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Article

Inclusive Teaching Strategies and Educational Technologies for Students with Autism Spectrum Disorder: A PRISMA Systematic Review

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Abstract
Autism Spectrum Disorder (ASD) creates heterogeneous academic, communicative, sensory, social, and behavioral support needs in inclusive education. This systematic integrative review synthesized primary, secondary, and grey evidence published from January 2000 through December 2025 concerning inclusive teaching strategies and educational technologies for learners with ASD. Searches of ERIC, Scopus, Web of Science, and Google Scholar identified 186 records; after deduplication and screening, 18 sources were retained. Two reviewers independently screened records and resolved disagreements through consensus. Because the evidence base contained diverse designs, methodological quality was assessed with design-appropriate Joanna Briggs Institute critical appraisal checklists. Three sources were judged high confidence, ten moderate confidence, and five low confidence. Seven interrelated themes were identified: structured teaching; behavioral and communication supports; peer-mediated practices; assistive and digital technologies; sensory-responsive classroom climates; teacher preparedness; and pedagogy-technology integration. Across designs, technology appeared most useful when embedded in explicit pedagogy, individualized supports, and relationally supportive classrooms. However, causal claims are limited by small samples, observational designs, narrative reviews, geographical concentration, and variable methodological quality. The review advances prior work by integrating psychological, behavioral, environmental, pedagogical, and technological evidence within one cautious framework for inclusive practice.

Keywords: autism spectrum disorder; educational technology; inclusive education; integrative review; PRISMA; teacher preparedness

1. Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition associated with differences in social communication and interaction and with restricted or repetitive patterns of behavior or interest (American Psychiatric Association, 2022). These characteristics vary substantially between learners and interact with language, cognition, sensory processing, educational level, and environmental demands. Accordingly, inclusion cannot be reduced to physical placement in a general education classroom. It requires meaningful access to instruction, communication, peer relationships, emotional safety, and opportunities for agency (Bolourian et al., 2021).

Research on ASD education spans distinct traditions. Behavioral and structured-teaching studies emphasize explicit routines, prompting, reinforcement, task analysis, and environmental

predictability (Iovannone et al., 2003; Meindl et al., 2020). Social and ecological research emphasizes peer relationships, mentorship, classroom climate, and the fit between a learner and surrounding systems (Carter et al., 2019; Feeney & Burke, 2021). Technology research examines communication tools, mobile applications, software, multimedia, and virtual reality (Chinchay et al., 2024; Silva et al., 2025a, 2025b). When considered separately, these literatures can lead to overly narrow conclusions about what drives successful inclusion (Bailey & Baker, 2020).

Three theoretical perspectives guide interpretation. Social Cognitive Theory explains how modeling, self-efficacy, reinforcement, and reciprocal interactions shape learning (Bandura, 1986). Ecological Systems Theory locates outcomes within interacting classroom, family, institutional, community, and policy systems (Bronfenbrenner, 1979). Universal Design for Learning (UDL) emphasizes multiple means of engagement, representation, and action or expression (CAST, 2018). Together, these perspectives predict that technologies will be most effective when they strengthen, rather than substitute for, responsive pedagogy and social support (Bray et al., 2023).

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1.1 Original contribution and review questions

Previous reviews commonly isolate one technology, one outcome domain, one age group, or one educational setting. The present review contributes an integrative framework linking instructional structure, functional communication, behavior, peer participation, sensory regulation, teacher capacity, and technology implementation. It also explicitly distinguishes the strength of evidence from the attractiveness of an intervention. The review addressed three questions: (1) Which inclusive teaching strategies and educational technologies are reported across the evidence base? (2) How are academic, behavioral, social, communicative, and psychological outcomes described? (3) How do methodological quality and contextual factors affect confidence in and transferability of the findings?(Fernández-Batanero et al., 2022)

2. Research Methods

2.1 Design and reporting framework

A systematic integrative review design was used because the question required the synthesis of heterogeneous evidence, including quantitative, qualitative, mixed-methods, review, conceptual, and grey literature sources. Reporting was guided by PRISMA 2020 (Page et al., 2021). PRISMA was used to document identification and selection transparently; it was not treated as evidence that all included sources had equivalent methodological strength. (Kunisch et al., 2022).

