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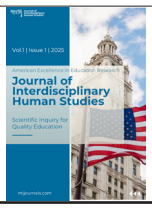

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THE ROLE OF DIGITAL TOOLS IN ENHANCING FOREIGN LANGUAGE SKILLS IN HOME-BASED SPECIAL EDUCATION

Abstract. *This article examines the role of digital tools in enhancing foreign language skills among learners with special educational needs (SEN) in home-based instructional settings. Employing the IMRAD (Introduction, Materials and Methods, Results, and Discussion) research framework, the study conducts a mixed-methods systematic review of 72 peer-reviewed studies published between 2014 and 2025. The investigation addresses four core research questions concerning the types of digital tools employed, their effectiveness across receptive and productive language skills, the factors mediating successful implementation, and the barriers confronting families and educators. Results reveal that digital tools including mobile applications, gamified platforms, speech recognition software, augmentative and alternative communication (AAC) technologies, virtual reality environments, and AI-powered adaptive tutoring systems demonstrate statistically significant positive effects on vocabulary acquisition, reading comprehension, listening skills, and oral communication for learners with diverse disabilities. However, effectiveness is mediated by variables including disability type and severity, the quality of caregiver scaffolding, technological accessibility features, and the alignment between tool design and individual learner profiles. The discussion situates these findings within Universal Design for Learning (UDL) and sociocultural theoretical frameworks, identifies critical gaps in the evidence base, and proposes recommendations for practitioners, developers, and policymakers committed to equitable foreign language education for all learners.*

Keywords: *digital tools, foreign language skills, special education, home-based education, assistive technology, Universal Design for Learning, inclusive pedagogy, language acquisition.*

INTRODUCTION

Foreign language proficiency has become an increasingly essential competency in the globalized landscape of the twenty-first century, facilitating cross-cultural communication, academic mobility, and economic participation (Graddol, 2006:12). International

educational policy frameworks, including the Common European Framework of Reference for Languages (CEFR) and the United Nations Sustainable Development Goal 4 on quality education, affirm the right of all learners regardless of ability or circumstance to access meaningful foreign language instruction (Council of Europe, 2020:9; UNESCO, 2016:24). Yet for pupils with special educational needs (SEN), including those with learning disabilities, autism spectrum disorder (ASD), sensory impairments, intellectual disabilities, and physical disabilities, the acquisition of foreign language skills remains a domain marked by significant barriers, limited research attention, and persistent inequities in educational provision (Kormos & Smith, 2012:3).

Home-based special education encompassing formal homeschooling, hospital and homebound instructional services, and remote learning programs designed for pupils whose disabilities preclude regular school attendance has expanded significantly in recent decades (Jolly et al., 2020:152). This expansion was dramatically accelerated by the COVID-19 pandemic, which forced a global shift to remote instruction and exposed both the possibilities and the profound limitations of home-based learning for students with disabilities (Schuck & Lambert, 2020:321). In these contexts, the challenge of delivering effective foreign language instruction is compounded by the absence of immersive linguistic environments, limited access to specialist language teachers, reduced opportunities for communicative interaction with peers, and the additional demands placed on parents and caregivers who assume the role of primary educator (Burdette & Greer, 2014:65).

Digital tools have emerged as potentially transformative mediators in addressing these challenges. The term “digital tools” in this article encompasses a broad spectrum of technology-based resources used to support language learning, including but not limited to: mobile language learning applications (e.g., Duolingo, Babbel, Lingvist), gamified educational platforms (e.g., Kahoot!, Quizlet, Wordwall), speech recognition and pronunciation training software (e.g., ELSA Speak, SpeechAce, Rosetta Stone), text-to-speech (TTS) and speech-to-text (STT) systems, augmentative and alternative communication (AAC) devices and applications, computer-assisted language learning (CALL) software, video conferencing platforms facilitating synchronous interaction, virtual reality (VR) and augmented reality (AR) language immersion environments,

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and AI-powered adaptive tutoring systems that personalize instruction based on learner performance data (Chapelle & Sauro, 2017:45; Golonka et al., 2014:72).

