Ed Process Int J

www.edupij.com

ISSN 2147-0901 (Print), 2564-8020 (Online)

EDUCATIONAL PROCESS
INTERNATIONAL JOURNAL

Utilization of Artificial Intelligence and Assistive Technology in Autism: Diagnosis, Treatment, and Education Applications—A Systematic Literature Review

Mohammad A. Beirat, Ahmad Algolaylat, Hussein Al Njadat, Bassam AlAbdallat, Alaa K. Al-Makhzoomy

Review Article

Cite this article: Beirat, M. A., Algolaylat, A., Al Njadat, H., AlAbdallat, B., & Al-Makhzoomy, A. K. (2025). Utilization of Artificial Intelligence and Assistive Technology in Autism: Diagnosis, Treatment, and Education Applications—A Systematic Literature Review. *Educational Process: International Journal, 17*, e2025350. https://doi.org/10.22521/edupij.2025.17.350

Received May 17, 2025
Accepted July 7, 2025
Published Online July 24, 2025

Keywords: Artificial intelligence, assistive technologies, autism diagnosis, therapeutic interventions, ethical frameworks, special education.

Author for correspondence:
Mohammad A. Beirat
beirat@ahu.edu.jo
Al-Hussein Bin Talal University, Ma'an, Jordan.

Abstract

Background/purpose. This paper systematically reviews current advancements in AI-based diagnostic tools and assistive technologies, analyzing their influence on the early detection, treatment, and educational support of autism spectrum disorders (ASDs). The review aims to identify both the benefits and challenges of incorporating these technologies into autism care and to highlight future opportunities, especially in enhancing learning and communication outcomes for individuals with autism.

Materials/methods. A systematic literature review was conducted based on 27 peer-reviewed articles published between 2010 and 2023. The search strategy involved major databases, including Scopus, ScienceDirect, PubMed, JSTOR, and Google Scholar. The analysis follows the PRISMA approach, with specific inclusion criteria and quality assessment procedures in place. The study focuses on four key subthemes: AI-driven diagnostic systems, therapeutic and assistive robotics, educational and communication applications, including augmented reality applications, and ethical and implementation challenges associated with autism-related technologies.

Results. The reviewed studies demonstrate that AI tools offer significant potential for early and precise autism diagnosis, particularly through the application of machine learning algorithms to behavioral and physiological data. Assistive technologies, particularly social robots and AR platforms, show positive outcomes in therapeutic engagement. Supporting educational development and skill acquisition. However, issues such as limited accessibility, ethical concerns regarding data privacy, and integration barriers persist.

Conclusion. AI and assistive technologies are transformative in autism care, offering innovative solutions for diagnosis and treatment. However, their successful implementation requires addressing ethical, infrastructural, and cultural challenges. This study provides evidence-based insights and practical recommendations for researchers, clinicians, educators, and policymakers to enhance the equity and impact of these emerging technologies in autism intervention and inclusive learning environments.

1. Introduction

In recent years, the diagnosis and treatment of autism spectrum disorder have led to a wide array of research efforts towards the integration of Artificial Intelligence and Assistive Technology. These forces of evolution stem from the continuous demand for more accurate, efficient, and accessible diagnostic methods compared to those of traditional counterparts, which are often slow and sometimes imprecise. ML has been a subcategory within AI and an important tool in this domain, enabling the identification of patterns and biomarkers that can facilitate earlier and more accurate diagnoses. Indeed, following the work by Joudar et al. (2023) and Yi et al. (2024).

Autism Spectrum Disorder (ASD) presents diverse challenges in diagnosis and intervention, requiring adaptive, scalable solutions. Recent technological innovations—particularly artificial intelligence and assistive tools—offer promising avenues for improving outcomes in ASD care (Smith et al., 2022; Zhang & Lee, 2023).

Various machine-learning techniques have been applied to behavioral assessments, neuroimaging, and physiological markers in the development and improvement of the diagnostic process for ASD. Various findings have identified that machine-learning models can classify autism with high accuracy based on features observed in the ADOS, one of the standard diagnostic tools for assessing ASD (Tariq et al., 2018; Kosmicki et al., 2015). These models employ various algorithms, including support vector machines and decision trees, to detect subtle differences in behavior and cognitive function that are characteristic symptoms of the disorder. Where large volumes of data can be analyzed, meaningful patterns that would not have been possible using conventional diagnosis techniques can be extracted.

