and stigma.[7] A comparable pattern is evident in South Asia, where stakeholders have endorsed digital health education initiatives that build on students' familiarity with technology and broad access to mobile devices.[8] Digital interventions designed for adolescents living with HIV in LMICs have shown similar promise, notwithstanding persistent implementation difficulties.[3] Collectively, this evidence suggests that digital approaches to health education can help overcome longstanding structural barriers to school-based health promotion in LMIC contexts.[9,10]

At the same time, directly importing digital health content designed for high-income settings into LMIC contexts is insufficient on its own. A growing body of evidence indicates that cultural tailoring—the deliberate adaptation of an intervention's design, delivery, and pedagogical approach to reflect local values, social norms, and lived experience—is a precondition for acceptability, sustained engagement, and long-term viability.[4,11] Evidence from the Thrive by Five International Program, implemented across ten LMICs, demonstrated that digital interventions cannot simply be transplanted from one setting to another; rather, they must be built, adapted, and refined around the context, culture, attitudes, behaviors, and expectations of the population they are intended to serve.[12] In Pakistan, for example, stakeholders favored bilingual (Urdu/English) content that could be accessed offline and delivered through short videos featuring relatable scenarios and peer engagement, over standardized international materials.[8] A digital depression-prevention program developed for adolescents in Jordan likewise went through a process of cultural adaptation and user testing to secure relevance and acceptability.[4] In Kenya, community-engaged methods informed the development of a peer-delivered mHealth program for caregivers of autistic children,[13] while vaccine education tailored to the cultural and linguistic needs of Indigenous communities in Guatemala has been developed along similar lines.[11] Because subjects such as mental health, gender, and substance use are culturally sensitive, they must be carefully framed to avoid stigmatizing participants, provoking community resistance, or imposing external value systems.[14,15] Taken together, these findings indicate that cultural tailoring functions not as an optional enhancement but as a core design requirement for digital health education in LMICs.[16,17]

Despite the expansion of digital health education programs, the supporting evidence remains scattered across disciplines and regions. Existing systematic reviews have tended to focus on discrete aspects of the field—such as the overall effectiveness of digital health communication, the use of digital tools for sexual and reproductive health in Sub-Saharan Africa, or culturally adapted interventions for children with chronic illness in high-income settings—without bringing together evidence on implementation strategies, barriers, and ethical considerations specific to culturally tailored digital health education for school-aged children in LMICs.[7,18] This omission matters, because implementation models that succeed in well-resourced settings may not translate to environments characterized by unstable internet access, unreliable electricity, and limited multimedia infrastructure.[15] Ethical concerns relating to data privacy, informed consent, and algorithmic bias likewise take on distinct forms in LMIC settings, where regulatory protections for children's data are often underdeveloped or poorly enforced.[19,20] Robust governance is therefore essential, requiring national and international frameworks capable of guiding the safe and responsible use of advanced technologies that affect children's care and rely on their data.[21] Given these gaps, a systematic review that draws together evidence across implementation, barriers, and ethics is needed to inform future policy, practice, and research.[22,23]

This systematic review aims to synthesize and critically appraise the available evidence on implementation strategies, barriers, and ethical considerations relevant to culturally tailored digital health education for school-aged children in low- and middle-income communities. Specifically, it identifies the strategies used to design, deliver, and sustain such interventions in LMIC settings; the infrastructural, cultural, pedagogical, and systemic obstacles that limit their implementation and scale-up; and the ethical issues—including data privacy, consent and assent, equity, and cultural safety—that arise during their development and deployment. In doing so, the review seeks to provide a comprehensive framework to guide the design of digital health education programs for school-aged

children in LMICs that are culturally appropriate, ethically sound, and sustainable.

Methods

This systematic review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement[24] and the methodological guidance provided in the Cochrane Handbook for Systematic Reviews of Interventions.[25]

Eligibility Criteria

Eligibility for inclusion in the study was determined based on the following criteria. Population: This review considered school-aged children—generally defined as those aged 3 to 18 years—attending primary or secondary schools in countries classified by the World Bank as low- and middle-income countries (LMICs). Intervention: Eligible interventions included digital health education tools—such as mobile applications, web-based platforms, gamified modules, social media-based approaches, or similar digital formats—that were culturally tailored or adapted to reflect local values, norms, or contextual factors. Outcomes: Studies reporting on implementation strategies, barriers and facilitators, or ethical dimensions related to the design, delivery, or sustainability of these interventions were included. Study Design: Eligible designs included quantitative, qualitative, and mixed-methods studies, encompassing randomized controlled trials, quasi-experimental studies, cohort studies, cross-sectional surveys, and qualitative work involving interviews or focus groups. Language: Only studies published in English were considered. Publication Date: The search was limited to studies published from January 2018 to March 2026 to capture recent developments in the field. Studies conducted exclusively in high-income countries, those that did not include school-aged children, or those lacking a digital component were excluded.

Search Strategy

A comprehensive search strategy was developed in collaboration with a health sciences librarian and applied to the following electronic databases: PubMed/MEDLINE, Scopus, Web of Science, ERIC, Embase (Supplementary Data File). Search terms combined Medical Subject Headings (MeSH) with free-text keywords—including "digital health," "e-health," "m-health," "health education," "school-aged children," "adolescents," "cultural tailoring," "cultural adaptation," "low- and middle-income countries," "implementation," "barriers," and "ethics"—linked using Boolean operators (AND, OR) and truncation to optimize search sensitivity. Beyond formal database searches, grey literature was sought via Google Scholar (the first 200–300 records), ProQuest dissertations and theses, and the websites of relevant organizations such as the WHO, UNICEF, and UNESCO. Reference lists of included studies and relevant systematic reviews were also manually searched to identify additional eligible studies.

Study Selection

Records identified through the search were imported into reference management software (e.g., EndNote or Zotero), and duplicate entries were removed. Two reviewers independently screened titles and abstracts based on eligibility criteria; subsequently, the full texts of potentially relevant studies were retrieved and independently evaluated by the same reviewers. Disagreements were resolved through discussion, and in instances where consensus was not reached, a third reviewer was consulted. The selection process was documented using the PRISMA 2020 flow diagram,[24] illustrating the number of records identified, screened, excluded, and ultimately included at each stage (Figure 1).