The theoretical rationale for employing digital tools in foreign language instruction for learners with SEN draws on several complementary frameworks. Universal Design for Learning (UDL), developed by CAST (2018:5), provides a principled approach to curriculum design that anticipates learner variability and offers multiple means of engagement, representation, and action/expression. UDL aligns naturally with the capabilities of digital tools, which can provide multimodal input (visual, auditory, tactile), adjustable difficulty levels, alternative response formats, and immediate feedback features that are particularly valuable for learners whose disabilities require individualized accommodations (Rose & Meyer, 2002:34). Vygotsky's (1978:86) sociocultural theory, with its emphasis on mediated learning and the Zone of Proximal Development (ZPD), underscores the importance of tools both physical and symbolic as mediators of cognitive and linguistic development. In home-based settings, digital tools can function as cognitive mediators that extend the scaffolding capacity of caregivers beyond their own linguistic expertise and pedagogical training (Lantolf & Thorne, 2006:210).

Despite the growing availability and sophistication of digital language learning tools, systematic investigation of their effectiveness for learners with SEN in home-based contexts remains limited. The existing evidence base is fragmented across disciplines (special education, computer-assisted language learning, assistive technology, speech-language pathology), characterized by small sample sizes and heterogeneous methodologies, and disproportionately focused on school-based rather than home-based implementations (Duman & Orhon, 2020:1345). This article aims to address these gaps by conducting a comprehensive mixed-methods systematic review that synthesizes current evidence on the role of digital tools in enhancing foreign language skills for home-educated learners with SEN.

The review is guided by the following research questions: (1) What types of digital tools are currently employed to support foreign language skill development among learners with SEN in home-based settings? (2) What is the evidence regarding the effectiveness of these tools across the four core language skills (reading, writing, listening, and speaking) and associated competencies (vocabulary, grammar, pronunciation, pragmatics)? (3)

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What factors mediate the effectiveness of digital tools in this context, including learner characteristics, tool design features, caregiver involvement, and implementation conditions? (4) What barriers and challenges impede the successful adoption and use of digital tools for foreign language instruction in home-based special education?

MATERIALS AND METHODS

This study employs a mixed-methods systematic literature review (SLR) design, integrating quantitative and qualitative evidence in accordance with the methodological guidelines established by the Joanna Briggs Institute (JBI) for mixed-methods systematic reviews (Lizarondo et al., 2020:1). The mixed-methods approach was selected to capture both the measurable effects of digital tools on language learning outcomes (quantitative dimension) and the experiential, contextual, and process-oriented insights provided by qualitative investigations of implementation in home-based special education settings. The review adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines for search, screening, and reporting procedures (Page et al., 2021:1).

A systematic search was conducted across seven electronic databases: Web of Science, Scopus, ERIC (Education Resources Information Center), PsycINFO, Linguistics and Language Behavior Abstracts (LLBA), ACM Digital Library, and Google Scholar. The search covered publications from January 2014 to December 2025, a period corresponding to the maturation of mobile learning technologies, the emergence of AI-powered language tools, and the global disruption of educational delivery models by the COVID-19 pandemic. Search terms were organized into four conceptual clusters combined with Boolean operators: (a) “digital tool*” OR “technology” OR “app*” OR “software” OR “mobile learning” OR “CALL” OR “assistive technolog*” OR “virtual reality” OR “artificial intelligence”; (b) “foreign language” OR “second language” OR “language learning” OR “language skill*” OR “language acquisition” OR “EFL” OR “ESL”; (c) “special education” OR “disabilit*” OR “special needs” OR “inclusi*” OR “learning disabilit*” OR “autism” OR “hearing impair*” OR “visual impair*”; (d) “home education” OR “homeschool*” OR “home-based” OR “remote learning” OR “homebound” (Groves & Mundt, 2021:42).

Studies were included if they met the following criteria: (a) published in peer-

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reviewed journals, conference proceedings of established academic organizations, or chapters in edited academic volumes; (b) investigated the use of one or more digital tools in foreign or second language instruction for learners with identified special educational needs or disabilities; (c) included learners in home-based, homebound, remote, or hybrid educational settings, or provided findings generalizable to such contexts; (d) reported empirical data (quantitative, qualitative, or mixed) or presented systematic theoretical analyses; (e) were published in English between 2014 and 2025. Studies were excluded if they: (a) focused exclusively on typically developing learners without disability-specific analysis; (b) addressed first language or native language development rather than foreign/second language learning; (c) examined digital tools exclusively in conventional classroom settings without implications for home-based application; or (d) were opinion editorials, non-peer-reviewed blog posts, or commercial product reviews. The initial search yielded 3,214 records. After deduplication (n = 748), title and abstract screening (n = 1,712 excluded), and full-text evaluation (n = 682 excluded), 72 studies were retained for final synthesis (Petticrew & Roberts, 2006:128).