Recent research has identified the potential for investigating home videos and similar data sources without intrusion for remote diagnosis. For example, the work of Tariq et al. (2018) demonstrates that machine learning techniques applied to the analytical inspection of home videos yield promising results in detecting specific traits associated with autism, thereby facilitating easier access to diagnosis. This will ease the burden not only for the families who may find it cumbersome to seek traditional diagnostic services but also provide an opportunity for continuous monitoring of changes in behavior over time. In conjunction with machine learning algorithms, video data significantly advances the field, as clinicians can derive insights without the need for in-person assessments (Rahman et al., 2020; Vakadkar et al., 2021).

In addition to video analysis, eye-tracking technology also has excellent potential for enhancing the diagnosis process for ASD. Eye-tracking research has shown different visual attentiveness patterns that machine learning techniques can quantitatively differentiate in autistic children (Tariq et al., 2018; Nabil et al., 2021). These may serve as biomarkers of autism, thus providing clinicians with objective measures to support their diagnostic decisions. This convergence of eye-tracking data with the machine learning model has the potential to enhance diagnostic accuracy and reduce the time it takes to identify autism, a crucial factor in early interventions.

Additionally, the investigation of neurophysiological markers, including EEG patterns, has opened new avenues for understanding and diagnosing the condition. Nonlinear measures associated with language-related EEG predicted ASD diagnoses as early as six months, as reported by Peck et al. (2020). This finding suggests that early detection, combined with the contribution of machine learning, may identify infants who are at risk well before frank symptoms appear. Advanced analytical techniques will thus enable clinicians to create targeted interventions tailored to the specific needs of children with autism, leading to improved overall outcomes (Alsaidi, 2024; Alarifi, 2023).

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

Machine learning has been applied to ASD diagnosis. Still, challenges, such as data quality, large and diverse datasets, and overfitting, must be considered to make these models reliable. The study also raises ethical considerations, including data privacy and the implications of automated healthcare decisions. As the field is constantly evolving, close collaboration between researchers and clinicians is necessary to refine these technologies, with best practices being defined for their implementation.

AI and assistive technologies make many contributions to the field of treatment. Robotic interventions, for example, have been explored as a way to improve social skills among children with autism. It has been evidenced that children with autism can more easily approach programmable robots that provide specific social cues and feedback in a controlled environment. This method, a new therapeutic tool, provides insight into the social dynamics of autism that will inform future interventions simultaneously.

Additionally, mobile applications have been developed to continuously treat autism. These applications utilize machine learning algorithms to provide parents and caregivers with immediate feedback on changes in their children's behavior and implement strategies to promote positive behavioral changes (Jacob et al., 2023; Wingfield et al., 2020). Using AI, these tools enable families and clinicians to face the diagnosis of autism together.

This opens a new frontier in modern autism research, specifically examining the feasibility of using machine learning to identify subtypes from behavioral and physiological data. This would enable clinicians to subsequently identify specific profiles on the autism spectrum and individualize treatments further, thereby developing more effective treatments that would ultimately improve outcomes in affected individuals. Such an approach is essential given the highly heterogeneous nature of autism manifestations, which vary across different presentations and challenges. Indeed, it does-Gardner (Hoag et al., 2021; Chaddad et al., 2021).

While many studies have explored AI applications in diagnosis and various assistive tools for therapy, there is a lack of a comprehensive synthesis that evaluates both diagnostic and therapeutic domains within a single framework. Most prior reviews have focused narrowly on either AI-driven diagnostics or robotic therapies, without addressing their intersection or the contextual challenges that arise, such as ethical use, equity, or scalability (Ahmed et al., 2023; Torres & Malik, 2022). Therefore, this study fills a critical gap by offering a systematic literature review that simultaneously examines AI and assistive technologies, assessing their diagnostic and therapeutic roles, implementation challenges, and future directions from an interdisciplinary perspective.

