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Technological Innovations in Learning for Autism Spectrum Disorder: A Systematic Literature Review

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Abstract

Autism Spectrum Disorder (ASD) is a lifelong neurodevelopmental condition that affects social communication, attention, sensory processing and learning participation. These challenges highlight the need for instructional approaches that are structured to the diverse learning profiles of autistic learners. In recent years, technological innovations have been increasingly explored as potential tools to address these educational needs. This systematic literature review synthesises empirical research on the use of technology-based interventions to support learning among students with autism. Guided by the PRISMA framework, relevant studies were identified through searches of Scopus, Web of Science and Google Scholar and analysed using qualitative thematic analysis. The findings indicate that technology-enhanced learning environments can support academic and functional skill development, improve social participation and enhance learner engagement when appropriately implemented. However, the effectiveness and sustainability of technology use are influenced by contextual factors such as teacher readiness, usability and access to resources. Overall, the review highlights the potential of technological innovations to support inclusive and meaningful learning experiences for autistic learners, while emphasising the importance of pedagogical alignment, professional support and context-sensitive implementation in educational practice.

Keywords: Autism Spectrum Disorder (ASD), Assistive Technology, Learning Engagement

1. INTRODUCTION

Autism Spectrum Disorder (ASD) is a lifelong neurodevelopmental condition characterised by persistent differences in social communication and interaction with restricted and repetitive patterns of behaviour and interests (American Psychiatric Association, 2022). Individuals with ASD exhibit substantial developmental diversity that is often presented with various levels of language impairment, social engagement difficulties, attention deficit and reduced adaptive functioning which may significantly influence their participation in educational settings (Lord et al., 2020). Beyond academic learning, many autistic individuals experience difficulties in emotional regulation and sensory processing including heightened sensitivity to environmental stimuli which can interfere with attention, classroom behaviour and overall learning engagement (Robertson & Baron-Cohen, 2017). These interrelated challenges highlight the importance of structured, individualised as well as supportive learning environments that are responsive to learners' unique cognitive, behavioural and sensory profiles (Schalock et al., 2021). As the prevalence of ASD continues to increase globally, educational systems face growing demands to adopt evidence-based approaches that promote

inclusion, independence and meaningful participation for autistic learners across diverse educational settings (Zeidan et al., 2022).

Technological innovations have increasingly been recognised as an effective means of addressing the educational challenges experienced by learners with ASD. Educational and assistive technologies, including tablet-based applications, augmentative and alternative communication (AAC) systems, digital games, and immersive platforms such as virtual and augmented reality, provide multimodal and visually rich learning environments that align well with the cognitive and perceptual strengths of many autistic learners (Scarcella et al., 2023). Empirical evidence indicates that digital and technology-supported interventions can significantly improve communication skills, vocabulary development and social responsiveness among students with ASD (Urrea et al., 2024). Similarly, Wang et al. (2024) reported that structured digital interventions also yield measurable improvements in attention regulation and learning engagement which are critical foundations for academic success. Overall, these findings suggest that technology-enhanced instruction constitutes an effective approach to supporting both the communicative and cognitive dimensions of learning among autistic students.

Beyond learning outcomes, technology also plays a critical role in facilitating participation and autonomy for autistic learners within educational contexts. A study by Klavina et al. (2024) demonstrated that assistive technologies such as mobile applications and digital visual prompts effectively support the acquisition of daily living and classroom-based skills by breaking tasks into manageable sequential steps. Similarly, tablet-based interventions designed for early learners have been shown to facilitate the development of self-care and routine-based skills thereby reducing reliance on adult support (Omar et al., 2024). In classroom contexts, Augmentative and Alternative Communication (AAC) systems and visual-based instructional media have been found to reduce communication barriers and increase students' participation in learning activities (Mavritsakis, 2024). However, the successful implementation of these technologies is highly dependent on contextual factors such as teacher competence, instructional design, and access to appropriate devices that can influence both the consistency and sustainability of technology use in educational settings (Alzahrani, 2022).