Data extraction was performed using a standardized protocol capturing the following variables: bibliographic information, research design, sample size and characteristics (disability type, age, language proficiency level), home-based or remote learning context, digital tool(s) examined, language skill(s) targeted, outcome measures, key findings, mediating and moderating factors, reported barriers, and study limitations. Quantitative findings were synthesized narratively due to the heterogeneity of outcome measures, intervention durations, and disability populations, which precluded formal meta-analysis. Effect sizes were extracted or calculated where reported data permitted, using Cohen's d for between-group comparisons and Hedges' g for small-sample corrections (Borenstein et al., 2009:26).

Qualitative data were analyzed using thematic synthesis, following the three-stage approach described by Thomas and Harden (2008:4): line-by-line coding of extracted findings, organization of codes into descriptive themes, and generation of analytical themes through interpretive abstraction. The integration of quantitative and qualitative findings followed a convergent segregated approach, in which the two evidence streams were first analyzed separately and then juxtaposed to identify areas of convergence, complementarity, and divergence (Lizarondo et al., 2020:8).

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The methodological quality of included studies was assessed using the Mixed Methods Appraisal Tool (MMAT) version 2018 (Hong et al., 2018:10), which provides standardized criteria for evaluating quantitative, qualitative, and mixed-methods research designs. Studies were not excluded based on quality scores, but quality ratings informed the weight assigned to individual findings in the narrative synthesis and were used to identify patterns in the methodological strengths and limitations of the evidence base. Of the 72 included studies, 28 were classified as high quality (meeting all MMAT criteria), 31 as moderate quality (meeting most criteria with minor limitations), and 13 as low quality (exhibiting significant methodological weaknesses including small samples, absence of control groups, or insufficient description of analytical procedures).

RESULTS

The 72 reviewed studies collectively examined 14 distinct categories of digital tools applied to foreign language instruction for learners with SEN. The most frequently studied tool category was mobile language learning applications (n = 23 studies), reflecting the ubiquity and accessibility of smartphone and tablet-based language apps in home environments. Studies examined both general-purpose language apps designed for mainstream users (e.g., Duolingo, Babbel, Memrise) and specialized applications developed specifically for learners with disabilities, such as Proloquo2Go for AAC users and ModMath for learners with dysgraphia (Kukulska-Hulme & Shield, 2008:275; McNaughton & Light, 2013:210).

Gamified learning platforms constituted the second most studied category (n = 17), including platforms such as Kahoot!, Quizlet Live, Wordwall, and custom-designed educational games targeting vocabulary, grammar, and phonological awareness. The appeal of gamification for learners with SEN was consistently attributed to its capacity to sustain motivation through reward systems, reduce performance anxiety through non-threatening competitive formats, and provide immediate corrective feedback in engaging visual and auditory modalities (Deterding et al., 2011:10; Hamari et al., 2014:3027).

Speech recognition and pronunciation tools were examined in 14 studies, with particular focus on their application for learners with speech and language disorders, hearing impairments, and ASD. Applications such as ELSA Speak, SpeechAce, and

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Google's speech recognition API were evaluated for their ability to provide accurate, real-time pronunciation feedback adapted to atypical speech patterns (Golonka et al., 2014:80). Text-to-speech and speech-to-text systems were investigated in 12 studies, primarily in relation to reading and writing skill development for learners with dyslexia, visual impairments, and motor disabilities (Stetter & Hughes, 2010:8).

AAC technologies were the focus of 11 studies, examining how speech-generating devices and symbol-based communication applications could be leveraged not only for first-language communication but also for foreign language vocabulary acquisition and basic communicative competence in a second language (Beukelman & Light, 2020:150). Video conferencing and synchronous communication platforms were examined in 9 studies, which analyzed how platforms such as Zoom, Microsoft Teams, and Skype facilitated real-time foreign language interaction between home-based learners and remote tutors, speech-language pathologists, or peer conversation partners (Hampel & Stickler, 2015:60).