2. Research Methodology

This section forms the research methodology, which means how the research objectives and questions have been addressed. According to Wilson (2014, methodology refers to the strategies and techniques an individual adopts to conduct a study systematically. Similarly, Piepenburg has also pointed out that a research methodology is a systematic approach through which important issues can be investigated and well-informed decisions can be made. A systematic review of the literature will be conducted, given the emphasis of the current study on the use of Artificial Intelligence and Assistive Technology in the diagnosis and treatment of autism. This qualitative methodology employs the analysis of data available or obtained from previously completed studies, which are rich sources of detailed information on the interaction between AI, assistive technologies, and autism care. In particular, this methodology is more suitable for this research, given the limited time and resources available. This breadth of focus allows for in-depth exploration of various topics within the available timeframe. The methods and procedures employed in data collection, analysis, and interpretation are clearly explained to ensure a solid foundation for addressing the research objectives.

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

2.1. Research Philosophy

The research philosophy is regarded as a fundamental element of methodology since it prescribes the underpinning principles that dictate the research process and approach toward addressing the stated objectives. Wilson (2014) defines research methodology as the strategies and methods that give form and direction to the research process. Additionally, Piepenburg (2011) reiterated that methodology is a systematic way of testing complex issues and making informed judgments. Therefore, the qualitative research philosophy was adopted for this study on the role of AI and assistive technology in diagnosing and treating autism. Such a philosophy is well-suited for analyzing the available literature by synthesizing knowledge from the existing data. The qualitative approach was best because it would achieve the research objectives, given the limited time and resources. This was intended to allow for deep exploration while simultaneously economizing on resources within the set timeline for the research. This section outlines the guiding philosophy and approach, thereby establishing the theoretical and methodological framework for the study.

2.2. Approaching and Strategy

This study adopted an inductive approach to developing a comprehensive theoretical framework for integrating Artificial Intelligence and Assistive Technology in diagnosis and treatment. It synthesizes insights from existing literature to advance our understanding of the interconnections between AI-driven diagnostic tools, assistive technologies, and therapeutic strategies. The research begins by establishing a foundational framework of key themes and theories that underpin these areas of inquiry. This would, in turn, form a basis for exploring how AI and assistive technologies influence the accuracy of autism diagnosis, improve therapeutic outcomes, and deliver personalized treatment plans.

A critical analysis of existing studies and their empirical evidence reveals significant insights into how these technological innovations interact with their applications in autism care. This provides an in-depth examination of how AI and assistive tools enhance diagnosis and treatment processes by facilitating access to more efficient and personalized solutions for individuals with autism.

2.3. Choices

Since detailed insight is required into the role of AI and Assistive Technology in diagnosis and treatment, this is the reason a qualitative methodology was chosen for data analysis in the present study. The exclusively qualitative nature of the data included allows for a deeper understanding of such complex relationships between AI-driven diagnostic tools, assistive technologies, and therapeutic approaches. This qualitative approach is particularly practical for investigating complex dynamics and variations that may not have been captured by methods using quantitative techniques. The qualitative inquiry, therefore, enables the current study to detail how such technologies influence the accuracy of diagnosis, personalization of treatment, and overall care outcomes for individuals with autism in particular ways.

2.4. Time horizons

The methodology used in the research will be cross-sectional, as the study lasts for two months, and therefore, time will be of great importance. The method is ideal for studying the interlinkages between AI, assistive technologies, and their applications in autism care over a stated period. The snapshots of the current state of knowledge provided by the cross-sectional design enable an analysis of the dynamics and interrelationships of the studied variables. This approach, coupled with the transformative potential of AI and assistive technologies in improving diagnosis and treatment related to autism, efficiently collects data from existing studies and literature within a limited period.

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

2.5. Methods

This paper, therefore, undertakes an exploratory study into the integration of AI and AT in the diagnosis and treatment of autism spectrum disorder. The review undertakes a systematic collection and synthesis of evidence from academic journals, periodicals, and articles obtained from reputable databases, including literature works from 2010 to date. Given the ongoing global development of relevant technology, the review ensures that studies extend beyond regional contexts to achieve a comprehensive understanding of the subject.