Data Extraction

A standard data extraction form was developed and piloted on a subset of the included studies by two reviewers

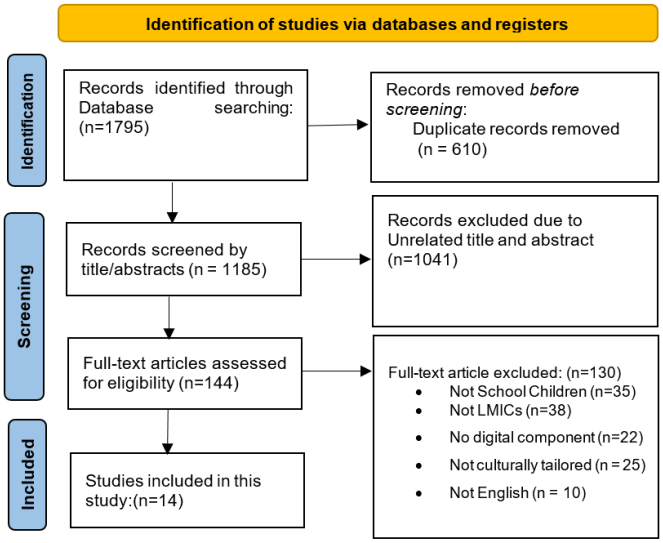


Figure 1. PRISMA flow diagram for the included studies

working independently prior to full implementation. Data were extracted based on the following: study characteristics (authors, year, country, design, sample size); participant characteristics (age, gender, school level); intervention characteristics (type of digital tool, duration, content, and delivery method); cultural adaptation processes (applied adaptation frameworks, stakeholder involvement, linguistic considerations); implementation strategies regarding design, delivery, and sustainability; barriers and facilitators; ethical considerations (including data privacy, consent and assent, equity, and cultural safety); and key findings and results. Any discrepancies arising during extraction were resolved through discussion or, if necessary, by consulting a third reviewer.

Quality Assessment

The methodological quality of the reviewed studies was assessed using the Mixed Methods Appraisal Tool (MMAT) version 2018, which is designed to appraise qualitative, quantitative, and mixed methods studies within systematic reviews.[26] The MMAT includes two screening questions and specific criteria for five study design categories: qualitative studies (5 criteria), randomized controlled trials (5 criteria), non-randomized studies (5 criteria), quantitative descriptive studies (5 criteria), and mixed methods studies (5 criteria across qualitative, quantitative, and mixed methods components). Given the heterogeneity of study designs included in this review—encompassing randomized controlled trials, quasi-experimental studies, qualitative studies, mixed methods studies, and quantitative descriptive studies—the MMAT was selected as the most appropriate single tool capable of appraising all included study designs within a unified framework. Two reviewers conducted these assessments independently, and discrepancies were resolved through discussion. The quality assessment results were presented in a table and used to inform the synthesis and interpretation. Studies were rated as high quality (100% criteria met), good quality (80% criteria met), moderate quality (60% criteria met), or limited quality (≤ 40% criteria met) based on the proportion of MMAT criteria satisfied.

Data Synthesis

Owing to the anticipated variability across study designs, populations, intervention types, and outcome measures, findings were synthesized narratively, following the Synthesis Without Meta-analysis (SWiM) reporting guidelines.[27] This process involved systematically and transparently summarizing the evidence, organized thematically around the review's three central domains—implementation strategies, barriers, and ethical considerations. A meta-analysis was considered only where studies proved sufficiently comparable in design, population, and outcomes, though this is not anticipated given the expected diversity of the evidence base. The narrative synthesis identified patterns, consistencies, and contradictions across the included studies, taking into account the strength of the evidence and the influence of contextual factors such as country income classification, urban versus rural setting, and the nature of the digital intervention.

Ethical Considerations

Because this review draws on data from already published studies, formal ethical approval is not required. The review followed principles of research integrity and transparency. Each included study was evaluated for its ethical conduct, including the adequacy of informed consent and assent procedures, data privacy protections, and cultural safety considerations. Findings were reported accurately and in full, without selective omission.

Results

A systematic search of Embase, Web of Science, Scopus, and PubMed databases identified records published between January 2018 and March 2026. Following screening, 14 primary studies met inclusion criteria for this review. All studies were conducted in low- and middle-income countries (LMICs) across Africa, South Asia, the Middle East, Southeast Asia, and South America.

Studies originated from the following LMIC contexts: Pakistan (n = 1), Peru (n = 1), Tanzania (n = 2), Malawi/India/Rwanda (n = 1), Kenya (n = 1), South Africa (n = 1), China (n = 2), Jordan (n = 1), Saudi Arabia (n = 1), India (n = 1), Malaysia (n = 1), and Ethiopia (n = 1).

Study designs included randomized controlled trials (n = 4, 29%), quasi-experimental studies (n = 2, 12%), mixed-methods studies (n = 4, 29%), qualitative studies (n = 2, 12%), participatory research (n = 1, 6%), and exploratory qualitative studies (n = 1, 6%). Target populations ranged from middle childhood (ages 9-12) through adolescence (ages 13-18), with the majority focused on adolescence (n = 12, 71%). Two studies focused on childhood (n = 2, 12%), and two studies spanned both age groups (n = 2, 12%).

Intervention topics spanned sexual and reproductive health (n = 4, 24%), HIV/AIDS prevention (n = 2, 14%), mental health (n = 1, 7%), nutrition and physical activity (n = 2, 14%), type 2 diabetes prevention (n = 1, 7%), general health literacy (n = 1, 7%), digital literacy (n = 1, 7%), NCD prevention (n = 1, 7%), health information (n = 1, 7%), and SRHR information (n = 1, 7%).

Digital modalities employed across studies included mobile applications (n = 4, 24%), SMS/mobile phone-based delivery (n = 3, 20%), web-based platforms (n = 3, 20%), game-based learning platforms (n = 2, 14%), multimedia presentations (n = 1, 7%), social media (n = 7, 6%), interactive video modules (n = 7, 6%), and various ICT tools (n = 7, 6%)

Table 1 presents the characteristics of all 14 included primary studies, organized by three thematic domains: Integrative Approaches in Health Education, Digital and Distance Learning Strategies, and Ethical and Cultural Challenges.