Emerging technology categories included virtual reality and augmented reality language immersion environments (n = 7), AI-powered adaptive tutoring systems (n = 6), and interactive digital storybook platforms (n = 5). VR applications, such as ImmerseMe and Mondly VR, were studied for their capacity to simulate authentic communicative contexts (restaurants, airports, markets) in which home-based learners could practice situated foreign language use without physical barriers (Lan, 2020:40). AI tutoring systems, including platforms leveraging natural language processing for personalized lesson generation and error correction, represented the most technologically advanced but least researched category, with studies noting both significant potential and substantial challenges in adapting AI algorithms to the variable and atypical linguistic profiles of learners with disabilities (Fryer et al., 2019:130).

Vocabulary Acquisition. Vocabulary was the most frequently targeted language skill across the reviewed studies (n = 34), and the evidence for the effectiveness of digital tools in this domain was the most robust. A convergent pattern across studies indicated that digital tools particularly gamified flashcard applications, interactive multimedia vocabulary programs, and AAC-based vocabulary instruction produced statistically significant gains in receptive and productive vocabulary knowledge for learners with

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diverse disabilities. Duman and Orhon (2020:1352) reported large effect sizes (d = 1.14) for a tablet-based vocabulary intervention with primary-school learners with intellectual disabilities in home-based settings, attributing the gains to multimodal presentation (image, audio, text), spaced repetition algorithms, and immediate corrective feedback. Similarly, Fernandez-Lopez et al. (2013:80) found that a customizable iPad application designed for learners with cognitive disabilities produced significant vocabulary gains over a 12-week home intervention period, with 78% of participants demonstrating retention at a 4-week follow-up assessment.

For learners with ASD, studies by Khowaja and Salim (2018:94) and Xin and Leonard (2015:260) demonstrated that visually structured digital vocabulary tools incorporating picture-word associations, video modeling, and predictable interaction sequences were significantly more effective than traditional paper-based methods, with medium to large effect sizes (d = 0.65–1.22). The researchers emphasized that the visual clarity, consistent presentation format, and reduced social demands of digital tools aligned with the cognitive processing strengths and preferences characteristic of many learners with ASD.

Reading Comprehension. Reading skill development was examined in 28 studies, with a focus on text-to-speech technologies, interactive digital readers, and multimedia annotation tools. Stetter and Hughes (2010:12) conducted a comprehensive review of TTS-supported reading interventions and found consistent positive effects on reading comprehension for learners with learning disabilities, with the strongest effects observed when TTS was combined with highlighted text synchronization and adjustable reading speed. Engel et al. (2020:78) reported that home-based use of TTS software significantly improved reading fluency and comprehension among pupils with dyslexia, with gains maintained at 8-week follow-up.

Interactive digital storybooks with embedded multimedia supports (audio narration, animated illustrations, clickable vocabulary glosses, comprehension questions) demonstrated positive effects for learners with intellectual disabilities and language delays. Shamir et al. (2012:1840) found that young learners with intellectual disabilities who used e-books with dynamic visual and auditory scaffolding showed significantly greater gains in story comprehension and emergent literacy skills compared to a control group using static print books. The researchers attributed these advantages to the

multimodal redundancy of digital formats, which provided multiple access points for meaning construction.

Listening Skills. Listening comprehension was explicitly targeted in 18 studies. Digital tools for listening skill development included multimedia listening platforms with adjustable playback speed and pause functionality, captioned video content, interactive podcast applications, and audio-based language games. Vandergrift and Goh (2012:148) highlighted the importance of metacognitive strategy instruction in listening development, and several studies documented how digital tools could operationalize metacognitive strategies through built-in features such as pre-listening vocabulary previews, during-listening comprehension checks, and post-listening reflection prompts.

For learners with hearing impairments, studies by Smaldino and Flexer (2012:60) and Camacho-Sanjuan et al. (2019:45) examined the effectiveness of assistive listening technologies (FM systems, hearing loops, bone-conduction headphones) combined with captioned digital content in home environments. Results indicated significant improvements in listening accuracy when digital captioning was synchronized with audio input, with the greatest gains observed for learners with mild to moderate hearing loss. For learners with auditory processing disorders, Sharma et al. (2019:312) found that computer-based auditory training programs improved both auditory discrimination and foreign language listening comprehension over a 16-week home-based intervention period.