Despite the growing use of technology in autism education, the existing literature remains fragmented across different intervention types, educational contexts, and learning outcomes. Previous studies have primarily focused on specific technologies or individual intervention outcomes, making it difficult to obtain a comprehensive understanding of how technological innovations support learning among students with ASD. In addition, limited synthesis has been conducted to identify common themes, implementation challenges, and areas requiring further investigation across the broader body of evidence. In response to this gap, this systematic literature review aims to synthesise empirical evidence on technological innovations in learning for students with ASD. By analysing findings from 21 peer-reviewed studies, this review identifies key thematic patterns related to communication, engagement, functional skill development, and implementation factors. Through a rigorous and transparent review process, the study seeks to provide educators, researchers, and policymakers with a comprehensive understanding of how technology can be effectively leveraged to support inclusive and meaningful learning experiences for autistic students. The findings also highlight research gaps and future directions necessary for advancing evidence-based technology enhanced education for learners with ASD.

2. METHODOLOGY

This paper followed the PRISMA framework, as illustrated in Figure 1. PRISMA or Preferred Reporting Items for Systematic Reviews and Meta-Analyses, is a standardized framework that enhances the transparency and accuracy of systematic literature reviews (Hayrol et al., 2019). By following this model, author can ensure a structured approach to data synthesis, allowing readers to assess the reliability and relevance of findings (BMJ, 2021). PRISMA consists of four key phases: identification, screening, eligibility and inclusion (Hayrol et al., 2019).

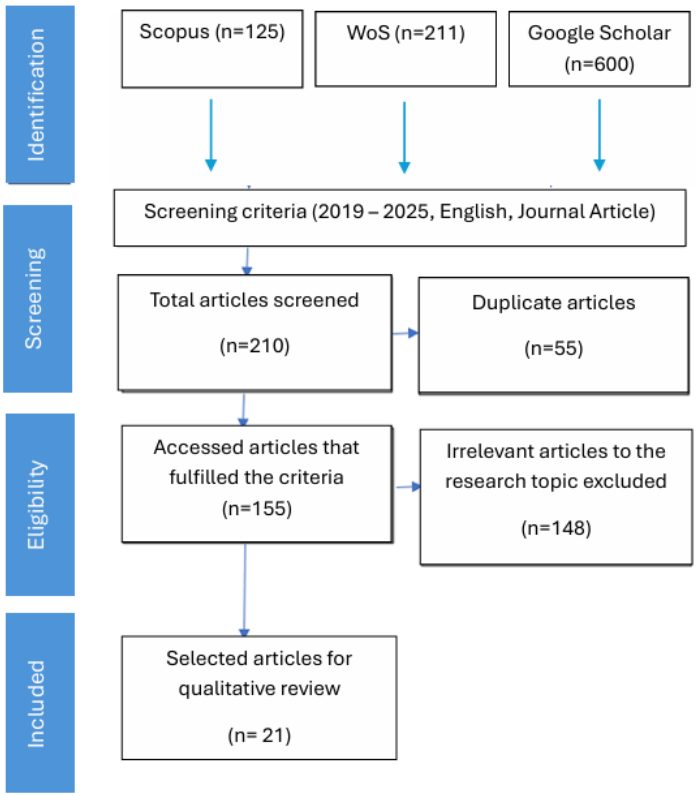

Figure 1: PRISMA flow chart

The selection of 21 articles was based on their strong alignment with the predefined inclusion criteria that emphasized methodological rigor, thematic relevance and contextual appropriateness within the research scope. These articles demonstrated a clear focus on the research objectives and provided empirical evidence directly related to the study's aims. By including only these 21 studies, the review ensures a concentrated synthesis of findings, allowing for deeper analytical insights and enhancing the overall validity of the systematic review.

2.1 Identification

The identification process involves the strategic selection of keywords to ensure the retrieval of studies examining a range of technological innovations designed to support learning in individuals with ASD. Comprehensive keyword strings were constructed using Boolean Operators to streamline the search for studies across three databases: Google Scholar, Scopus and Web of Science (Table 1). Four keywords were selected, technology, innovation, ASD and learning. The databases used offer comprehensive coverage of peer-reviewed publications from global sources. To expand the scope while staying relevant to this study, the Boolean Operator "OR" was added to include alternate

keywords and synonyms for each keyword. The searching process on these databases was conducted in November 2025, resulting in 936 articles.