Specific keywords combined with Boolean operators were used to search for studies aligned with the objectives of this systematic review. The searches were applied to the title and abstract fields using advanced search options across multiple databases, including Scopus, PubMed, ScienceDirect, JSTOR, Google Scholar, and ProQuest. Representative Boolean search strings included: "autism diagnosis" AND ("artificial intelligence" OR "machine learning") AND ("assistive technology" OR "therapeutic tools"), "autism treatment" AND ("augmented reality" OR "mobile applications") AND ("AI" OR "robotics"), and "autism" AND ("AI-based diagnosis" OR "machine learning models") AND ("ethical concerns" OR "privacy issues"). These search strings were refined iteratively to ensure a balance between comprehensive coverage and relevance. No specialized software was used for data analysis; instead, a manual inductive coding approach was applied. Articles were read and re-read, and open coding was used to identify key themes. These were organized into a thematic matrix, allowing for synthesis across studies. This manual process was considered suitable due to its qualitative focus and manageable volume of included articles, which ensured transparency and reproducibility.

For example, a representative Boolean search string applied was:

"autism diagnosis" AND ("artificial intelligence" OR "machine learning") AND ("assistive technology" OR "therapeutic tools").

Although no specialized software was used for content analysis, the review employed an inductive manual coding approach to identify and synthesize key themes from the included studies. This involved iterative reading, thematic categorization, and synthesis based on recurring concepts and ideas. The overall selection and reporting process was conducted in accordance with the PRISMA 2020 guidelines, ensuring methodological transparency and reproducibility.

The secondary data, for instance, were gathered from peer-reviewed journals, books, and conference proceedings. The accredited databases used in the search include, but are not limited to, ScienceDirect, Scopus, PubMed, JSTOR, ResearchGate, Google Scholar, and ProQuest. The search strategy was designed to select relevant and credible literature based on where AI tools are discussed, such as assistive technologies and their use in treating autism. This structured methodology will enable the study to give insightful implications and recommendations that benefit both the researcher and practitioner in diagnosing and treating autism.

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

Table 1. The search strategy outlines and the data collection approach employed in this study.

Search Strategy Component	Description
Data Collection	Secondary data
Data Source	Literature published in journals related to AI, assistive technology, autism diagnosis, and autism treatment.
Main Concepts	Artificial Intelligence, Assistive Technology, Autism Diagnosis, Autism Treatment
Keywords	Artificial intelligence, AI in healthcare, machine learning, autism spectrum disorder, assistive technology, autism diagnosis, autism treatment, technological interventions
Databases	ScienceDirect, Scopus, PubMed, JSTOR, ResearchGate, Google Scholar, ProQuest
Search Techniques	Advanced search options to narrow down the search when necessary
Date Range	2010–2023

A forward and backward manual search was conducted to trace references from primary studies after the automated search. Third, to identify additional relevant studies that may not have been identified during the computerized search, the reference lists of articles were systematically reviewed using snowball sampling (Watson & Webster, 2020). The backward search involves all those references cited in identified articles, while the forward search involves the studies that cited these primary articles. This was complemented by a manual search to complete the results when the findings of the automated search were limited. The forward search also helped identify publications that validated the findings of primary studies and implemented or further developed them; thus, this added value to the dataset.

The studies that were to be eliminated for duplicates were sorted using Mendeley's reference management tool. The review followed the methodology by Kitchenham et al. (2002) in three steps: preparation, execution, and documentation. These included formulating the review question, defining the research methodology, establishing inclusion and exclusion criteria, conducting a quality assessment, and synthesizing evidence to answer the research objectives. The following approach combines automated searches with forward and backward search methods to ensure comprehensiveness in reviewing relevant literature, as suggested by Watson and Webster (2020).

The retrieved studies underwent a process to check for duplicate records, which were subsequently removed. The remaining ones critically reviewed the respective abstracts against pre-set inclusion criteria. The full review of methodology and discussion was reserved for articles that met the requirements for providing salient insights into the role of AI and AT in diagnosing and treating autism. The present research employed open coding and an inductive strategy for content analysis to synthesize the findings effectively.

Through the systematic article selection process, 1,084 publications were identified from databases such as Wiley Online Library, ScienceDirect, and ISI Web of Knowledge. Of these, 162 were drawn from Wiley Online Library, 692 from ScienceDirect, and 230 from ISI Web of Knowledge. Removing 27 duplicates left 1,057 articles. Following the abstract screening process, 812 articles were screened out as irrelevant, leaving 245 papers that were further reviewed. A full-text review of the introduction, methods, and discussion sections of these articles, using 89 predefined quality criteria, further excluded 24 articles for lack of relevance. Thus, 27 articles fulfilled all the inclusion

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

criteria. Figure 1 presents this visually and illustrates the systematic approach used. This has, in effect, provided a rigorous methodology that ensured high-quality studies were conducted and provided insight into the application of AI and Assistive Technology in autism care.

