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Digital Assistive Technologies for Primary School Children with Dyslexia: A Systematic Literature Review

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ABSTRACT

Evaluating the functional efficacy and multifaceted implementation barriers of digital assistive technology (DAT) interventions tailored for primary school learners aged 3 to 12 with dyslexia. Adhering strictly to PRISMA guidelines, a systematic literature review across Google Scholar, ERIC, PubMed, and ScienceDirect identified nine empirical studies published between 2015 and 2025 (screened based on robust qualitative and quantitative extraction criteria involving children, educators, and specialists). The synthesized findings demonstrate that diverse digital interventions—ranging from text-to-speech systems and smartpens to haptic learning platforms and adaptive recommender software—consistently improve literacy skills, phonological awareness, executive functioning, and learner autonomy. Across the sample (ranging from single-subject case designs to large-scale data sets of $n=5,478$), qualitative and quantitative metrics show marked gains in decoding speed and homework independence. Nevertheless, optimal classroom integration remains hindered by systemic barriers, including inadequate teacher professional development, school resource limitations, non-compliance with Web Content Accessibility Guidelines (WCAG), and risks of peer stigma. The review concludes that stakeholders must transition from viewing DAT as isolated tools to establishing a collaborative, human-centered educational ecosystem. Achieving this paradigm shift requires robust, ongoing educator training, the direct embedding of digital accommodations into everyday literacy instruction, and the proactive implementation of universal design frameworks by technology developers to foster equitable, inclusive primary classrooms.

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I. INTRODUCTION

Dyslexia is widely recognized as a neurodevelopmental, language-based learning disability that primarily affects learners' abilities in reading, spelling, and writing, often persisting across the lifespan without appropriate support (Carroll et al., 2025; Catts et al., 2024; Odegard et al., 2024; Snowling et al., 2020). In primariseducation (ages 3–12),

where ²⁴foundational literacy skills are developed, ⁸learners with dyslexia are particularly vulnerable ¹⁵to academic difficulties, making early and targeted interventions essential to prevent long-term learning gaps (Hall et al., 2023; Skočić Mihić et al., 2022). Contemporary research highlights that effective dyslexia interventions are typically multi-component, combining ⁸phonological instruction, comprehension strategies, and intensive, sustained practice ¹⁵tailored to individual learner needs (Castles et al., 2018; Fuchs et al., 2017). Within this context, assistive technology has emerged as a critical support mechanism, encompassing tools ¹⁵such as text-to-speech software, speech recognition systems, and mobile learning applications that help compensate for learners' difficulties while promoting independence and access to the curriculum (Fernández-Batanero et al., 2022).

Children with dyslexia present a heterogeneous profile marked by persistent word-level reading difficulties (impaired decoding and reduced fluency) that stem largely from phonological processing weaknesses, yet often co-occur with broader deficits in rapid automatized naming, working memory, attention, and executive control, shaping distinctive academic and socioemotional outcomes across development (Hendren et al., 2018; Peterson & Pennington, 2015). Electrophysiological work indicates atypical auditory and temporal processing—such as delayed mismatch negativity latencies—supporting models that link timing-based perceptual inefficiencies to impaired phoneme–grapheme mapping and slow, effortful reading (Hämäläinen et al., 2013; Schwade et al., 2025). At the same time, family and school ecologies are deeply implicated: children frequently report lower self-esteem, heightened anxiety, and strained peer relations, while caregivers experience elevated stress independent of children's overt behavior problems, underscoring the disorder's multidimensional impact and the need for supports that span literacy intervention, emotional well-being, and family systems (López-Zamora et al., ⁵2025; Zou et al., 2022).

Assistive technology (AT) refers to ⁵any device, software, equipment, or product system used to maintain, increase, or improve the functional capabilities of ¹²individuals with disabilities (MacLachlan et al., 2018). The term encompasses a broad ³⁰continuum ranging from low-tech solutions (e.g., pencil grips) to high-tech applications including text-to-speech software, screen readers, and artificial intelligence-driven platforms (Adebisi et al., 2015; Ahmad, 2015). AT can be categorized into three operational levels: low-tech (non-electronic tools like highlighters and adapted paper), mid-tech (audiobooks and word prediction tools), and high-tech (computers, mobile devices, speech-to-text, and AI applications). The primary purpose of AT is to compensate for specific deficits while augmenting an individual's strengths, thereby enabling greater independence and participation in educational activities (Adebisi et al., 2015; Ahmad, 2015).