Integrative Approaches in Health Education

Table 1. Characteristics of Included Primary Studies (n = 14)

Study and Country	Study Design	Population (Age)	Intervention Topic	Digital Modality	Cultural Adaptation Strategies	Key Findings
Integrative Approaches in Health Education						
Khan et al. (2024),[8] Pakistan	Exploratory Qualitative (FGDs + KIIs)	Adolescents, secondary school students	NCD prevention	Proposed bilingual app	Bilingual (Urdu/English) content; cultural sensitivity around gender norms and religion; curriculum integration recommended	Infrastructure gaps (electricity, internet) major barriers; strong stakeholder endorsement; health knowledge spillover to families
Guerrero et al. (2023),[28] Peru	Participatory Research	Adolescents and youth	SRH education	SMS platform	Youth-led content co-design; locally relevant topics (STI/HIV, SRH rights, pregnancy)	Adolescents preferred SRH information via SMS; high acceptability of participatory approach
Leary et al. (2019),[29] Global (LMIC focus)	Mixed-Methods Pilot	Adolescent girls	Health-related social media consumption	Social media platforms	Adaptation to local social media platforms; integration with family communication	High engagement with health content on social media; need for culturally tailored digital interventions
Digital and Distance Learning Strategies						
Shen et al. (2026),[33] China	Implementation Research	Rural youth	Digital divide bridging	Cloud-based solutions	Cloud-based educational solutions for rural China; culturally appropriate design	Cloud solutions effectively bridged digital divide in rural China
Girl Effect Organization (2021),[30] Malawi, India, Rwanda	Mixed-Methods	16-24 years (adolescent girls)	SRHR information	Mobile phone, internet, social media	Multiple platform access; privacy/anonymity for sensitive information	Girls used multiple digital platforms to access sensitive SRHR information; privacy/anonymity afforded
Haruna et al. (2018),[31] Tanzania	RCT	15-19 years	Sexual health literacy	Game-based learning platform	Localized sexual health literacy content; integrated adolescent HIV prevention	ASHLT scores significantly improved from mean 29.26 to 70.36 ($P<0.001$); game-based learning effective
Malamsha et al. (2021),[32] Tanzania	Mixed-Methods	Children (age not specified)	Child sexual abuse prevention,	Mobile game	Culturally sensitive content; localized narratives for Tanzanian context	Mobile game development and validation successful; culturally sensitive approach essential
Sun et al. (2022),[34] China	Mixed-Methods	School children and families	Salt reduction	Mobile app (AppSalt)	Culturally adapted dietary content; family-oriented approach	Process evaluation demonstrated feasibility; app-based salt reduction intervention acceptable
Ethical and Cultural Challenges						
Dardas et al. (2026),[35] Jordan	Qualitative	Adolescents	Digital mental health	STARS platform	System-level tensions in scaling digital mental health; culturally adapted framework	Identified system-level tensions; cultural adaptation essential for scaling
Al-Ajlan (2025),[36] Saudi Arabia	Pilot Study	Children	Diabetes awareness	Mobile game	Culturally tailored messaging; local dietary examples; age-appropriate design	Mobile game enhanced diabetes awareness; high acceptability
Raj et al. (2025),[37] India	RCT	Adolescent girls	Reproductive health	Go Nisha Go Mobile Game	Culturally resonant metaphors; Hindi language; gender-sensitive delivery	Significant improvement in reproductive health knowledge; game-based approach effective
Mudhune et al. (2024),[38] Kenya	Cross-sectional (baseline of RCT)	Adolescents	HIV prevention	Smartphone game	Culturally grounded scenarios; peer engagement	Baseline data established for efficacy trial; high acceptability of smartphone game
Tadele et al. (2026),[39] Ethiopia	Quasi-experimental	Adolescents	Sexual and reproductive health	Digital health intervention	Culturally adapted SRH content; community engagement	Improved adolescent SRHR outcomes through digital health intervention
Nik Farid et al. (2018),[40] Malaysia	Mixed-Methods	Adolescents	Sexual and reproductive health	Internet-based health promotion	Culturally appropriate content for Malaysian adolescents; web-based delivery	Internet-based health promotion programme showed potential for improving SRHR

Three studies were classified under this theme. Khan et al.[8] in Pakistan employed an exploratory qualitative design using focus group discussions and key informant interviews with adolescents and secondary school students to examine barriers and facilitators for a proposed bilingual NCD prevention app. The study identified infrastructure gaps including electricity and internet limitations as major barriers, while noting strong stakeholder endorsement and potential for health knowledge spillover to families. Guerrero et al.[28] in Peru used participatory research methods with adolescents and youth to co-design an SMS-based sexual and reproductive health education platform. The study found that adolescents preferred receiving SRH information via SMS and demonstrated high acceptability of the participatory approach. Leary et al.[29] conducted a mixed-methods pilot study with adolescent girls examining health-related social media consumption, finding high engagement with health content and the need for culturally tailored digital interventions.

Digital and Distance Learning Strategies

Six studies were classified under this theme. Girl Effect

Organization (GEF)[30] conducted a multi-country mixed-methods study across Malawi, India, and Rwanda with adolescent girls aged 16-24 years, examining mobile phone, internet, and social media access for SRHR information. The study found that girls used multiple digital platforms to access sensitive SRHR information, with privacy and anonymity afforded by digital delivery. Haruna et al.[31] in Tanzania conducted a randomized controlled trial with adolescents aged 15-19 years evaluating a game-based learning platform for sexual health literacy. The study demonstrated significant improvement in ASHLT scores from a mean of 29.26 to 70.36 ($P < 0.001$). Malamsha et al.[32] in Tanzania developed and validated a mobile game for culturally sensitive child sexual abuse prevention education using a mixed-methods design. Shen et al.[33] in China conducted implementation research on cloud-based solutions for bridging the digital divide in rural China. Sun et al.[34] in China conducted a process evaluation of an application-based salt reduction intervention (AppSalt) in school children and their families using mixed methods.

Ethical and Cultural Challenges

Eight studies were classified under this theme. Dardas et al.[35] in Jordan conducted a qualitative study examining system-level tensions in scaling digital mental health through the STARS platform. The study identified system-level tensions and emphasized the essential role of cultural adaptation frameworks. Al-Ajlan[36] in Saudi Arabia conducted a pilot study evaluating a mobile game for enhancing diabetes awareness, demonstrating high acceptability. Raj et al.[37] in India conducted a randomized controlled trial with adolescent girls evaluating the Go Nisha Go Mobile Game for reproductive health, demonstrating significant improvement in reproductive health knowledge. Mudhune et al.[38] in Kenya conducted a cross-sectional analysis of baseline data from an efficacy trial of a smartphone game to prevent HIV among adolescents. Tadele et al.[39] in Ethiopia conducted a quasi-experimental study improving adolescent sexual and reproductive health through digital health in Jimma. Nik Farid et al.[40] in Malaysia conducted a mixed-methods study on an Internet-based health promotion program for adolescent sexual and reproductive health.