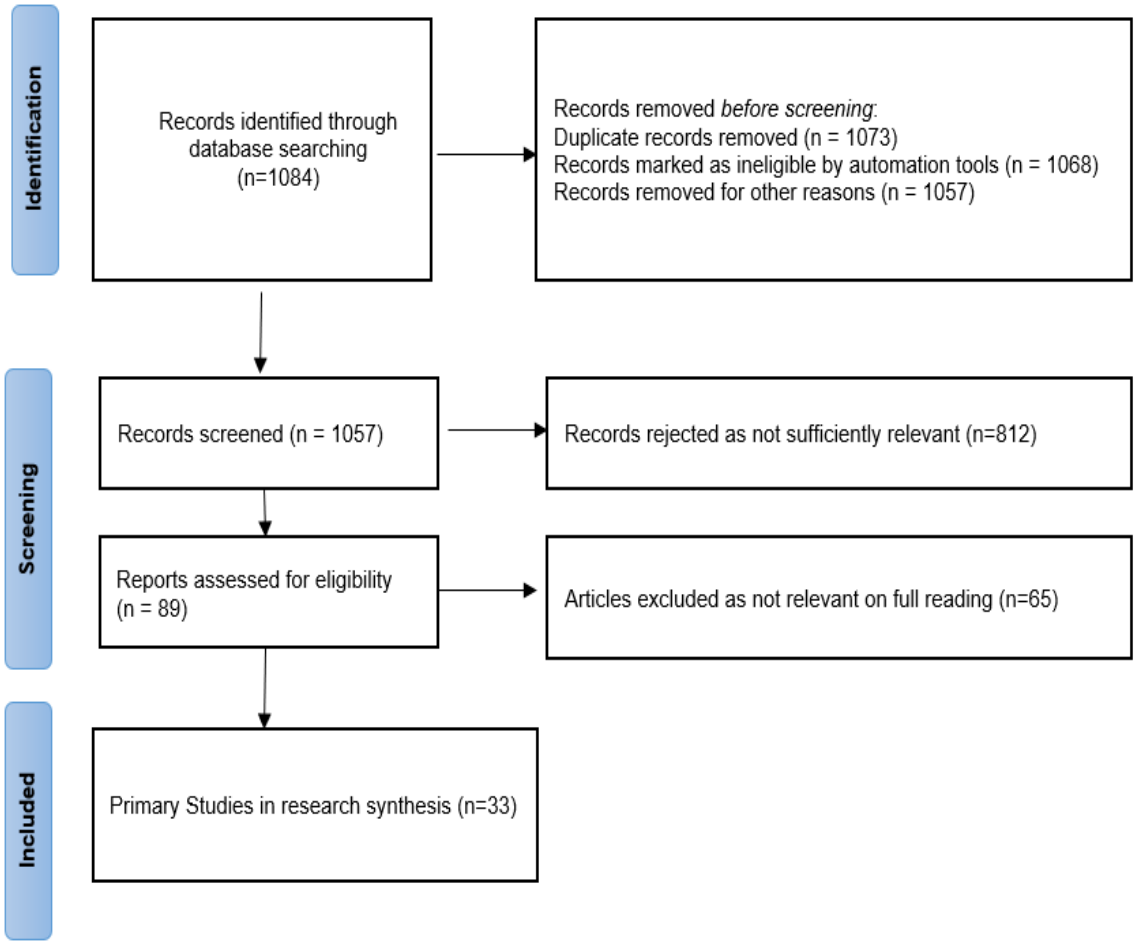

Figure 1. PRISMA Flow chart for SLR included searches of databases and registers only.

2.6. Inclusion and Exclusion Criteria

The study focused on English-language articles published in reputable international academic journals that had undergone peer review, ensuring the authenticity and quality of the information. The study's primary objective was to apply AI and assistive technology in diagnosis and treatment. The articles were selected based on relevance to the study's objectives, methodological vigor, and adherence to the selection criteria.

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

Table 2. Summarizes the inclusion and exclusion criteria used in this research.