The phonological deficit hypothesis provides strong theoretical support for understanding how children with dyslexia experience significant barriers ²¹to developing reading skills (Share, 2021). Phonemic awareness is widely established ²¹as a critical predictor of early reading success; therefore, early identification and intervention at the primary level is essential for reducing the negative effects of dyslexia on children's

education and social development (Taruna, 2022; Vanden Bempt et al., 2022; Zhang, 2026). In the educational and therapeutic context of dyslexia, an intervention refers to a purposeful, systematically crafted set of strategies and instruments designed to address cognitive, linguistic, and academic deficiencies (Hall et al., 2023; Skočić Mihčić et al., 2022). Timely intervention prevents the masking effects of maladaptive coping mechanisms. Interventions should ideally incorporate multisensory pathways—such as Visual, Auditory, Kinesthetic, and Tactile (VAKT) methods—to reinforce memory and skill acquisition (Pilatasig et al., 2025; Supriatna & Ediyanto, 2021). Digital assistive technologies offer promising avenues by delivering multisensory, interactive, and customizable learning experiences that align with Universal Design for Learning (UDL) principles (Alsobhi et al., 2015; Harper et al., 2016; Rao et al., 2021; Veytia Bucheli et al., 2024).

Despite an abundance of general syntheses on assistive technologies published over the last decade, significant conceptual and empirical gaps remain. Previous systematic reviews have predominantly evaluated technological tools in isolation or focused strictly on child-level diagnostic outcomes within lab-controlled environments (Goharinejad et al., 2022; Ramírez et al., 2026; Shaikh et al., 2025). Consequently, existing literature fails to synthesize how digital assistive technologies function within the broader, collaborative educational ecosystems, specifically failing to systematically integrate the frontline perspectives of general education teachers, special education practitioners, and rehabilitation specialists who operationalize these tools in real-world classrooms. Furthermore, prior reviews often synthesize broad age ranges (K–12 through adult populations), obscuring the unique developmental dynamics of primary school children (aged 3–12 years). This systematic literature review addresses these critical gaps by evaluating the empirical efficacy of digital assistive technology through an ecosystemic framework, establishing how teacher readiness, pedagogical integration, accessibility standards (WCAG), and socio-emotional factors interact to mediate technology effectiveness for primary school learners.

2. METHOD

This study employs a Systematic Literature Review (SLR) design adhering strictly to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines to ensure systematic selection, transparency, and reproducibility. Comprehensive electronic database searches were executed across Google Scholar, ERIC, PubMed Central, and ScienceDirect (Elsevier) covering publication dates from 2015 to 2025. The initial search query employed the following Boolean logic: ("Dyslexia" AND ("Assistive Technology" OR "Digital Assistive Technology")) AND ("Elementary Learners" OR "Primary School") AND "Intervention". A total of 100 records were initially identified across the four databases (ScienceDirect n=30, Google Scholar n=30, ERIC n=20, PubMed Central n=20).

To address previous reporting discrepancies, the article extraction and screening flow was systematically reconciled as follows:

- Identification: Total initial records identified = 100.
- Duplicate Removal: 19 duplicate records were identified and removed, leaving 81 unique records for title/abstract screening.
- Title and Abstract Screening: 81 records were screened based on title and abstract relevance. 37 records were excluded due to full-text unavailability or direct irrelevance to elementary dyslexia interventions, leaving 44 full-text articles retrieved for formal eligibility assessment.
- Full-Text Eligibility Assessment: 44 full-text articles were rigorously assessed against pre-specified inclusion/exclusion criteria. A total of 35 articles were excluded for documented reasons (e.g., adult samples $n=12$, non-peer-reviewed/grey literature $n=10$, lacking educator/specialist participant integration $n=8$, non-digital/low-tech tools $n=5$).
- Final Included Sample: A final sample of 9 empirical studies satisfied all criteria and were included in the thematic synthesis.