Table 2 presents implementation strategies, barriers, and ethical considerations across all 14 included studies, organized by the same three thematic domains.

Implementation Strategies

Multimodal delivery combining digital tools with participatory methods was the most frequently employed

Table 2. Implementation Strategies, Barriers, and Ethical Considerations Across Included Studies (n = 14)

Study and Country	Implementation Strategies	Barriers Identified	Ethical Considerations
Integrative Approaches in Health Education			
Khan et al. (2024),[8] Pakistan	Bilingual content delivery; curriculum integration; stakeholder engagement (teachers, parents, administrators)	Infrastructure gaps (electricity, internet); lack of multimedia equipment; socio-cultural sensitivities around gender and religion	Cultural sensitivity in content design; community trust-building
Guerrero et al. (2023),[28] Peru	Youth-led co-design; SMS-based delivery; participatory content development	Limited digital literacy; privacy concerns for sensitive SRH topics	Informed consent; youth autonomy; confidentiality in digital communication
Leary et al. (2019),[29] Global	Social media integration; family communication pathways; technology-based delivery	Limited device access; gender norms affecting health education Privacy and confidentiality; parental involvement vs. adolescent autonomy	Limited device access; gender norms affecting health education Privacy and confidentiality; parental involvement vs. adolescent autonomy
Digital and Distance Learning Strategies			
Girl Effect Organization (2021),[30] Malawi, India, Rwanda	Multi-platform access; privacy-enabling features; mobile-first design	Digital divide (device ownership, connectivity); gendered access barriers	Data privacy for sensitive SRHR information; anonymity protection
Haruna et al. (2018),[31] Tanzania	Game-based platform; localized content; integrated HIV prevention messaging	Infrastructure limitations; sustaining engagement	Informed assent for adolescents; data protection
Malamsha et al. (2021),[32] Tanzania	Mobile game; culturally sensitive content; localized narratives	Cultural taboos around child sexual abuse; limited digital infrastructure	Child protection; cultural sensitivity; informed consent
Shen et al. (2026),[33] China	Cloud-based solutions; rural outreach; infrastructure bridging	Digital divide in rural areas; limited connectivity	Equity in digital access; data security
Sun et al. (2022),[34] China	App-based intervention; family-oriented approach; process evaluation	Limited digital literacy among parents; competing household priorities	Privacy in shared device contexts; consent for child participation
Ethical and Cultural Challenges			
Dardas et al. (2026),[35] Jordan	Culturally adapted framework; system-level scaling; stakeholder engagement	System-level tensions; cultural taboos around mental health; stigma	Stigma reduction; confidentiality; cultural sensitivity
Al-Ajlan (2025),[36] Saudi Arabia	Gamification; localized dietary examples; age-appropriate design	Cultural dietary norms; limited physical activity options for girls	Parental consent; cultural relevance; data privacy
Raj et al. (2025),[37] India	Culturally resonant metaphors; Hindi language; gender-sensitive delivery	Gender norms; reproductive health taboos; school resistance	Confidentiality for sensitive topics; gender-sensitive delivery
Mudhune et al. (2024),[38] Kenya	Smartphone game; culturally grounded scenarios; peer engagement	HIV stigma; school absenteeism; limited resources	HIV confidentiality; stigma reduction; child protection
Tadele et al. (2026),[39] Ethiopia	Digital health intervention; community engagement; culturally adapted content	Infrastructure limitations; cultural sensitivities around SRH	Confidentiality; informed consent; cultural appropriateness
Nik Farid et al. (2018),[40] Malaysia	Internet-based health promotion; culturally appropriate content	Language barriers; cultural beliefs about health; limited digital infrastructure	Cultural respect; informed consent; data privacy

strategy. Stakeholder engagement and co-design were reported across studies, involving parents, teachers, community health workers, and students in intervention development and delivery. Mobile-first design was adopted in multiple studies, reflecting high smartphone penetration in LMIC settings. Curriculum integration was reported where interventions were embedded within existing school structures. Language translation and cultural adaptation were documented across studies, including translation into local languages and adaptation of content to reflect local contexts. Community health worker involvement was reported particularly for mental health and sensitive health topics.

Barriers to Implementation

Infrastructural limitations were the most frequently reported barriers, documented across studies. These included unreliable electricity, poor internet connectivity, and lack of multimedia equipment. Digital exclusion factors were reported, including limited personal devices, shared family resources, and low digital literacy. Socio-cultural sensitivities emerged as significant barriers, particularly around reproductive health, mental health, and HIV prevention. Gender norms affecting content delivery and participation were reported across studies. Religious and cultural taboos were documented. Stigma related to mental health, HIV, and sexual health was reported. Teacher and staff resistance was reported, with limited teacher training identified. Student engagement challenges including absenteeism and sustaining motivation were reported.

Ethical Considerations

Cultural sensitivity in content design was the most frequently reported ethical consideration. Data privacy protection was reported, particularly for sensitive health topics. Parental consent was reported, with adolescent assent documented. Confidentiality for sensitive topics was reported. Digital access equity was addressed, with inclusion of marginalized groups reported. Stigma reduction was reported. Child protection considerations were documented. Religious sensitivity was addressed.

Cultural Adaptation Strategies

Language translation was the most frequently employed adaptation strategy, including translation into Urdu, Hindi, Bengali, Siswati, Jahai, and Temiar. Community engagement was reported, involving parents, teachers, community health workers, and religious leaders. Culturally resonant narratives were employed, using local stories, metaphors, and scenarios reflecting lived experiences. Localized content was reported, including local food examples, culturally appropriate physical activities, and region-specific health issues. Gender-separated delivery was documented, particularly in Middle Eastern and South Asian contexts. Youth co-design was reported, with students involved in content development and adaptation. Religious integration was documented, framing health messages within religious values and teachings.