Criteria Type	Criteria
Inclusion Criteria	- Studies written in English only.
	- Studies published in reputable international academic journals listed in ABS or SJR databases.
	- Articles focusing on applying AI and assistive technologies in autism diagnosis and treatment.
	- Studies that provide measurable insights into the effectiveness of AI or assistive tools.
	- Articles employing sound research design and methodology.
	- Studies that meaningfully contribute to understanding how AI and assistive technologies improve diagnosis accuracy and therapeutic outcomes for autism.
	- Research published after 2010 to ensure relevance and up-to-date findings.
Exclusion Criteria	- Studies not written in English.
	- Articles that do not focus on the role of AI and assistive technologies in autism diagnosis and treatment.
	- Studies with unclear or ambiguous results or conclusions.
	- Articles published in low-quality or non-peer-reviewed journals.
	- Research that lacks methodological rigor or has significant flaws in design.
	- Studies using non-qualitative methods or theoretical frameworks only.
	- Articles published before 2010.

2.7. Study Quality Assessment

A ranked quality assessment system was applied to the selected papers to ensure only valid, dependable papers were included. This system classified the documents as "high," "medium," and "low" quality. Each paper was then scored according to the criteria listed in Table 3, where a paper that fully met a criterion was given a score of 1, and one that partially met a criterion was given 0.5. At the same time, when it did not meet the criterion, it was given a score of 0. The scoring methodology is based on the approach suggested by Nidhra et al. (2013) to maintain consistency and rigor during the evaluation process.

For any paper, the highest score attainable was 5, representing full compliance with all five criteria, and the lowest score was 0. Papers in the range of 4 to 5 were classified as high quality, those in the range of 3.0 to 3.5 as medium quality, and those papers scoring 2.5 and below were classified as low quality. Of the 33 research articles reviewed, 46% were classified as high quality, 42% as medium quality, and 12% as low quality.

The identification and inclusion of only high-quality studies that provide reliable and relevant information on the role of AI and Assistive Technology in autism diagnosis and treatment were selected through a non-selective critical evaluation process. A critical assessment of the quality of each paper enables the maintenance of a high standard and enhances the credibility of the findings and the supporting research objectives.

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

Table 3. Quality assessment criteria (QAC) were applied in this study.

Criteria No.	Quality Criteria
QAC1	Does the study examine the application of AI or assistive technology in the diagnosis or treatment of autism?
QAC2	Does the study examine the effectiveness of AI-driven tools in improving the accuracy of autism diagnoses?
QAC3	Does the study explore the role of assistive technologies in improving therapeutic outcomes for individuals with autism?
QAC4	Does the study identify potential challenges and opportunities associated with implementing AI and assistive technology in autism care?
QAC5	Does the study provide recommendations for healthcare professionals, researchers, and policymakers to optimize the use of AI and assistive technologies in autism care?

3. Results Analysis

Figure 2 provides a pictorial representation of the number and dates of publications. From this, it can be observed that the trend of research activity about AI-based assistive technology in autism care has been increasing during the last decade. Starting from just one publication in 2014, the number of publications increased gradually and progressively, culminating in a sharp rise in 2022, when the total reached 11 for the first time. Interest and, hence, investment in the area are increasing, reflecting the growing attention that AI and assistive technologies are receiving as significant tools for diagnosis and treatment. The graph further depicts a notable decline in 2023, with six publications, following the peak in 2022. Although this might reflect a plateau in research output, it could also result from delays in publication processes or changes in the research focus within the domain. Further exploration is needed to define whether this decline constitutes an anomaly or signals the beginning of a stabilization phase.

The increasing number of publications from 2019 to 2022 can be attributed to the convergence of several factors. First of all, research has been driven by a wide range of developments in AI, including Machine Learning and Robotics, which have given rise to new tools for early autism diagnosis and personalized therapeutic interventions. For example, researchers have increasingly focused on using AI during this period for behavioral data analysis and the design of support technologies, resulting in a significant increase in the number of studies.

Such high output is probably linked to global funding initiatives and interdisciplinary collaborations. Governments, academic institutions, and private organizations have taken the lead in integrating AI into healthcare, further accelerating progress. The decline in 2023 may suggest that a reevaluation of research priorities is required, or it highlights the challenges in scaling AI or assistive technologies. These could include factors such as a digital divide, regulatory hurdles, and ethical concerns that might have slowed the publication process.