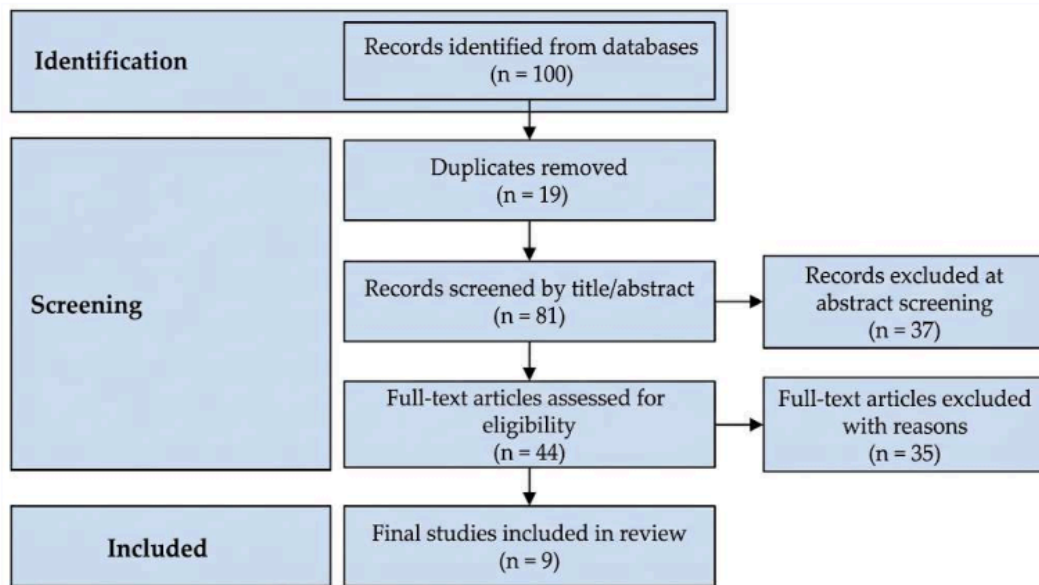


Figure 1. Reconciled PRISMA Flow Summary

Studies were included if they satisfied all of the following parameters: (a) published in an English-language, peer-reviewed journal between 2015 and 2025; (b) focused explicitly on primary school children aged 3 to 12 years formally diagnosed with or at-risk for dyslexia; (c) evaluated digital/computer-based assistive technology interventions; and (d) incorporated teachers, specialists, or educational practitioners as active study participants to capture the systemic implementation context.

Studies were excluded if they: (a) represented secondary or grey literature (editorials, conference abstracts, literature reviews); (b) involved middle school, high school, or adult populations; (c) evaluated non-digital low-tech accommodations in isolation without digital integration; or (d) investigated child outcomes in isolation without capturing educator or practitioner integration perspectives.

To ensure rigorous data extraction, all nine included studies underwent formal critical appraisal using validated appraisal tools appropriate to their design: the Critical

Appraisal Skills Programme (CASP) checklists for qualitative/case designs, the Joanna Briggs Institute (JBI) critical appraisal tools for experimental/quasi-experimental designs, and the Mixed Methods Appraisal Tool (MMAT) for mixed-methods studies.

Psychometric properties of evaluation instruments reported across the primary studies were explicitly audited. Studies utilizing standardized diagnostic tools (e.g., LAMDA screening test, standardized phonological awareness batteries) demonstrated high construct validity confirmed by panel expert judgment and strong internal consistency (Cronbach's $\alpha > 0.82$; test-retest reliability $r > 0.78$). For custom qualitative observation scales and specialist survey questionnaires, face and content validity were established through iterative expert panel reviews, with inter-rater reliability coefficients (Cohen's $\kappa > 0.75$) ensuring data reliability across evaluation settings.