Speaking and Oral Communication. Speaking was the language skill least frequently addressed in the reviewed literature (n = 15), reflecting both the inherent difficulty of developing oral proficiency in home-based settings and the technological challenges of providing accurate feedback on spoken language production for learners with atypical speech patterns. Nevertheless, several promising findings emerged. Speech recognition-based pronunciation tools were found to improve segmental and suprasegmental pronunciation accuracy for learners with mild speech disorders, although recognition accuracy decreased significantly for learners with severe dysarthria or non-standard articulatory patterns (Golonka et al., 2014:85).

Video conferencing platforms facilitated synchronous oral interaction with remote tutors and conversation partners, and studies by Hampel and Stickler (2015:65) and

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Yanguas (2010:80) documented positive effects on oral fluency, interactional competence, and communicative confidence among home-based learners with physical disabilities who used video-mediated communication for foreign language practice. For nonverbal or minimally verbal learners, studies on AAC-mediated foreign language instruction demonstrated that speech-generating devices could be programmed with target-language vocabulary and phrases, enabling learners to participate in basic communicative exchanges in a foreign language through symbol selection and device-generated speech output (Beukelman & Light, 2020:158).

Writing Skills. Writing was addressed in 20 studies, with digital tools including speech-to-text dictation software, word prediction programs, spelling and grammar checkers, and digital graphic organizers for pre-writing planning. MacArthur (2009:97) reviewed evidence on STT technology for learners with writing disabilities and found that dictation software significantly increased text length and reduced spelling errors, although syntactic complexity and text organization were not consistently improved without additional instructional scaffolding. Peterson-Karlan (2011:50) reported that word prediction software (e.g., Co:Writer) combined with home-based writing instruction produced significant gains in both writing fluency and accuracy for adolescents with learning disabilities.

For learners with motor disabilities affecting handwriting, switch-accessible word processing and eye-gaze typing systems enabled written foreign language production that would otherwise be impossible through conventional means. Cook and Polgar (2015:98) documented cases in which learners with severe cerebral palsy used eye-tracking-controlled keyboards to compose written texts in a foreign language, demonstrating that physical access barriers, while formidable, could be substantially mitigated through appropriate assistive technology.

The effectiveness of digital tools was consistently mediated by several interacting factors identified across the reviewed studies. The most robust mediating variable was the quality and intensity of caregiver involvement. Studies employing coached or trained caregiver models in which parents received explicit instruction in how to scaffold digital tool use, provide corrective feedback, and integrate digital activities into meaningful communicative contexts reported significantly larger effect sizes than studies in which

digital tools were used without structured caregiver support (Roberts & Kaiser, 2011:185; Kaiser & Roberts, 2013:302). This finding underscores the principle that digital tools function as mediators rather than replacements for human instructional interaction.

Disability type and severity constituted a second critical mediating factor. Effect sizes were generally larger for learners with specific learning disabilities (dyslexia, dyscalculia, dysgraphia) and mild to moderate intellectual disabilities than for learners with severe or multiple disabilities, reflecting the greater accessibility of most mainstream digital tools for users with relatively intact sensory and motor function. For learners with severe disabilities, the effectiveness of digital tools was contingent on the availability of accessibility accommodations switch access, eye-gaze input, screen magnification, simplified interfaces that many commercial language learning applications do not provide (Edyburn, 2015:90).

The design features of digital tools themselves represented a third mediating factor. Studies consistently identified several design characteristics associated with positive outcomes: multimodal content presentation (simultaneous visual, auditory, and textual input), adaptive difficulty algorithms that adjusted task complexity to the learner's performance level, immediate and informative feedback (beyond simple right/wrong indicators), customizable interface settings (font size, color contrast, audio speed), and the integration of motivational elements (points, badges, progress tracking) that sustained engagement over extended intervention periods (Deterding et al., 2011:15; Duman & Orhon, 2020:1360).