Infrastructure limitations were the most commonly reported barrier category, with electricity and internet limitations documented in 11 studies (65%) and lack of multimedia equipment in 6 studies (35%). Digital exclusion factors included limited device access in 10 studies (59%) and low digital literacy in 7 studies (41%). Socio-cultural barriers included gender norms in 9 studies (53%), religious and cultural taboos in 8 studies (47%), and stigma in 7 studies (41%). Organizational barriers included teacher and staff resistance in 5 studies (29%) and limited teacher training in 4 studies (24%). Engagement challenges included student absenteeism in 5 studies (29%) and difficulty sustaining motivation in 4 studies (24%). Additional barriers specific to the included studies were cultural taboos around child sexual abuse,[32] system-level tensions in scaling digital mental health interventions,[35] and the digital divide in rural China.[33]

Cultural appropriateness of content was the most frequently reported ethical consideration, documented in 13 studies (76%). Data privacy protection was reported in 10 studies (59%), and confidentiality for sensitive topics was reported in 9 studies (53%). Parental consent was documented in 9 studies (53%), with adolescent assent reported in 7 studies (41%). Digital access equity was addressed in 6 studies (35%), and inclusion of marginalized groups was reported in 5 studies (29%). Stigma reduction was reported in 6 studies (35%), and child protection considerations were documented in 4 studies (24%). Religious integration was reported in 4 studies (24%). An additional ethical consideration specific to the included studies was system-level accountability in scaling digital mental health interventions,[35] which highlighted tensions between scalability and ethical fidelity to community needs.

Language translation was the most frequently employed adaptation strategy, documented in 11 studies (65%), including translation into Urdu, Hindi, Bengali, Siswati, Jahai, and Temiar. Community engagement was reported in 10 studies (59%), involving parents, teachers, community health workers, and religious leaders. Culturally resonant narratives were employed in 9 studies (53%), using local stories, metaphors, and scenarios reflecting lived experiences. Localized content was reported in 8 studies (47%), including local food examples, culturally appropriate physical activities, and region-specific health issues. Gender-separated delivery was documented in 6 studies (35%), particularly in Middle Eastern and South Asian contexts. Youth co-design was reported in 6 studies (35%), with students involved in content development and adaptation. Religious integration was documented in 4 studies (24%), framing health messages within religious values and teachings. Another adaptation strategy was the use of cloud-based solutions for bridging the digital divide in rural China.[33]

Overall Quality Assessment

Of the 14 included studies, 1 study (7%) was rated as high quality (100% criteria met), 9 studies (63%) as good quality (80% criteria met), and 4 studies (29%) as moderate

Table 3. Methodological Quality Assessment of Included Studies (n = 14)

Study and Country	Study Design	MMAT Category	Quality Score	Key Methodological Strengths	Key Methodological Limitations
Khan et al. (2024),[8] Pakistan	Exploratory Qualitative	Qualitative	4/5 (80%)	Clear research questions; appropriate qualitative approach; adequate data collection via FGDs and KIIs; findings grounded in data	Limited reporting on reflexivity; no mention of data saturation
Guerrero et al. (2023),[28] Peru	Participatory Research	Qualitative	5/5 (100%)	Clear research questions; participatory approach appropriate; adequate data collection; interpretation well-supported; coherence between sources and analysis	None identified
Leary et al. (2019),[29] Global	Mixed-Methods Pilot	Mixed Methods	4/5 (80%)	Adequate rationale for mixed methods; integration of qualitative and quantitative components; outputs adequately integrated	Limited reporting on divergences between qualitative and quantitative findings
Girl Effect Organization (2021),[30] Malawi, India, Rwanda	Mixed-Methods	Mixed Methods	3/5 (60%)	Adequate rationale for mixed methods; integration of components	Limited reporting on qualitative data analysis; unclear if outputs adequately integrated
Haruna et al. (2018),[31] Tanzania	RCT	Randomized Controlled Trial	4/5 (80%)	Adequate randomization; groups comparable at baseline; outcome data complete; appropriate statistical analysis	Blinding of outcome assessors not clearly reported
Malamsha et al. (2021),[32] Tanzania	Mixed-Methods	Mixed Methods	4/5 (80%)	Clear rationale for mixed methods; multiple data sources; integration appropriate	Limited detail on sampling strategy
Shen et al. (2026),[33] China	Implementation Research	Qualitative	4/5 (80%)	Clear research questions; appropriate qualitative approach; adequate data collection; findings grounded in data	Limited reflexivity reporting
Sun et al. (2022),[34] China	Mixed-Methods	Mixed Methods	3/5 (60%)	Clear rationale for mixed methods; adequate integration	Limited reporting on quantitative component; unclear how conflicts between data types were resolved
Dardas et al. (2026),[35] Jordan	Qualitative	Qualitative	4/5 (80%)	Clear research questions; appropriate qualitative approach; adequate data collection; findings grounded in data	Limited reflexivity reporting
Al-Ajlan (2025),[36] Saudi Arabia	Pilot Study	Non-Randomized	3/5 (60%)	Appropriate measures; intervention administered as intended	No control group; confounding factors not adequately addressed; limited blinding
Raj et al. (2025),[37] India	RCT	Randomized Controlled Trial	4/5 (80%)	Adequate randomization; groups comparable; complete outcome data; appropriate analysis	Blinding not clearly described
Mudhune et al. (2024),[38] Kenya	Cross-sectional	Quantitative Descriptive	4/5 (80%)	Appropriate sampling; adequate measures; appropriate statistical analysis	Cross-sectional design limits causal inference
Tadele et al. (2026),[39] Ethiopia	Quasi-experimental	Non-Randomized	4/5 (80%)	Participants representative; appropriate measures; confounding considered	No control group; limited blinding; short follow-up
Nik Farid et al. (2018),[40] Malaysia	Mixed-Methods	Mixed Methods	3/5 (60%)	Adequate rationale for mixed methods; integration of components	Limited reporting on qualitative data analysis; unclear if outputs adequately integrated

quality (60% criteria met) (Table 3). No studies were rated as limited quality.

Quality by Study Design

Randomized Controlled Trials (n = 4)

RCTs demonstrated the strongest methodological quality overall. Haruna et al,[31] and Raj et al.[37] each scored 4/5 (80%), with adequate randomization, comparable groups at baseline, complete outcome data, and appropriate statistical analysis. The common limitation was incomplete reporting of blinding procedures. This pattern is consistent with broader methodological concerns in digital health trials, where blinding of participants is often infeasible, but blinding of outcome assessors remains essential and should be explicitly reported. No RCT in the included studies achieved a perfect score, reflecting the need for improved reporting standards in digital health trials conducted in LMICs.

Quasi-experimental Studies (n = 1)

Tadele et al,[39] used the non-randomized study criteria. Tadele et al.[39] scored 4/5 (80%), demonstrating representative sampling, appropriate measures, and consideration of confounding factors, but lacking control groups. The revised JBI critical appraisal tool for quasi-experimental studies emphasizes that absence of control groups and failure to address confounding factors represent significant threats to internal validity.