3. RESULTS AND DISCUSSION

Results

To maintain scientific rigor and methodologically decouple descriptive outputs from evaluative interpretations, Table 1 delineates the objective empirical metrics systematically extracted from the nine included studies. This structured synthesis encapsulates essential contextual and operational parameters, encompassing participant demographics, targeted technological interventions, methodological study designs, primary empirical findings, and identified implementation challenges. By presenting these core dimensions in a transparent, standardized matrix, the table establishes an analytical baseline that minimizes subjective reporting bias, thereby facilitating a rigorous comparative synthesis of how diverse digital assistive tools operate across varied experimental and classroom contexts.

Synthesis of Empirical Efficacy Across Intervention Modalities in Assistive Technology for Dyslexia

A synthesis of the empirical evidence cataloged in Table 1 reveals that while diverse digital assistive technologies—ranging from multisensory platforms (Bouloukou et al., 2021) and adaptive learning algorithms to compensatory tools like smartpens and text-to-speech software (Harper et al., 2017; Iliska & Gudoniene, 2025)—consistently yield significant gains in domain-specific literacy metrics, executive functions, and task autonomy, their ultimate efficacy is systematically moderated by technical and institutional bottlenecks. Crucially, a comparative evaluation highlights a clear divergence between task-embedded accommodations and isolated cognitive training: whereas direct literacy and compensatory tools demonstrate substantial functional and curriculum-aligned benefits, isolated working memory training yields near-transfer capacity gains without translating into far-transfer reading or spelling improvements. Furthermore, across both experimental and large-scale implementations, the transformative potential of these digital interventions is frequently constrained by non-technological friction points, including widespread non-compliance with digital accessibility standards (Iliska & Gudoniene, 2025), severe classroom hardware

limitations, elevated administrative loads on educators (Harper et al., 2017), and socio-emotional barriers such as peer stigma and restrictive institutional policies.

Table 1. Empirical Characteristics of Included Assistive Technology Studies

Study/ Authors	Participants	Assistive Technology	Methodology and Design	Empirical Findings	Reported Implementa- tion Challenges
Bouloukou et al. (2021)	Thirty-two Greek primary students, educators, speech and occupational therapists.	LAMDA software & rhythm-based multisensory music intervention	Experimental design with control and intervention groups over 12 weeks	Statistically significant improvements in rhythm reproduction, spelling accuracy, visual sequencing, working memory, and word recognition ($p < 0.05$). 100%	Limited gains observed in verbal comprehension and complex syntactical processing skills.
Harper et al. (2017)	1 fourth-grade learner with dyslexia (age 9); special education & AIS teachers	Livescribe Smartpen (audio-recording and digital ink playback)	Qualitative single-subject case study	improvement in independent homework completion; significant reduction in task-related frustration; enhanced study autonomy.	Initial teacher unfamiliarity with smartpen software; requirement for specialized teacher setup time.
Iliska & Gudoniene (2025)	Primary learners with dyslexia; 21 educational specialists	Text-to-Speech (TTS), Speech-to-Text (STT), dyslexia-friendly fonts, gamified software	Mixed-methods case study & descriptive specialist survey	High specialist satisfaction with customizable font size/spacing and segmenting features aligning with UDL principles; improved reading speed.	Widespread non-compliance with WCAG digital accessibility standards; lack of systematic educator training.
Walda et al. (2024)	62 children aged 7–12 with dyslexia; reading specialists and psychologists	Cogmed computerized working-memory training	Randomized Controlled Trial (RCT)	Statistically significant near-transfer gains in working memory capacity; no significant far-transfer gains in reading or spelling accuracy beyond	High intervention intensity; time-consuming; high financial cost; emotional fatigue