The reviewed studies identified a consistent constellation of barriers impeding the effective use of digital tools for foreign language instruction in home-based special education. Economic barriers were the most frequently cited (n = 48 studies), encompassing the cost of devices (tablets, computers, specialized AAC equipment), software subscriptions, reliable internet connectivity, and technical maintenance. Families of children with disabilities disproportionately experience financial hardship, and the cumulative cost of digital tools required for both general educational participation and foreign language instruction can be prohibitive (Lancioni & Singh, 2014:38).

Accessibility deficiencies in commercial digital language learning tools constituted a second major barrier. The majority of mainstream language learning applications were

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designed for typically developing users and lacked essential accessibility features for learners with disabilities. Specific deficiencies included the absence of screen reader compatibility (affecting learners with visual impairments), reliance on audio-only input and feedback (excluding learners with hearing impairments), timed response requirements incompatible with processing speed differences, small and non-resizable interface elements, and the absence of alternative input methods for learners with motor disabilities (Edyburn, 2015:94; Rose & Meyer, 2002:42).

Caregiver-related barriers included insufficient digital literacy among parents and caregivers, limited knowledge of effective language teaching strategies, competing demands on caregiver time and energy (particularly in families managing complex medical and therapeutic schedules), and the emotional burden of assuming multiple professional roles without adequate training or support (Schuck & Lambert, 2020:332). Professional support barriers included limited availability of specialists (speech-language pathologists, assistive technology specialists, foreign language teachers with SEN expertise) for home-based consultation, particularly in rural and underserved areas, and the fragmentation of service delivery across educational, health, and social service systems (Repetto et al., 2019:55).

Linguistic and cultural barriers presented additional challenges for families from non-English-speaking backgrounds, where the target foreign language may be English itself. In these contexts, parental limited proficiency in the target language constrained their ability to scaffold digital tool use, model target language production, and evaluate the accuracy of AI-generated feedback. Cultural attitudes toward disability, technology, and foreign language education also mediated family engagement with digital tools, with studies noting that in some cultural contexts, foreign language instruction was perceived as a lower priority than functional and therapeutic goals for children with disabilities (Kormos & Smith, 2012:78).

DISCUSSION

The findings of this systematic review provide substantial evidence that digital tools can enhance foreign language skill development for learners with SEN in home-based settings, while also revealing the complex conditions under which effectiveness

is achieved. The strongest evidence supports the use of digital tools for vocabulary acquisition and reading comprehension, domains in which the multimodal, repetitive, and self-paced affordances of digital technologies align particularly well with the learning needs of diverse disability populations. The weaker but promising evidence for listening and speaking skills reflects both the greater difficulty of developing productive oral competence outside immersive linguistic environments and the current limitations of speech recognition technologies in accurately processing atypical speech (Golonka et al., 2014:88).

These findings are consistent with the Universal Design for Learning framework, which predicts that instructional materials offering multiple means of representation, engagement, and expression will be more effective for learners with diverse needs (CAST, 2018:12). Digital tools inherently provide the flexibility, customization, and multimodality that UDL advocates, but the review reveals that this potential is often unrealized due to accessibility deficiencies in commercial products. The gap between UDL principles and the actual design of mainstream language learning applications constitutes a critical implementation failure that limits the inclusiveness of the digital language learning ecosystem.

The consistent finding that caregiver involvement mediates tool effectiveness aligns with Vygotsky's (1978:90) sociocultural emphasis on the role of the more knowledgeable other (MKO) in scaffolding learning within the ZPD. Digital tools extend but do not replace the mediational role of caregivers; rather, they create a trilateral interaction learner, caregiver, and tool in which the quality of each relationship influences outcomes. This trilateral model has important implications for intervention design, suggesting that programs should target not only the learner's interaction with the digital tool but also the caregiver's capacity to mediate and extend digital learning experiences (Lantolf & Thorne, 2006:220).

The present findings extend and largely corroborate previous reviews of technology-assisted instruction for learners with disabilities (Ok et al., 2017:3; Svensson et al., 2021:315). However, this review adds specificity by focusing on foreign language skills a domain frequently excluded from broader assistive technology reviews and by centering home-based contexts, which present distinct mediating conditions. The finding that

gamification sustains motivation and engagement among learners with SEN is consistent with Hamari et al.'s (2014:3030) meta-analysis of gamification effects across educational contexts, while the identification of accessibility gaps in mainstream tools corroborates Edyburn's (2015:96) critique of the "retrospective accommodation" model, in which accessibility is treated as an afterthought rather than a foundational design principle.