2.2 Protocol and deviations

The review protocol was not prospectively registered. Registration was not planned before screening began, and retrospective registration was not undertaken. The principal reporting deviation identified during revision concerned inconsistent date descriptions: the original search-strategy paragraph stated 2020-March 2025, whereas the eligibility criteria and included evidence covered 2000-2025. The corrected and consistently applied period is January 2000 through December 2025. The revision also clarifies that the project is an integrative review and that eligible evidence included primary studies, evidence syntheses, a scholarly reference chapter, and a doctoral dissertation. These deviations are disclosed to prevent the appearance of a purely empirical effectiveness review. (Moher et al., 2015)

2.3 Information sources and final search date

ERIC, Scopus, Web of Science Core Collection, and Google Scholar were searched for English-language material published from January 1, 2000 through December 31, 2025. The final search was conducted on December 31, 2025. Reference lists of eligible sources were also examined. Google Scholar was used as a supplementary discovery source because of its broad coverage of educational and grey literature. (Moser et al., 2026)

2.4 Full search strategies

Search syntax was adapted to each platform while retaining four conceptual blocks: ASD, inclusive education, instructional or behavioral support, and educational technology. The following reproducible strings were used:

- ERIC: (autism OR "autism spectrum disorder" OR ASD) AND ("inclusive education" OR "inclusive classroom" OR mainstream) AND (teach OR instruction OR pedagogy OR "behavior support" OR communication) AND (technology OR "assistive technology" OR digital OR mobile OR software OR "virtual reality")
- Scopus: TITLE-ABS-KEY((autism OR "autism spectrum disorder" OR ASD) AND ("inclusive education" OR "inclusive classroom" OR mainstream) AND (teach OR instruction OR pedagogy OR "behavior support" OR communication) AND (technology OR "assistive technology" OR digital OR mobile OR software OR "virtual reality")) AND PUBYEAR > 1999 AND PUBYEAR < 2026
- Web of Science: TS=((autism OR "autism spectrum disorder" OR ASD) AND ("inclusive education" OR "inclusive classroom" OR mainstream*) AND (teach OR instruction* OR pedagogy OR "behavior? support" OR communication) AND (technology OR "assistive technology" OR digital OR mobile OR software OR "virtual reality")); Timespan: 2000-2025
- Google Scholar: allintitle/autocomplete combinations of "autism spectrum disorder" inclusion teaching technology, supplemented by phrase searches using "inclusive classroom," "assistive technology," "behavioral support," and "virtual reality." Results were screened for relevance and duplicates. (Iovannone et al., 2003).
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2.5 Eligibility criteria

Sources were eligible when they: (a) addressed learners with ASD or educational personnel supporting them; (b) examined or synthesized inclusive teaching, communication, behavioral, environmental, social, or technology-related supports; (c) reported outcomes, implementation evidence, or an explicit evidence-informed framework relevant to education; (d) were published in English between 2000 and 2025; and (e) were available as peer-reviewed articles, scholarly chapters, systematic or narrative reviews, or substantial graduate research. Clinical or medical interventions without educational relevance, editorials, conference abstracts, sources lacking sufficient methodological or conceptual detail, and duplicates were excluded. Inclusion of a dissertation and scholarly chapter was intentional to broaden contextual evidence and is treated as a potential source of bias rather than concealed as peer-reviewed evidence. (Tsou et al., 2024)

2.6 Screening and disagreement resolutions

The searches produced 186 records. After 52 duplicates were removed, 134 titles and abstracts were screened. Ninety-two records were excluded at this stage, and 42 reports underwent full-text assessment. Twenty-four reports were excluded because they were not focused on ASD (n=10), were not situated in an educational context (n=8), or contained insufficient relevant data (n=6). Eighteen sources were included. Rajendra Bista and Surakshya Paudel independently screened titles and abstracts and independently assessed full texts. Disagreements were resolved through discussion and consensus. Inter-rater agreement was not statistically quantified; this is reported as a limitation rather than replaced with a retrospective estimate. (Deb et al., 2020).