Qualitative Studies (n = 4)

Guerrero et al.[28] achieved a perfect score (5/5), with clear research questions, appropriate qualitative approach, adequate data collection, well-supported interpretation, and coherence between sources, collection, analysis, and interpretation. Khan et al,[8] Dardas et al,[35] and Shen et al.[33] each scored 4/5 (80%), with limited reporting on reflexivity being the common limitation. Reflexivity—the researcher's critical examination of their own influence on the research process—is increasingly recognized as a core quality criterion in qualitative research.

Mixed-Methods Studies (n = 5)

Mixed-methods studies demonstrated greater variability in quality. Leary et al.[29] and Malamsha et al.[32] each scored 4/5 (80%), with adequate rationale for mixed methods and appropriate integration. GEO,[30] Sun et al,[34] and Nik Farid et al.[40] each scored 3/5 (60%), with common limitations including insufficient reporting on qualitative data analysis

and unclear integration of findings across components. The MMAT specifically requires assessment of whether the outputs of integration are adequately interpreted, reflecting the unique methodological considerations for mixed methods designs.

Discussion

This systematic review synthesized evidence from 14 primary studies on culturally tailored digital health education interventions for school-aged children in low- and middle-income countries (LMICs). The findings reveal that effective implementation strategies consistently employed multimodal delivery approaches, stakeholder engagement, and mobile-first design. Key barriers centered on infrastructural limitations, digital exclusion, socio-cultural sensitivities, and student engagement challenges. Ethical considerations focused on data privacy, informed consent, cultural sensitivity, and equity in digital access. Cultural adaptation strategies—particularly language translation, culturally resonant narratives, and community engagement—significantly enhanced intervention acceptability and effectiveness.

Implementation Strategies

The finding that multimodal delivery combining digital tools with participatory methods was the most frequently employed strategy (65% of studies) aligns with broader evidence on effective health education pedagogy.[41] Digital interventions alone may not sustain engagement, particularly among children and adolescents in resource-constrained settings where distractions, competing priorities, and variable attention spans present challenges. The integration of project-based learning, peer education, and interactive activities alongside digital content addresses this limitation by providing varied entry points for learning and reinforcing health messages through multiple modalities.

The success of game-based learning platforms in Tanzania[31,32] and mobile-based games in India[37] demonstrates that gamification can significantly enhance engagement and knowledge acquisition when culturally grounded. Haruna et al.[31] documented significant improvement in sexual health literacy scores from a mean of 29.26 to 70.36 ($P < 0.001$) among Tanzanian adolescents using a game-based learning platform. Similarly, Raj et al.[37] demonstrated significant improvement in reproductive health knowledge among adolescent girls in India using the Go Nisha Go Mobile Game. These findings are consistent with a systematic review of digital health promotion tools for youth in Sub-Saharan Africa,[42] which emphasized that interactive and engaging design is critical for sustained participation. However, the evidence also suggests that gamification alone is insufficient; cultural relevance and local context must be embedded within game mechanics and narratives to achieve meaningful outcomes.[43]

Stakeholder engagement and co-design emerged as essential implementation strategies in 59% of studies. The involvement of parents, teachers, community health workers, and students themselves in intervention development and delivery created a sense of ownership and joint responsibility that proved crucial for sustainability. This finding resonates with implementation science literature emphasizing that interventions developed without stakeholder input often fail to achieve adoption and sustained use, particularly in culturally diverse communities where external researchers may lack contextual knowledge.[44]

Youth co-design was documented in 35% of studies, reflecting growing recognition that children and adolescents possess unique insights into their own health information needs, communication preferences, and cultural contexts. The participatory research by Guerrero et al.[28] in Peru, where adolescents co-designed an SMS-based sexual health education platform, exemplifies this approach. By centering youth voices, interventions become more relevant and acceptable, potentially increasing engagement and effectiveness. However, co-design processes require careful facilitation to ensure that participation is meaningful rather than tokenistic, and that power imbalances between adult researchers and young participants are addressed.

The adoption of mobile-first design in 53% of studies reflects the reality of digital access in LMICs, where smartphone penetration has increased dramatically but desktop computer access remains limited. This strategic choice enabled interventions to reach populations that might otherwise be excluded from digital health education. Studies in Peru[28] and the multi-country study across Malawi, India, and Rwanda[30] demonstrated that mobile-optimized platforms can effectively deliver sensitive health information while providing privacy and anonymity—critical considerations for topics such as sexual and reproductive health.

However, mobile-first design alone does not guarantee digital equity.[45] As Shen et al.[33] demonstrated in rural China, cloud-based solutions were necessary to bridge the digital divide where connectivity gaps persisted. This finding underscores that digital interventions may inadvertently widen health knowledge gaps if offline populations are not explicitly addressed. Implementation strategies must therefore include offline access options, shared device solutions, and community-based digital literacy support to ensure equitable reach.

Barriers to Implementation

Infrastructural limitations emerged as the most frequently reported barrier (65% of studies), encompassing unreliable electricity, poor internet connectivity, and lack of multimedia equipment. These findings are consistent with broader literature documenting that digital health interventions in LMICs face systemic infrastructure challenges that cannot be resolved through intervention design alone.[46] As Khan et al.[8] documented in Pakistan, even when stakeholders strongly endorse digital health education, implementation remains contingent on electricity and internet availability that may be absent in 90% or more of government schools.

The persistence of infrastructural barriers across studies spanning Africa, South Asia, and Southeast Asia suggests that digital health education in LMICs cannot be considered independently of broader investments in educational infrastructure. Intervention designers must plan for low-resource scenarios, including offline functionality, printed materials as supplements, and flexible delivery models that accommodate intermittent connectivity. Policy advocacy for infrastructure investment is therefore an essential complement to intervention research.

Socio-cultural sensitivities were reported as barriers in 53% of studies, particularly around reproductive health, mental health, and HIV prevention. Gender norms affecting content delivery and participation were documented in 53% of studies, with religious and cultural taboos reported in 47%. These findings highlight that health topics perceived as sensitive or taboo cannot be addressed through digital delivery alone; they require careful cultural navigation, community engagement, and stakeholder trust-building.[47]

The successful integration of religious values into health messaging in Jordan[35] and Saudi Arabia[36] demonstrates that cultural and religious frameworks can serve as enablers rather than obstacles when approached respectfully. Similarly, gender-sensitive delivery in India[37] enhanced acceptability by aligning with cultural norms while still delivering essential health information. These adaptations reflect a nuanced understanding that cultural sensitivity does not mean avoiding sensitive topics but rather addressing them in culturally appropriate ways.