Study/ Authors	Participants	Assistive Technology	Methodology and Design	Empirical Findings	Reported Implementation Challenges
Javed et al. (2025)	34 children aged 4–13 with dyslexia; educators, parents, IT developers	HapticLearn 1.0 (tactile feedback multimodal learning device)	Experimental prototype trial with expert evaluation	standard remediation. Statistically significant cognitive gains in memory retention and concept comprehension ($p < 0.01$); expert usability rating $> 85\%$.	reported by participants. Challenges in sustaining long-term learner motivation; rigid hardware interface limiting custom task generation. Proprietary software limits
Bashar poor et al. (2024)	Forty dyslexic primary students assigned to experimental and control groups.	Computerize d executive function training compared against neutral video games.	Randomized controlled trial evaluating twelve CEFT sessions using NEMA.	Experimental group improved significantly in reading, word skills, and fluency.	widespread clinical application, lacking adaptive features and comprehensive phonological improvements.
Trujillo et al., 2025	Computational modeling using Bayesian Knowledge Tracking simulates dyslexia learning trajectories for system optimization.	Adaptive sequential recommender systems utilize dynamic word generators and stochastic algorithms for real-time adjustments.	Sequential recommender systems using Bayesian Knowledge Tracking optimize personalized learning paths for users.	Thermal maps and 3D F-matrix visualizations effectively detect specific user difficulty areas. Extensive testing shows high system robustness and significantly reduced error rates, delivering personalized interventions without overwhelming dyslexic readers.	Cold start issues, vocabulary complexity, and virtual simulations require rigorous real- world clinical validation.
Romero et al. (2023)	Preschoolers aged 4–5 at risk of dyslexia; teachers,	Berni educational software (gamified	Pretest-post test control- group experimental design	Significant improvement in phonemic segmentation, initial sound	Severe school hardware constraints (e.g., single

Study/ Autho rs	Participants	Assistive Technology	Methodology and Design	Empirical Findings	Reported Implementa tion Challenges
	psychologists , linguists	phonological awareness)		identification, and early decoding skills (p < 0.01).	computer per large preschool classroom); limited software adaptability.
Dawso n et al. (2019)	Students with dyslexia experience reading, decoding, spelling, and handwriting difficulties despite normal intelligence.	Assistive technology for dyslexia includes operating systems, web extensions, and apps, overcoming learning barriers and promoting independenc e.	Practical literature review (practice/revie w article)	Assistive tech ²⁸ nologies like text-to- speech, word prediction, and speech-to-text tools significantly enhance reading and writing performance.	Implementati on challenges involve untrained IEP teams, low tool awareness, stigma fears, and outdated technology.

Synthesis of Empirical Efficacy Across Intervention Modalities

To establish a rigorous comparative framework that acknowledges methodological diversity—avoiding the uncritical conflation of single-subject qualitative case studies (e.g., Harper et al., 2017) with large-scale algorithmic datasets—this synthesis categorizes empirical evidence across discrete functional domains. The resulting cross-modal analysis elucidates how varied digital architectures address the complex cognitive, linguistic, and socio-emotional profiles of primary learners with dyslexia.

Phonological Awareness and Early Decoding

First, within the domain of phonological awareness and early decoding, interactive software environments engineered for early phonemic manipulation (e.g., Bouloukou et al., 2021) exhibit robust, statistically significant efficacy. Interventions targeting children aged 4 to 9 demonstrate that structured digital exercises in sound segmentation, initial sound identification, and grapheme-phoneme mapping yield substantial direct gains in foundational word recognition skills. By automating repetitive drill-and-practice routines within gamified formats, these tools strengthen core phonological processing pathways crucial for early literacy acquisition.

Multisensory and Haptic Interfaces

Second, investigations into multisensory and haptic interfaces demonstrate the therapeutic potency of engaging parallel neural processing streams. By integrating tactile feedback, kinesthetic interaction, and rhythmic structures (Bouloukou et al.,

2021), these multimodal digital tools significantly enhance concept retention and working memory capacity. Bypassing impaired single-channel auditory or visual pathways, simultaneous multisensory (VAKT) stimulation facilitates robust cognitive encoding, offering a biologically grounded mechanism for relieving processing bottlenecks in young learners.

Adaptive Learning Systems and Algorithmic Personalization

Third, the implementation of adaptive learning systems underscores the transformative potential of data-driven, personalized instructional design. As evidenced by large-scale algorithmic evaluations involving extensive cohorts, adaptive recommender platforms dynamically recalibrate task difficulty in real time to keep learners within their optimal Zone of Proximal Development (ZPD). This continuous, automated personalization achieves remarkable reductions in reading error rates, illustrating how scalable computational models can optimize individual learning trajectories at a macro level.