Figure 1. PRISMA Flow Diagram of Study Selection

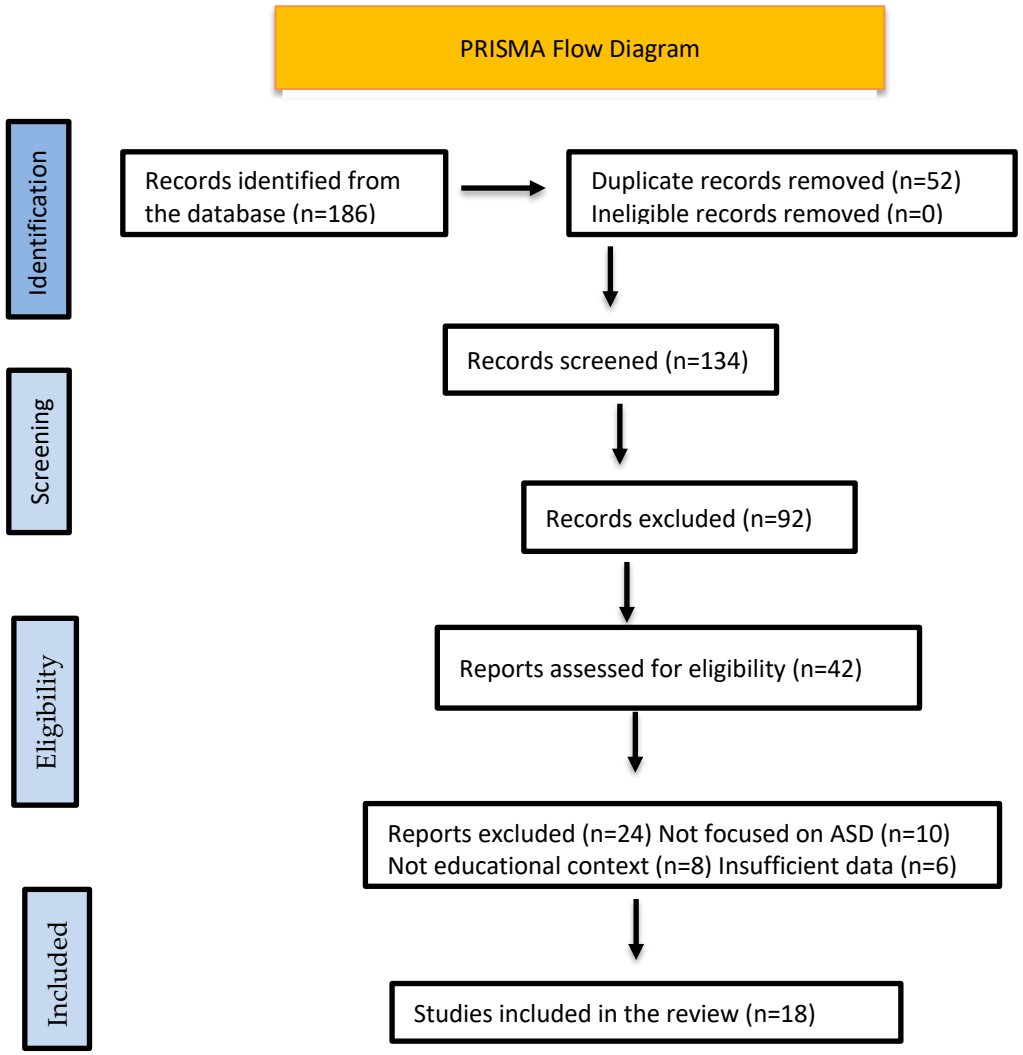


Figure 1. PRISMA 2020 flow diagram for study selection.

2.7 Data extraction and synthesis

A structured matrix captured citation, country, educational level, evidence type, participants or evidence base, intervention or support, outcomes, and limitations. Findings were coded inductively and then compared with the review questions. Codes were grouped into candidate themes, refined through constant comparison, and checked against discrepant or null findings. Because study designs, populations, interventions, and outcomes were highly heterogeneous, meta-analysis was neither appropriate nor attempted. The synthesis emphasizes direction, consistency, context, and confidence rather than pooled effectiveness. (Dhakal et al., 2022).

2.8 Methodological quality appraisal

Methodological quality was assessed using the Joanna Briggs Institute (JBI) critical appraisal checklist most closely aligned with each evidence type: cohort, analytical cross-sectional, quasi-experimental, qualitative/case evidence, systematic review, or text and opinion. Design-science, Delphi, and mixed-method sources were appraised using the relevant component checklists and an integrative judgment. Appraisal considered clarity of the question, appropriateness of design, participant or source selection, measurement validity, confounding, analysis, transparency, and alignment between evidence and conclusions. Overall confidence was classified as high (few or no

material concerns), moderate (some concerns but usable evidence), or low (major limitations restricting inference). Sources were not excluded solely because of quality; quality informed the weight assigned in synthesis. (Barker et al., 2023).