Table 1: The search string and findings

Search String	Database	Search Limitations	Findings
TITLE-ABS-KEY ("autism spectrum disorder" OR autism OR ASD AND (technology OR technological innovation OR digital tool* OR educational technology OR assistive technology OR ICT OR computer-based OR mobile application* OR app* OR virtual reality OR augmented reality OR serious game* OR artificial intelligence) AND (learning OR education OR teaching OR instruction OR intervention OR training)*	Scopus	2021-2025	125
TS= ("autism spectrum disorder" OR autism OR ASD) AND (technology OR technological innovation OR digital tool* OR educational technology OR assistive technology OR ICT OR computer-based OR mobile application* OR app* OR virtual reality OR augmented reality OR serious game* OR artificial intelligence) AND (learning OR education OR teaching OR instruction OR intervention OR training)*	Web of Science	2021-2025	211
("autism spectrum disorder" OR autism OR ASD) technology learning education	Google Scholar	2019-2025	600

2.2 Screening

This paper initially reviewed 936 articles based on predefined inclusion and exclusion criteria. The inclusion criteria required studies to be journal articles, published in English, within the field of technology, between 2019 and 2025, and containing empirical data. The time frame was set to ensure that only the most recent research was considered. Additionally, no restrictions were placed on the country of publication, allowing for a diverse and global perspective. During the screening phase, 726 articles were automatically excluded for not meeting the criteria and 55 duplicate articles were removed. This resulted in 155 articles advancing to the eligibility phase, where further evaluation was conducted. The rigorous selection process ensured that only high-quality, relevant studies were included in the final systematic review, strengthening the credibility and reliability of the findings.

Table 2: Criteria set in the filtering phase

Criteria	Qualifications
Type of literature	Journal (Study article)
Language	English
Year of publication	2019-2025
Index	Google Scholar, Scopus & Web of Science
Country	All

2.3 Eligibility

In the third phase, the authors manually assessed the screened articles to ensure that all 155 articles met the study criteria. Following the screening of titles and abstracts, 134 articles were excluded as they did not address technological innovations or digital interventions in learning for individuals with autism. Ultimately, only 21 articles were selected. All the selected articles use qualitative methodologies to ensure a rigorous and consistent review process.

2.4 Included

A total of 155 articles were initially identified through database searches and screened according to predefined inclusion and exclusion criteria. Studies were included if they focused on technology-based interventions or innovations for individuals with autism spectrum disorder (ASD), were published in peer-reviewed journals between 2019 and 2025, were written in English or Malay, and provided empirical or review-based evidence relevant to educational, communication or developmental outcomes. Studies were excluded if they were duplicate records, non ASD-focused studies or lacked sufficient methodological information. Articles that did not meet the eligibility criteria were excluded during the screening and full-text assessment stages. Following this process, 21 studies were retained for the final analysis. This systematic selection process ensured that only relevant studies were included in the review.

2.5 Data Analysis

The present review adopted qualitative research design, employing thematic analysis as the analytical method. As noted by Kiger and Varpio (2020), thematic analysis is particularly suitable for synthesizing abstracted qualitative data and for generating meaningful interpretations of experiential evidence. The analytical procedure was informed by the frameworks proposed by Braun and Clarke (2006) and Kiger and Varpio (2020) and involved five sequential stages.

First, all 21 articles were read repeatedly to achieve data familiarisation, with emphasis on the abstract, results, and discussion sections. Next, initial codes were systematically generated across the dataset. These codes were then examined and organised to construct themes and sub-themes by identifying recurring patterns and conceptual relationships. Subsequently, the themes were reviewed and refined to ensure coherence and accurate representation of the findings. Finally, the themes were clearly defined and named, resulting in the identification of three main themes and seven sub-themes.