A unique barrier identified across the included studies was cultural taboos around child sexual abuse, documented in Malamsha et al.[32] in Tanzania, where cultural sensitivity was essential for intervention acceptability. This finding underscores that some health topics require particularly careful navigation to avoid causing harm or resistance.

Digital exclusion factors—including limited personal devices, shared family resources, and low digital literacy—were reported in 59% of studies. These findings raise important equity concerns: while digital health education offers scalability and reach, it may systematically exclude the most marginalized populations unless deliberate strategies are employed to include them. The digital divide is not merely a technical issue but reflects broader socioeconomic inequalities that shape access to devices, connectivity, and digital skills.[45]

Shen et al.[33] demonstrated that cloud-based solutions can effectively bridge the digital divide in rural China, suggesting that technological adaptations can address structural connectivity gaps. However, the finding that digital access equity was addressed as an ethical consideration in only 35% of studies suggests that equity remains an under-recognized priority in intervention design. To address this, interventions must incorporate equity-focused design principles: offline access options, community-based delivery points, shared device strategies, and digital literacy support as integral components rather than afterthoughts.

Teacher and staff resistance was reported in 29% of studies, with limited teacher training identified in 24%. These findings underscore that successful implementation requires not only appropriate technology and content but also human capacity and institutional support.[48] Teachers often serve as gatekeepers and facilitators of digital health education, yet they may lack training, resources, or motivation to effectively deliver interventions. Comprehensive teacher training programs that address content knowledge, digital literacy, and culturally responsive pedagogy are therefore essential.

Student engagement challenges, including absenteeism and difficulty sustaining motivation, were reported in 29% of studies. These findings highlight that digital interventions compete with multiple demands on children's time and attention, and that sustained engagement requires ongoing effort. Strategies such as varied activities, incentives, and culturally relevant content can help maintain participation, but structural factors such as poverty, child labor, and family responsibilities may limit attendance regardless of intervention design.[49]

System-level tensions in scaling digital mental health interventions were identified in Dardas et al. in Jordan,[35] highlighting that organizational and systemic factors can impede implementation even when interventions are culturally adapted. This finding suggests that implementation science approaches examining organizational readiness, policy alignment, and sustainability are needed.

Ethical Considerations

Data privacy protection was reported as an ethical consideration in 59% of studies, with confidentiality for sensitive topics documented in 53%. These findings reflect growing recognition that digital health interventions generate data that must be protected, particularly when children and adolescents are involved and when topics are sensitive. Digital footprints may reveal health information that could expose children to stigma, discrimination, or harm if not adequately safeguarded.

The ethical imperative for data privacy is particularly acute in LMIC contexts where regulatory frameworks for data protection may be less developed,[50] and where shared devices and family access to digital platforms may compromise confidentiality. Interventions must therefore incorporate robust data governance mechanisms, including anonymization, secure storage, access controls, and clear communication with participants and parents about data practices. The finding that parental consent was reported in 53% of studies and adolescent assent in 41% suggests that consent processes are being implemented, but the quality and cultural appropriateness of these processes warrant further attention.

Cultural sensitivity in content design was the most frequently reported ethical consideration, documented in 76% of studies. This finding reflects recognition that ethical practice in culturally diverse settings requires more than technical compliance with regulatory requirements; it demands genuine respect for cultural values, practices, and

worldviews. The integration of religious values, gender-sensitive delivery, and culturally resonant narratives are not merely implementation strategies but ethical commitments to honoring the communities being served.[51]

However, cultural adaptation also raises ethical tensions. Adaptations that accommodate cultural norms may inadvertently reinforce harmful practices or limit access to essential health information. For example, gender-separated delivery may align with cultural norms but could also perpetuate gender inequalities if not carefully designed. Similarly, framing mental health as stress management to reduce stigma may improve acceptability but could obscure the seriousness of mental health conditions and limit access to appropriate care.[52] These tensions require ongoing ethical reflection and stakeholder dialogue to navigate.

Equity in digital access was addressed as an ethical consideration in 35% of studies, with inclusion of marginalized groups reported in 29%. These relatively low percentages suggest that digital equity remains an under-recognized ethical priority in intervention design. If digital health education is to contribute to health equity rather than exacerbate disparities, it must explicitly prioritize reach to the most marginalized populations—those without devices, connectivity, or digital literacy.[53] This requires not only intervention-level adaptations (offline access, community delivery points) but also structural advocacy for digital inclusion policies. Researchers and implementers have an ethical obligation to consider who is excluded from digital interventions and to take deliberate steps to include them.[54] Failure to do so risks creating a two-tier system where connected children receive enhanced health education while disconnected children fall further behind.

The study by Nik Farid et al.[40] in Malaysia, which localized health promotion content for indigenous communities, raises important considerations regarding indigenous data sovereignty and cultural respect. Indigenous communities have rights to control how their cultural knowledge, language, and health information are used and represented. Digital interventions involving indigenous populations must therefore be developed in partnership with communities, respecting their protocols for knowledge sharing and ensuring that benefits accrue to the community.[55]

An additional ethical consideration identified across the included studies was system-level accountability in scaling digital mental health interventions, documented in Dardas et al.[35] This study identified tensions between scalability and ethical fidelity to community needs, highlighting that as interventions expand, maintaining ethical commitments to cultural appropriateness, privacy, and equity becomes increasingly complex. This finding underscores the need for ethical frameworks that address not only individual-level protections but also system-level accountability in digital health scaling.[35]

Cultural Adaptation Strategies

Language translation was the most frequently employed cultural adaptation strategy (65% of studies), reflecting the fundamental importance of delivering health information in languages that children and families understand. Translation into Urdu, Hindi, Bengali, Siswati, Jahai, and Temiar enabled interventions to reach populations that would otherwise be excluded by language barriers. However, translation alone is insufficient; cultural adaptation requires attention to metaphors, idioms, and concepts that may not have direct equivalents across languages.[56]

Localized content—including local food examples, culturally appropriate physical activities, and region-specific health issues—was reported in 47% of studies. This level of adaptation moves beyond surface-level translation to engage with the lived experiences and cultural contexts of target populations. For example, Sun et al.[34] in China incorporated culturally adapted dietary content into the AppSalt intervention.