3 Results

A total of 18 studies met the inclusion criteria and were included in the final synthesis. The studies represented diverse educational settings, participant populations, and methodological approaches, including experimental, mixed-method, case study, action research, and review designs. Table 1 presents the characteristics of the included studies. Thematic analysis identified seven major themes related to inclusive teaching strategies and educational technologies supporting students with Autism Spectrum Disorder (ASD).(Fernández-Batanero et al., 2022).

Table 1. Summary of Included Studies in the Systematic Review

Authors	Years	Methodology	Participants	Key Findings
Athawuda, N.	2025	Mixed-method (survey + interviews)	50 Teachers, 5 principals	Assistive technologies support communication, limited by training gaps and resource constraints
Pira, R. N	2021	Case study (mixed-method)	Students with ASD, educators, and parents	Mobile technologies improve social inclusion and communication through structured collaborative use
Karagianni & Drigas	2023	Review Study	Students with SEN	Technology-enhanced pedagogy promotes inclusion, engagement, and functional skill development
Fidosieva, H.	2025	Action research	58 students with ASD	SPARK model improves participation, autonomy, and inclusive learning outcomes
Gokaydin et al.	2020	Document/content analysis	ASD population (multiple studies	Technology-based interventions are effective across multiple developmental domains
Melo et al.	2022	Case study	Elementary ASD students	Digital tools enhance communication, participation, and inclusive classroom practices
Newbutt, N.	2019	Literature review	Individuals with ASD	VR and multimedia tools improve communication, learning, and independence
Feeney & Burke	2021	Quantitative study	27,417 adolescents with ASD	Adult mentorship significantly improves social engagement outcomes
Reutebuch et al.	2015	Experimental pilot study	High school ASD students	Reading interventions improve comprehension, interaction, and reduce behavioral challenges
Carter et al.	2019	Longitudinal study	90 ASD students	Educational support models influence engagement, placement success, and academic outcomes
Davis et al.	2021	Systematic review	ASD students in higher education	Academic and social supports improve outcomes but are frequently underutilized

Silva et al.	2025a	Experimental (VR-based)	Students with ASD	Virtual reality enhances cognitive, behavioral, and social development
Silva et al.	2025b	Design science research	ASD learners	VR-based STEM environments support inclusive, interactive learning
Chinchay et al.	2023	Heuristic evaluation	ASD children	Educational software improves accessibility and inclusive learning quality
Meindl et al.	2019	Review study	ASD students in classrooms	Evidence-based practices improve engagement in inclusive classrooms
Murray, J.	2015	Literature Review	Students with ASD	Teaching strategies improve academic, behavioral, and social outcomes
Iovannone et al.	2003	Review study	Students with ASD	Structured instruction and individualized supports enhance learning outcomes
Dyer, R.	2015	Conceptual study	Students with ASD	Inclusive classrooms support social development and peer interaction

Note: SEN=Special Educational Needs; VR=Virtual Reality; ASD=Autism Spectrum Disorder.
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Themes

3.1Structured Teaching and Predictable Learning Environments

Structured teaching emerged as one of the most consistently supported approaches for promoting successful educational outcomes among students with ASD. Across the reviewed studies, structured instructional practices, visual supports, predictable routines, and individualized learning systems were associated with improved engagement, behavioral regulation, and academic participation. Foundational work by Iovannone et al. (2003) identified structured instruction, visual organization, and predictable classroom routines as essential components of effective ASD education. These findings were reinforced by later studies, including Murray (2015), Meindl et al. (2019), and Fidosieva (2025).

The literature suggests that structured environments reduce uncertainty and provide learners with clear expectations, thereby supporting attention, task completion, and self-regulation. Visual schedules, organized work systems, consistent transition cues, and clearly defined classroom procedures were repeatedly identified as beneficial practices. Fidosieva (2025) reported that implementation of the SPARK model significantly enhanced student participation, independence, and engagement in inclusive classroom activities.

Importantly, the evidence indicates that effective structured teaching extends beyond classroom organization and requires individualized adaptation. The most successful interventions were those that aligned instructional supports with students' communication abilities, sensory preferences, and executive functioning needs. Collectively, the findings suggest that structured teaching provides a foundational framework for inclusive education by creating learning environments that are

predictable, accessible, and responsive to the diverse needs of students with ASD. (Iovannone et al., 2003).