2.6 Location of Studies

The data analysis showed that among the 21 selected articles, studies were conducted across 15 countries. A total of eight studies were conducted in Malaysia and Indonesia, representing the highest concentration of research. This was followed by five studies from European countries. Additionally, two studies were conducted in East Asia, two studies in the Middle East and two studies in Africa. The remaining studies were conducted in North America (n = 1) and Oceania (n = 1). This distribution highlights the geographical scope of the reviewed research.

Table 3: Country by study location

Country	Number	Author
Italy	1	Ileana Scarcella et al. (2023)
Spain	2	Ana et al. (2024), Patricia et al. (2024)
Hong Kong	1	Leung et al. (2021)
China	1	Tianqi Wang et al. (2024)
Greece	1	Dionisia (2024)
Saudi Arabia	2	Asma (2022), Alzrayer (2024)
United States	1	Zoder-Martell et al. (2021)
Uganda	1	Ntalindwa et al. (2021)
Australia	1	Silvera et al. (2022)
Romania	1	Chitu et al. (2023)
South Africa	1	Mudau (2023)
Malaysia	4	Sarah Omar et al. (2024), Md Abdur Rahman et al. (2023), Kaarrtini & Hilwa (2019), Rusli & Kheng (2025)

Indonesia	4	Yulaikha & Nimas (2023), Nikolas et al. (2024), Dian & Rizki (2024), Yohan & Lisfarika (2024)

2.7 Year of Publication

Studies were tabled by year of publication (Table 4), showing one study published in 2019. This increased to three studies in 2021 and two studies in 2022. A notable growth was observed in 2023 with five studies, followed by a peak in 2024 with nine studies. However, the number of publications declined to one study in 2025. Overall, the findings indicate a clear upward trend in publications from 2019 to 2024, reflecting growing research interest in technology-based interventions for autism in educational contexts.

Table 4: Number of articles by publication year

Year	Number	Author(s)
2019	1	Kaarrtini & Hilwa
2021	3	Leung et al.; Zoder-Martell et al.; Ntalindwa et al.
2022	2	Asma; Silvera et al.;
2023	5	Ileana Scarcella et al.; Chitu et al.; Mudau; Md Abdur Rahman et al.; Yulaikha & Nimas
2024	9	Ana et al.; Patricia et al.; Tianqi Wang et al.; Dionisia; Alzrayer; Sarah Omar et al.; Nikolas et al; Dian & Rizki; Yohan & Lisfarika
2025	1	Rusli & Kheng

2.8 Themes and Sub-themes

The thematic analysis followed the six-phase approach proposed by Braun and Clarke (2006). Findings from the selected studies were systematically reviewed to identify recurring concepts, patterns, and issues related to the use of technology in supporting learning among individuals with autism spectrum disorder (ASD). Initial codes were generated from the reported findings and subsequently grouped according to similarities in focus and meaning. These categories were continuously compared and refined through an iterative process to ensure conceptual coherence and minimise overlap between themes. Related categories were then synthesised into broader themes, while more specific recurring patterns were organised into sub-themes. This analytical process resulted in the development of four overarching themes and eight sub-themes that represented the dominant patterns identified across the 21 reviewed studies.

Four themes emerged from the thematic analysis: (1) technology-supported learning and skill development, (2) communication and social interaction support, (3) teacher readiness, perceptions and implementation challenges and (4) design, engagement and effectiveness of digital interventions. Further analysis of the themes has resulted in eight sub-themes. These themes are presented in Table 5.

Table 5: Articles by themes studied

Year	Author	T1 Technology-Supported Learning and Skill Development	T2 Communication and Social Interaction Support	T3 Teacher Readiness and Implementation Challenges	T4 Digital Intervention Effectiveness
2025	Rusli & Kheng	/	/	/	/
2024	Ana et al.	/	/		/
2024	Patricia et al.	/			/
2024	Tianqi Wang et al.	/	/		/
2024	Dionisia		/	/	
2024	Alzrayer		/	/	/
2024	Sarah Omar et al	/			/
2024	Nikolas et al.	/			/
2024	Dian & Rizki		/		/
2024	Yohan & Lisfarika			/	
2023	Ileana Scarcella et al.	/	/		/
2023	Chitu et al.	/		/	/
2023	Mudau		/	/	
2023	Abd Rahman et al.	/			/
2023	Yulaikha & Nimas	/			/
2022	Asma		/	/	/
2022	Silvera et al.	/	/	/	/
2021	Phil Leung et al.	/	/		/
2021	Zoder-Martell et al.	/	/	/	/
2021	Ntalindwa	/			/
2019	Kaarrtina & Hilwa		/		/