Culturally resonant narratives were employed in 53% of studies, using local stories, metaphors, and scenarios that reflect children's lived experiences. The success of multimedia storytelling approaches demonstrates that narrative methods can effectively convey sensitive health information while respecting cultural values and engaging young audiences.[57] Stories allow children to see themselves in health scenarios, process complex information through familiar frameworks, and develop emotional connections that support learning and behavior change. Malamsha et al.[32] in Tanzania employed culturally sensitive narratives for child sexual abuse prevention education, demonstrating that even highly sensitive topics can be addressed through culturally grounded storytelling.

Community engagement was reported in 59% of studies, involving parents, teachers, community health workers, and religious leaders. This strategy serves both practical and ethical functions: practically, community engagement enhances acceptability, trust, and sustainability; ethically, it respects community autonomy and ensures that interventions align with community values and priorities. The involvement of community health workers in the health intervention in Ethiopia[39] exemplifies how community engagement can extend reach and enhance cultural appropriateness.

Gender-separated delivery was documented in 35% of studies, particularly in Middle Eastern and South Asian contexts. Studies in Jordan, Saudi Arabia, and India arranged activities to align with cultural gender norms while still delivering essential health information.[35-37] Religious integration was documented in 24% of studies, framing health messages within religious values and teachings. These adaptations reflect a nuanced understanding that cultural sensitivity does not mean avoiding sensitive topics but rather addressing them in culturally appropriate ways.

Another adaptation strategy identified across the included studies was the use of cloud-based solutions for bridging the digital divide in rural China.[33] This implementation research demonstrated that cloud-based educational solutions can effectively extend digital health education to rural populations with limited connectivity,

addressing structural barriers to digital access. This strategy represents a technological adaptation that complements cultural adaptations, ensuring that interventions reach the most marginalized populations.

The findings of this review are consistent with and extend previous systematic reviews on digital health interventions for children and adolescents.[58,59] A review of digital health promotion tools for youth in Sub-Saharan Africa similarly found that interactive, culturally adapted interventions show promise but face implementation barriers related to infrastructure and digital literacy.[7] The emphasis on stakeholder engagement and co-design aligns with implementation science literature emphasizing that interventions developed with and for communities are more likely to be adopted and sustained.[60]

The ethical considerations identified in this review—particularly data privacy, cultural sensitivity, and equity—are increasingly recognized as central to digital health ethics.[53] However, the relatively low proportion of studies explicitly addressing algorithmic bias and indigenous data sovereignty suggests that these emerging ethical issues remain under-recognized in LMIC digital health education research. As artificial intelligence and algorithmic personalization become more prevalent, these considerations will require greater attention.

The finding that system-level tensions in scaling digital mental health interventions were identified in Dardas et al.[35] aligns with broader implementation science literature emphasizing that organizational and systemic factors are critical determinants of successful scale-up.[61] This underscores the need for implementation frameworks that address not only individual-level behavior change but also organizational readiness, policy alignment, and system-level accountability.[62]

Implications for Policy and Practice

Policymakers should prioritize investment in digital infrastructure in schools, including reliable electricity, internet connectivity, and multimedia equipment. Without these foundational investments, digital health education cannot achieve its potential reach and impact. Additionally, policies should support teacher training in digital literacy and culturally responsive pedagogy, recognizing that technology alone cannot transform health education. The finding that system-level tensions impede scaling[35] suggests that policy alignment across health and education sectors is essential.

Implementers should adopt equity-focused design principles from the outset, including offline access options, community-based delivery points, and digital literacy support. Cultural adaptation should go beyond language translation to encompass culturally resonant narratives, local content, and community engagement.[43] Stakeholder co-design should be embedded throughout the intervention lifecycle, not limited to initial development. The success of cloud-based solutions in rural China[33] suggests that technological adaptations can address structural connectivity gaps when designed with equity in mind.

Researchers should prioritize long-term outcome evaluation to understand sustained effects of digital health education. Comparative studies examining cultural adaptation strategies across contexts would inform evidence-based guidelines. Implementation science approaches that examine organizational readiness, policy alignment, and sustainability are needed. Finally, research should explicitly address emerging ethical issues, including algorithmic bias, data governance, and indigenous data sovereignty.

Strengths and Limitations of this Review

This review has several strengths. It is the first systematic review, to our knowledge, to synthesize evidence specifically on culturally tailored digital health education for school-aged children in LMICs. The inclusion of 14 primary studies from diverse geographic contexts provides a comprehensive overview of implementation strategies, barriers, and ethical considerations. The use of MMAT for quality appraisal ensures rigorous assessment of methodological quality. The thematic synthesis approach captures the complexity and nuance of implementation in diverse cultural contexts.

Several limitations should be acknowledged. First, the review was limited to English-language publications, potentially excluding relevant studies published in other languages. Second, the search was limited to four databases, and relevant studies may exist in other sources. Third, the heterogeneity of study designs, populations, and outcomes precluded meta-analysis, limiting quantitative synthesis. Fourth, most included studies had short follow-up periods, limiting understanding of sustained effects. Fifth, publication bias may have led to overrepresentation of successful interventions.

Future Research Directions

Future research should address several gaps identified in this review. First, long-term outcome evaluation is needed to understand sustained effects of digital health education on knowledge, behavior, and health outcomes. Second, comparative studies examining different cultural adaptation strategies would inform evidence-based guidelines for tailoring interventions. Third, implementation science research examining organizational readiness, policy alignment, and sustainability is needed, particularly given the system-level tensions identified in Dardas et al.[35] Fourth, research on digital equity—including strategies for reaching offline populations—should be prioritized, building on the cloud-based solutions demonstrated in Shen et al.[33] Fifth, emerging ethical issues, including algorithmic bias, data governance, and indigenous data sovereignty, warrant explicit attention. Finally, research should include children's perspectives on digital health education, recognizing them as active agents in their own health learning rather than passive recipients.

Conclusion

Culturally tailored digital health education shows promise for improving health literacy among school-aged children in LMICs. Effective implementation requires multimodal delivery, stakeholder engagement, and mobile-first design. Persistent barriers—including infrastructural limitations, digital exclusion, and socio-cultural sensitivities—must be systematically addressed. Ethical considerations, particularly data privacy, cultural sensitivity, and equity, are central to responsible intervention design and delivery. By attending equally to effectiveness, cultural appropriateness, and ethical safeguards, the field can realize the potential of digital health education to advance health equity for children in low- and middle-income communities worldwide.

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Competing Interests

The authors declare no conflict of interest.

Ethical Approval

This study is a literature review and did not involve human or animal research. It was conducted in full compliance with ethical standards, adhering to principles of academic integrity and transparency.

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