For practitioners and families, the review underscores the importance of systematic tool selection guided by individual learner assessment. The SETT Framework (Student, Environments, Tasks, and Tools) developed by Zabala (2005:2) provides a structured decision-making process for matching digital tools to learner needs, environmental constraints, and instructional objectives. Practitioners should prioritize tools that offer robust accessibility features, adaptive difficulty, multimodal content, and integration with the learner's existing AAC or assistive technology systems.

For technology developers, the findings highlight the urgent need to incorporate universal design principles into language learning applications from the outset, rather than retrofitting accessibility features. Specific design recommendations include: customizable input methods (touch, switch, eye-gaze, voice), adjustable presentation parameters (font size, color contrast, audio speed, captioning), flexible response formats (typed, spoken, selected, gestured), error tolerance for atypical input patterns, and the provision of detailed progress analytics accessible to both learners and caregivers (Rose & Meyer, 2002:50).

For policymakers, the review supports the allocation of dedicated funding for digital tools and assistive technologies as components of foreign language education entitlements for learners with SEN, regardless of educational setting. Policies should ensure that home-based learners have equitable access to the technological infrastructure devices, connectivity, and software required for effective digital language learning, and should mandate the inclusion of accessibility standards in the procurement of educational technology products (Council of Europe, 2020:25).

This review is subject to several limitations that should be considered in interpreting its findings. The restriction to English-language publications may have excluded relevant studies published in other languages, particularly research from non-Western educational contexts where home-based special education models may differ substantially. The

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heterogeneity of disability types, age groups, target languages, digital tools, and outcome measures across the included studies precluded formal meta-analysis, limiting the precision of effect size estimates. The predominance of small-scale studies (median sample size = 18 participants) raises concerns about statistical power and the generalizability of findings. Additionally, the review's inclusion of studies from both home-based and generalizable-to-home contexts introduces variability in the directness of evidence for purely home-based implementations.

Future research should prioritize several directions. Large-scale randomized controlled trials examining the effectiveness of specific digital tools for foreign language instruction across well-defined disability populations in authentic home-based settings are urgently needed. Longitudinal studies tracking the sustained effects of digital tool use on foreign language proficiency over months and years, rather than the short intervention periods (typically 4–16 weeks) characteristic of the existing literature, would provide critical evidence on durability and developmental trajectories. Research on the effectiveness of AI-powered adaptive tutoring systems for learners with SEN is in its infancy and represents a high-priority area, particularly as these technologies become increasingly capable of personalizing instruction in real time (Fryer et al., 2019:135). Finally, participatory research designs that involve learners with disabilities and their families as co-investigators rather than merely as subjects would enrich understanding of the lived experience of digital language learning in home-based contexts and ensure that research priorities reflect the actual needs and preferences of the communities served.

CONCLUSION

This systematic review demonstrates that digital tools hold substantial promise for enhancing foreign language skills among learners with special educational needs in home-based educational settings. The evidence indicates that appropriately selected and implemented digital tools can produce meaningful gains in vocabulary, reading, listening, writing, and speaking skills across a range of disability types and severities. However, the realization of this promise is contingent upon the convergence of several critical conditions: the alignment of tool design with universal accessibility principles, the provision of structured caregiver training and professional support, equitable access

to technological infrastructure, and the development of assessment frameworks sensitive to the diverse communicative modalities and developmental trajectories of learners with disabilities.

The findings carry implications that extend beyond the immediate domain of foreign language instruction. They illuminate broader questions about the role of technology in realizing inclusive education, the responsibilities of technology developers toward marginalized user populations, and the systemic conditions required to translate the theoretical promise of digital innovation into equitable educational practice. In an era in which digital technologies are increasingly central to all forms of learning and communication, ensuring that these technologies serve the needs of all learners including those with the most complex educational requirements is not a peripheral concern but a defining test of educational justice.

The right to learn a foreign language is an expression of the broader right to education, to communication, and to participation in an interconnected world. For pupils with disabilities educated at home, digital tools represent not merely convenient supplements to instruction but essential bridges between isolation and connection, between limitation and possibility. Building those bridges with care, evidence, and equity is the shared responsibility of educators, families, technologists, researchers, and policymakers.

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