3.2 Behavioral and Communication-Focused Interventions

Behavioral and communication-focused interventions emerged as a central theme across the reviewed literature. Evidence-based behavioral strategies, including reinforcement systems, prompting techniques, functional behavior assessments, and structured instructional supports, were consistently associated with improvements in student engagement, task completion, and adaptive functioning. Studies by Iovannone et al. (2003), Murray (2015), and Meindl et al. (2019) demonstrated that behaviorally informed interventions improve classroom participation and increase independence among students with ASD.

The literature also emphasized the close relationship between communication and behavioral outcomes. Many behaviors exhibited by students with ASD serve communicative functions, reflecting attempts to express needs, preferences, or discomfort. Melo et al. (2022) reported that the integration of digital communication supports alongside behavioral interventions resulted in improvements in both communication frequency and behavioral regulation. Similarly, augmentative and alternative communication (AAC) tools, including picture-based systems and speech-generating devices, were identified as effective mechanisms for enhancing communication and reducing barriers to participation.

Overall, the findings suggest that communication and behavioral interventions are most effective when implemented as complementary supports that address both functional communication and classroom engagement. (Morin et al., 2018).

3.3Peer-Mediated and Socially Supportive Practices

Peer-mediated interventions and socially supportive practices were consistently associated with improved social participation and inclusion. The reviewed studies indicated that placement within a general education setting alone does not guarantee meaningful social engagement. Instead, successful inclusion depends on the availability of structured opportunities for interaction, collaboration, and relationship building.

Feeney and Burke (2021) found that mentorship and social support structures significantly improved social engagement outcomes among adolescents with ASD. Likewise, Carter et al. (2019) reported that supportive social environments and peer interactions were strongly associated with sustained educational engagement and positive school experiences. Peer-mediated interventions often involved training classmates to initiate conversations, model appropriate communication, and facilitate participation in classroom activities.

The collective evidence indicates that social inclusion is enhanced when peer relationships are intentionally supported through structured and collaborative educational practices. (Kasari et al., 2011).

3.4 Assistive and Digital Educational Technologies

Educational technologies emerged as one of the most prominent themes across the reviewed studies. A wide range of technologies, including mobile applications, assistive communication devices, multimedia learning tools, virtual reality platforms, and interactive educational software, were reported to support learning and participation among students with ASD.

Several studies highlighted the effectiveness of technology-based interventions in promoting communication, engagement, and independent learning. Pira (2021) found that mobile technologies enhanced social interaction and communication through structured collaborative activities. Karagianni and Drigas (2023) reported that technology-enhanced instructional approaches contributed to improved inclusion and skill development, while Silva et al. (2025) demonstrated positive cognitive, behavioral, and social outcomes associated with virtual reality-based learning environments.

However, the findings also suggest that the effectiveness of technology depends on appropriate implementation and alignment with educational objectives. Studies emphasized that technology

functions most effectively when integrated within evidence-based instructional practices and individualized supports. (Carnett et al., 2022).

3.5 Sensory Experience, Classroom Climate, and Participation

The sensory and relational characteristics of classroom environments emerged as important influences on participation and learning. Students with ASD frequently experience sensory processing differences that may affect their ability to engage effectively in traditional classroom settings. Several studies identified environmental accommodations, such as reduced distractions, flexible seating, visual supports, and predictable routines, as beneficial strategies for promoting participation and emotional regulation.

The literature further highlighted the importance of classroom climate in supporting inclusion. Positive teacher-student relationships, respectful interactions, and supportive classroom cultures were associated with increased engagement and improved social outcomes. Carter et al. (2019) found that classrooms characterized by both high expectations and supportive relationships produced stronger academic and social outcomes than environments lacking either structure or relational support. These findings suggest that inclusive education extends beyond instructional practices and requires attention to the physical, sensory, and social dimensions of the learning environment. (Rotheram-Fuller et al., 2010).

3.6 Teacher Preparedness and Professional Capacity

Teacher preparedness emerged as a critical factor influencing the success of inclusive education. Across the reviewed studies, educator knowledge, confidence, and access to professional development were consistently identified as important determinants of implementation quality and student outcomes.