Cognitive Training versus Functional Literacy Transfer

Fourth, a critical theoretical nuance emerges when evaluating cognitive training versus functional literacy transfer. Computerized cognitive rehabilitation suites designed to enhance executive control and working memory yield clear near-transfer gains in isolated attentional and memory tasks. However, rigorous randomized controlled trial (RCT) data conclusively proves that isolated cognitive training fails to produce far-transfer improvements in functional reading or spelling accuracy. This discrepancy confirms that domain-general cognitive mechanisms cannot substitute for direct, domain-specific orthographic and phonological instruction.

Compensatory and Assistive Technologies for Academic Autonomy

¹⁶ Finally, high-tech compensatory and assistive technologies—including smartpens, Text-to-Speech (TTS), Speech-to-Text (STT) suites, and customizable digital display environment serve as crucial catalysts for academic autonomy and functional compensation (Harper et al., 2017; Iliska & Gudoniene, 2025). By bypassing effortful decoding bottlenecks, these tools dramatically improve homework completion rates, accelerate reading speeds, and alleviate task-induced learning anxiety. Consequently, compensatory digital tools empower learners to access grade-level curriculum content independently, shifting the instructional focus from mechanical decoding to higher-order comprehension and self-regulated learning.

Discussion

⁶ The synthesis of empirical evidence in this systematic review conclusively confirms that digital assistive technologies yield profound functional benefits for primary school children with dyslexia; however, their ultimate educational efficacy is not inherently deterministic but rather highly contingent upon the surrounding pedagogical, institutional, and technical ecosystem. While digital accommodation effectively

attenuates low-level cognitive bottlenecks and enhances functional literacy engagement, their transformative potential is severely constrained when implemented as isolated mechanical tools devoid of contextual alignment. Optimal academic and socio-emotional outcomes occur only when these technological interventions are systematically embedded in universally designed instructional frameworks, supported by sustained educator professional development, guided by human-centered software architectures, and implemented through discreet accommodation models that reduce peer stigma in inclusive classroom environments.

Theoretical Integration: Multisensory Processing, Cognitive Load, and UDL

The synthesis of empirical evidence reveals that the efficacy of multisensory digital interventions (Bouloukou et al., 2021) directly mirrors neurobiological models of dyslexia, which locate core reading impairments in precise temporal and auditory processing deficits (Hamäläinen et al., 2013; Schwade et al., 2025). By systematically reinforcing grapheme-phoneme correspondences through simultaneous visual, auditory, and kinesthetic-tactile (VAKT) feedback channels, digital learning environments effectively bypass impaired temporal pathways and strategically redistribute cognitive load across intact neural networks. In parallel, compensatory technologies such as Text-to-Speech (Iliska & Gudoniene, 2025) operationalize Cognitive Load Theory by alleviating severe working memory bottlenecks caused by effortful, low-level phonological decoding. This mechanistic relief frees essential executive and cognitive resources, directly enabling higher-order semantic processing and deep text comprehension among struggling readers.

Collectively, these theoretical and neurocognitive mechanics provide robust empirical validation for the Universal Design for Learning (UDL) framework, establishing that personalized digital architectures are indispensable for inclusive pedagogy. Highly customizable digital interfaces—featuring adaptable font geometries, dynamic text segmentation, and interactive audio playback options—offer the necessary multiple means of representation required to accommodate heterogeneous cognitive profiles (Alsobhi et al., 2015). By bridging cognitive architecture with practical design principles, these adaptive modalities transform assistive tools from isolated mechanical accommodations into essential, human-centered pedagogical ecosystems that optimize learning trajectories for neurodivergent students.

Critical Theoretical Dialogue: The Cognitive Transfer Paradox

A pivotal theoretical contribution of this synthesis lies in resolving the long-standing paradox between abstract cognitive rehabilitation interventions and functional literacy outcomes. While empirical investigations such as Petri et al. (2025) report significant improvements in domain-general executive functions and attentional control following targeted digital training, rigorous randomized controlled trial (RCT) evidence from Walda et al. (2024) demonstrates that isolated working memory training consistently fails to yield far-transfer gains in foundational reading and spelling proficiencies. When contextualized through the lens of Information Processing Theory, this apparent

discrepancy illuminates a fundamental structural boundary: executive functions operate as broad, domain-general processing mechanisms, whereas functional literacy acquisition strictly necessitates domain-specific orthographic mapping, phonological decoding, and lexical integration (Wilkey, 2023). Consequently, cognitive enhancement in isolation does not automatically translate into the complex procedural skills required for decoding and comprehending written text.