3. DISCUSSION

3.1 Technology-Supported Learning and Skill Development

Out of the 21 articles selected, 14 studies in this review reported findings related to technology-supported learning and skill development. This theme was divided into two sub-themes namely academic learning and functional skills. Across empirical technology was consistently positioned as a facilitative tool to enhance learning outcomes, support skill acquisition and promote independence among children with ASD. (Omar et al., 2024; Rahman et al., 2023; Scarcella et al., 2023; Wang et al., 2024).

A substantial number of studies highlighted the role of technology in supporting academic and cognitive skill development by enabling structured, adaptive and cognitively engaging learning environments. Tablet-based and mobile applications were frequently reported as effective tools for improving academic outcomes by providing visual and interactive learning supports. For example, empirical studies focusing on numeracy and vocabulary development found that digital applications enabled children with ASD to engage in repeated practice and scaffolded learning. This resulted in measurable improvements in academic performance (Ntalindwa et al., 2021; Urrea et al., 2024). Similarly, ICT-based interventions reviewed in randomized controlled trials demonstrated positive effects on cognitive engagement and learning accuracy (Scarcella et al., 2023; Wang et al., 2024). Beyond basic academic skills, several studies reported enhanced cognitive engagement as a secondary outcome of technology use. Augmented reality and virtual reality environments were

found to support conceptual understanding by presenting abstract information in concrete formats (Maratullatifah & Ratnasari, 2023; Chițu et al., 2023). These technologies created more structured learning environments with fewer distractions. As a result, learners were better able to focus on tasks and process information effectively. The findings indicate that technology-supported academic learning not only improves subject-specific skills but also strengthens underlying cognitive functions essential for sustained learning among students with ASD.

In addition to academic learning, technology was widely reported as an effective medium for developing functional skills. Several empirical studies focused on tablet-based applications designed to teach functional skills such as self-care routines and independent task completion. Findings consistently showed that visual prompts, step-by-step instructions, and interactive features embedded in digital tools facilitated skill acquisition and generalization to real-life settings (Omar et al., 2024; Klavina et al., 2024). These technologies were especially beneficial for learners who require structured guidance and visual reinforcement. Besides, game-based and motion-based technologies further expanded the scope of skill development by targeting motor coordination. Studies employing motion capture games and technology-assisted therapy reported improvements in gross motor skills, body awareness and engagement during therapeutic sessions (Nikolas Antoni et al., 2024). Similarly, assistive technologies implemented for individuals with multiple disabilities, including autism and hearing impairment, supported functional skill development through personalized and adaptive interfaces (Alzahrani, 2022). Collectively, these findings show that technology-supported interventions extend beyond academic learning to support practical and motor skill development. This contributes to greater independence and improved quality of life for individuals with ASD.

3.2 Communication and Social Interaction Support

Communication and social interaction were frequently addressed across the literature, with 13 studies highlighting technology-based support. Communication difficulties and limited social interaction are core challenges experienced by individuals with ASD. The importance of this theme was evident across multiple empirical studies. These studies reported improvements in communication-related outcomes when technology was integrated into intervention and instructional practices (Mudau, 2023; Alzrayer, 2024; Mavritsakis, 2024). Rather than replacing human interaction, technology functioned as a mediating tool that supported communication exchanges between learners, teachers, peers, and caregivers. Randomized controlled trials showed that technology-assisted communication interventions produced positive developmental outcomes when tailored to individual needs.