Athawuda (2025) reported that although teachers recognized the value of assistive technologies, many lacked sufficient training and institutional support to implement them effectively. Similar findings were reported across studies examining inclusive instructional practices, communication supports, and technology integration. The literature suggests that successful inclusion requires specialized knowledge related to ASD characteristics, behavioral supports, communication interventions, assistive technologies, and differentiated instruction.

Furthermore, several studies emphasized the value of collaboration among general educators, special educators, speech-language pathologists, and other specialists. Ongoing professional development and interdisciplinary collaboration were consistently identified as essential components of effective inclusive practice. (Donath et al., 2023).

3.7 Integration of Pedagogy and Technology

The final theme identified through the thematic analysis was the integration of pedagogical practices and educational technologies. Across the reviewed literature, the strongest educational outcomes were observed when technology was embedded within structured instructional frameworks rather than implemented as a standalone intervention.

Studies consistently demonstrated that technological tools enhanced learning when aligned with clear educational goals, individualized supports, and evidence-based teaching strategies. Pira (2021) found that mobile technologies produced meaningful gains in communication and social participation when incorporated into structured collaborative learning activities. Similarly, Reutebuch et al. (2015) reported that technology-supported reading interventions were most effective when accompanied by direct instructional guidance and scaffolding.

Collectively, the findings suggest that technology serves as a facilitator of inclusive education when integrated with pedagogically sound instructional practices. Rather than replacing effective teaching, technological tools extend and enhance opportunities for participation, communication, and learning among students with ASD. (Fernández-Batanero et al., 2022).

4.Discussion

This systematic integrative review synthesized 18 sources published between 2000 and 2025 and identified seven interconnected elements of effective ASD inclusion: structured teaching, behavioral

and communication support, peer-mediated practices, educational technology, sensory-responsive environments, teacher preparedness, and pedagogy–technology integration.

Structured routines, visual supports, and clear expectations can reduce uncertainty and support engagement among students with ASD (Iovannone et al., 2003; Mesibov & Shea, 2010; Murray, 2015; Meindl et al., 2019). Communication supports, including augmentative and alternative communication, may also reduce behavior-related barriers by helping students express their needs and participate more independently.

Meaningful inclusion requires more than placement in a general education classroom. Peer-mediated interventions and collaborative activities can strengthen communication, social participation, and belonging. Likewise, sensory-responsive modifications—such as reduced distractions, flexible seating, and predictable transitions—may improve students' classroom experiences.

Digital tools and virtual environments show potential for supporting communication, academic learning, and social development. However, their effectiveness depends on instructional design, teacher guidance, accessibility, and alignment with students' needs (Gokaydin et al., 2020; Chinchay et al., 2023). Technology should therefore supplement, rather than replace, evidence-based teaching. This integration reflects Universal Design for Learning by providing multiple means of engagement, representation, and expression.

Teacher preparedness remains essential. Schools should provide sustained professional development, specialist support, assistive technologies, and resources for differentiated instruction. Nevertheless, conclusions must remain cautious because the reviewed sources varied in design, quality, educational context, and resource availability. Future research should prioritize longitudinal and primary empirical studies, culturally diverse settings, student and family perspectives, and emerging technologies such as artificial intelligence and adaptive learning.

Overall, effective inclusion requires coordinated attention to instruction, communication, social participation, classroom environment, technology, and teacher capacity. (Finkelstein, Sharma, & Furlonger, 2019).

5.Conclusions

This systematic review synthesized evidence from 18 studies examining inclusive teaching strategies and educational technologies for students with Autism Spectrum Disorder (ASD). The findings indicate that successful inclusion is supported by structured teaching, communication and behavioral supports, peer-mediated practices, assistive technologies, sensory-responsive environments, teacher preparedness, and the effective integration of pedagogy and technology.

The review demonstrates that meaningful inclusion extends beyond classroom placement and requires coordinated instructional, social, and environmental supports that address the diverse needs of students with ASD. Effective implementation depends on well-prepared educators, accessible communication systems, supportive learning environments, and evidence-based technology integration.

These findings have important implications for educators, schools, and policymakers seeking to strengthen inclusive educational practices. Future research should continue to investigate the long-term effectiveness of technology-enhanced interventions, culturally responsive approaches to inclusion, and emerging technologies such as artificial intelligence and adaptive learning systems. Overall, successful inclusion is best achieved through a holistic approach that combines instructional excellence, technological innovation, and collaborative support to promote positive educational outcomes for students with ASD. (Fernández-Batanero et al., 2022)

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