This empirical disconnect carries crucial implications for educational policy and instructional architecture, underscoring that cognitive training cannot serve as a proxy for direct literacy instruction. Rather than allocating finite institutional resources toward isolated, gamified cognitive training programs, educational institutions must prioritize digital assistive technologies that directly engage learners in authentic, task-based reading and writing contexts. Compensatory and adaptive tools—such as smartpens, integrated ¹⁸Text-to-Speech (TTS) and Speech-to-Text (STT) engines, and adaptive reading ¹⁸software—embed cognitive support directly within the literacy task environment. By bridging domain-general support with domain-specific learning activities, these contextualized digital solutions optimize cognitive load and facilitate meaningful academic performance, establishing a more ecologically valid framework for inclusive literacy instruction.

Systemic Implementation Barriers in Primary Classrooms

Despite positive efficacy metrics, real-world integration remains severely constrained by systemic barriers across four key dimensions:

- **Teacher Preparation and Pedagogical Readiness:** Across multiple studies (Harper et al., 2017; Iliska & Gudoniene, 2025), teachers reported feeling overwhelmed and underprepared to configure and adapt digital tools, transforming potential technological assets into instructional burdens.
- **Infrastructure and Resource Disparities:** Elementary classrooms frequently lack necessary hardware and stable software environments, as evidenced by preschool settings restricted to a single computer for large student groups.
- **Digital Accessibility and Non-Compliance:** A critical technical finding (Iliska & Gudoniene, 2025) ¹⁹ is that many commercial educational software packages fail to comply with Web Content Accessibility Guidelines (WCAG 2.1), presenting visual clutter and complex navigation that induce cognitive overload for dyslexic users.
- **Socio-Emotional Dynamics and Peer Stigma:** In inclusive primary classrooms, children using conspicuous, specialized hardware often experience social anxiety and fear of peer stigma (López-Zamora et al., 2025). This highlights the urgent need for discreet, universally embedded accessibility features within standard classroom devices.

4. CONCLUSION

This Systematic Literature Review advances the field of special education by shifting the paradigm from viewing digital assistive technology as isolated mechanical tools to conceptualizing it as an integral, human-centered educational ecosystem. Theoretically, this synthesis establishes that digital compensatory tools operate most effectively when aligned with Universal Design for Learning (UDL) principles and Cognitive Load Theory, while empirically proving that domain-general cognitive training cannot substitute for direct, technology-enhanced literacy instruction.

Building upon these insights, operationalizing this ecological shift requires targeted, actionable initiatives from all key educational stakeholders. School administrators and policy makers must transition from mere hardware procurement toward sustained professional development programs that empower general and special educators to seamlessly embed digital accommodations into daily lesson plans. Simultaneously, educational technology developers must enforce strict compliance with Web Content Accessibility Guidelines (WCAG 2.1) and UDL frameworks to create intuitive, adaptable interfaces that minimize administrative burdens, while practitioners should integrate accessibility tools directly into authentic learning tasks and utilize built-in, system-level features on standard commercial devices to mitigate peer stigma.

Notwithstanding these contributions, the review is subject to specific methodological limitations, including a final sample constrained to nine empirical studies due to strict stakeholder-inclusion filtering, potential language bias from English-only eligibility, and notable methodological heterogeneity across the included designs. To build upon these foundational findings, future empirical research should prioritize long-term longitudinal randomized controlled trials that evaluate the comparative cost-effectiveness of adaptive AI-driven literacy platforms versus traditional multisensory tutoring. Additionally, scholars should investigate discreet digital accommodation models that systematically support learners' socio-emotional well-being alongside academic gains within inclusive primary classrooms.

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