A significant proportion of studies emphasised communication support, particularly through the use of augmentative and alternative communication (AAC) systems and assistive technologies. Empirical studies conducted in classroom and intervention settings reported that tablet-based AAC applications and digital communication tools enabled learners with ASD to express needs and participate more actively in learning activities (Mudau, 2023; Alzrayer, 2024). These tools were especially beneficial for individuals with limited verbal abilities, as they provided structured and accessible communication pathways that reduced frustration and supported functional communication. Case studies and applied research further demonstrated that AAC-supported interventions facilitated more consistent communication across settings including inclusive classrooms and specialised learning environments. This consistency was attributed to the structured and visual nature of AAC systems. These systems enabled learners to use the same communication methods with communication partners supporting continuity of communication across contexts. Alzahrani (2022), mentioned that the use of assistive technology for learners with co-occurring

disabilities, such as hearing impairment and autism, highlighted the adaptability of digital communication tools in meeting complex communication needs.

In addition to communication support, several studies reported improvements in social interaction as a result of technology-mediated interventions. Technologies such as socially assistive robots, digital learning platforms, and interactive applications were found to encourage social engagement by providing structured interaction opportunities. Empirical studies involving robotic and technology-assisted interventions reported increased social responsiveness, turn-taking and interactional participation among learners with ASD (Silvera-Tawil et al., 2022; Zoder-Martell et al., 2021). These technologies supported social interaction by reducing social anxiety and offering consistent interaction cues. Intervention studies suggested that technology-assisted approaches can enhance social participation when embedded within instructional or therapeutic frameworks. Digital interventions targeting language use, vocabulary and interaction skills were associated with improved engagement in social learning contexts (Urrea et al., 2024; Leung et al., 2021). In inclusive classroom settings, technology supported learning environments were associated with increased peer interaction and participation in group activities. Structured digital tasks provided clear roles and expectations, reducing social ambiguity during collaborative learning (Khatab, S et al, 2024). Shared digital resources also encouraged joint attention and cooperative engagement among students. Together, these features supported more consistent and meaningful peer interaction for learners with ASD.

3.3 Teacher Readiness and Implementation Challenges

Teacher readiness and implementation challenges emerged as a prominent theme across the reviewed literature, reflecting the critical role of educators in the successful integration of technology-based interventions for learners with autism spectrum disorder (ASD). Across empirical studies conducted in school and intervention settings, teachers were consistently identified as key facilitators whose perceptions and preparedness influenced how technology was adopted and used in practice. Several studies reported that while teachers generally recognised the potential benefits of technology for supporting learning, their readiness to implement such tools varied depending on prior experience, access to training and institutional support (Zoder-Martell et al., 2021; Mudau, 2023; Rusli & Kheng, 2025). The findings further indicated that challenges related to implementation often shaped the extent to which technology-based interventions could be sustained over time. Even when positive outcomes were reported, studies noted that successful implementation required alignment between teacher capability, school infrastructure and systemic support mechanisms (Alzrayer, 2024; Chițu et al., 2023).

Several studies highlighted teacher readiness as a determining factor in the adoption and effective use of technology-based interventions. Empirical findings indicated that teachers' attitudes and confidence levels influenced their willingness to integrate digital tools into teaching and intervention practices. Studies involving interviews and qualitative data reported that teachers who perceived technology as beneficial and manageable were more likely to incorporate it consistently into classroom routines (Zoder-Martell et al., 2021; Rusli & Kheng, 2025). Positive perceptions were often linked to prior exposure to technology and observable improvements in student engagement or learning outcomes. However, variations in readiness were also evident across contexts. Some studies reported that teachers expressed uncertainty or hesitation due to limited familiarity with specific technologies, particularly advanced tools such as robotics, virtual reality, or AAC systems. Empirical evidence suggested that readiness increased when teachers received hands-on experience and

guidance in using technology with learners with ASD (Mudau, 2023; Alzrayer, 2024). These findings indicate that teacher readiness is not static but can be strengthened through targeted support and experiential learning opportunities.

Implementation challenges were widely reported across the reviewed studies, often relating to training, resources and institutional constraints. Previous research identified insufficient professional development as a key barrier, with teachers reporting difficulties in selecting appropriate technologies, adapting tools to individual learner needs and troubleshooting technical issues during instruction (Chițu et al., 2023; Rusli & Kheng, 2025). Limited access to devices and software further constrained implementation efforts. These challenges were particularly evident in inclusive or under-resourced educational settings where technical support was insufficient. In addition to practical constraints, studies also highlighted systemic and organisational challenges that affected technology integration. These included time limitations, lack of clear guidelines and inconsistent institutional support for technology-based practices. Empirical findings suggested that when implementation challenges were not addressed, teachers tended to reduce or discontinue technology use despite recognising its potential benefits (Kurniawan & Napitupulu, 2024; Alzahrani, 2022). Together, these findings underscore the need for comprehensive implementation strategies that address training, infrastructure and organisational support to ensure the sustainable use of technology interventions for learners with ASD.

3.4 Digital Intervention Effectiveness

Design quality, learner engagement and intervention effectiveness emerged as a central theme across the reviewed studies. These highlight the importance of how digital technologies are developed and implemented for learners with ASD. Multiple studies indicated that the quality of digital intervention design played a key role in learner engagement and participation. Structured and visually clear interventions supported sustained involvement by reducing cognitive demands during learning tasks. Design features that accommodated individual needs further enhanced learner responsiveness. Consequently, learners were more likely to remain engaged throughout learning and intervention activities (Omar et al., 2024; Ntalindwa et al., 2021; Maratullatifah & Ratnasari, 2023).

Learner engagement and usability were frequently emphasised in empirical studies examining technology-based interventions for ASD. Studies reported that digital tools which were easy to navigate and adaptable to individual abilities were more likely to sustain learner interest and reduce frustration. Futhermore, tablet-based and mobile applications were found to support engagement by allowing learners to interact with content at their own pace within structured learning environments (Rahman et al., 2023; Omar et al., 2024). Usability was particularly important for learners with limited attention spans as complex interfaces made it harder for these learners to remain engaged. Apart from learner engagement, usability from the perspective of teachers and caregivers was also highlighted. Empirical findings indicated that technologies perceived as intuitive and manageable were more readily adopted and used consistently in classroom and intervention settings (Alzrayer, 2024; Mudau, 2023). Moreover, studies involving emerging technologies such as robotics and virtual reality further noted that engagement was enhanced when these tools were introduced gradually and supported by clear instructional guidance (Zoder-Martell et al., 2021; Chițu et al., 2023).

The reviewed studies indicated that technology-supported approaches were associated with positive intervention outcomes. Studies measuring learning, communication and functional

outcomes reported improvements when digital interventions were implemented as part of structured instructional programs. Evidence from randomized controlled trials and applied research indicated that technology-based interventions were effective in supporting skill development particularly when aligned with individual learning goals and used alongside teacher support (Leung et al., 2021; Scarcella et al., 2023; Wang et al., 2024). However, studies also highlighted that effectiveness was influenced by contextual and implementation factors. Empirical findings suggested that digital interventions were most effective when integrated purposefully into existing practices rather than used in isolation. Factors such as consistent use, alignment with learner needs and ongoing monitoring of progress were associated with more positive outcomes (Urrea et al., 2024; Klavina et al., 2024). These findings indicate that while digital interventions show strong potential for supporting learners with ASD, their effectiveness depends on appropriate implementation and sustained engagement over time.

4. CONCLUSION

The findings of this systematic literature review demonstrate that technology-based interventions hold considerable promise for addressing the diverse learning needs of learners with Autism Spectrum Disorder (ASD) across educational and therapeutic contexts. The reviewed evidence indicates that digital technologies can enhance academic achievement, functional skill acquisition, social participation, and learner engagement when they are thoughtfully designed, appropriately implemented, and aligned with individual learning needs. However, the effectiveness and sustainability of these interventions depend not only on the technologies themselves but also on contextual factors, including teacher readiness, implementation quality, usability, access to resources, and institutional support. Persistent challenges related to professional training, technological infrastructure, and systemic constraints continue to influence the successful integration of technology into educational practice. Taken together, these findings suggest that technology should be regarded as a complementary pedagogical tool rather than a standalone solution. To maximise its educational impact, technology-enhanced interventions should be embedded within well-structured instructional frameworks, supported by continuous professional development, and adapted to the contextual realities of diverse educational settings.

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