Further studies may investigate the potential obstacles to consistency in output, including funding constraints, barriers to accessing technology, or changes in research interests. Additionally, the potential impact of events such as the COVID-19 pandemic on productivity in this area may also be instructive to determine. The review has demonstrated that research on AI and assistive technology in autism care is a vibrant area. The increase in published works reflects the rapid advancement of the field, driven by both technological innovations and growing societal demands

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

for improved solutions. The slight decline in 2023 warrants the attention of researchers and policymakers to sustain momentum and address emerging challenges, thereby promoting continued growth and innovation.

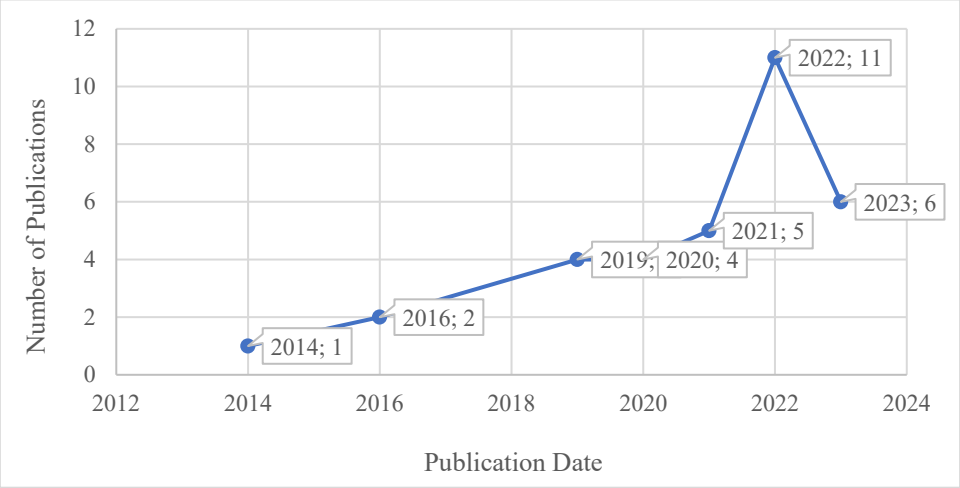

Figure 2. Number and date of related Publication.

Figure 3 displays methodologies found in reviewed studies. The notorious predominance of qualitative approaches, 25 studies, over the quantitative ones, totaling 8, is infamous. This suggests a significant predominance of exploratory and descriptive research methods in AI and assistive technologies for autism care. Most of these studies employed qualitative methodologies, as this is one of the ways AI and assistive technologies can be explored for use in improving the diagnosis and treatment of autism cases. The approach is also appropriate since a new technology often requires descriptive and exploratory techniques to understand user experiences, perceptions, and contextual applicability of tools.

A qualitative investigation of assistive technologies' social robots and mobile apps interacting with users, with a focus on areas for improvement and effectiveness in real life, as called for in the studies by Lancioni & Singh (2014) and Guerrero-Vásquez et al. (2022), is particularly beneficial to explore and describe nuanced social-emotional benefits related to AI use within autism treatment.

On the other hand, there are far fewer quantitative studies, but they prove essential in verifying the efficiency and effectiveness of AI tools in autism care. For instance, Alam et al. conducted a quantitative study in 2022 to evaluate machine learning algorithms for autism diagnosis, while the survey by Deveau et al., conducted in 2022, measured the accuracy and reliability of the systems. Many such studies focus on experimental designs, statistical evaluations, and performance metrics to derive empirical evidence of the benefits of AI-driven interventions.

The limited number of quantitative studies indicates a gap in this field, whereas robust statistical evidence is requisite to generalize findings and support the broad adoption of these technologies. Embedding more quantitative analysis would suggest an opportunity to balance the methodological spectrum through future research.

Its preference for qualitative methodologies underlines the exploratory character of the field, given that the researchers aim to understand the challenges, user perceptions, and contextual nuances related to AI and assistive technologies. Given the underrepresentation of quantitative studies, it is generally problematic to draw generalized conclusions and establish evidence-based practices. This imbalance may also reflect the early-stage nature of many applications in autism care, where the focus remains on developing and piloting new tools rather than conducting large-scale evaluations. Moving forward, a shift toward more quantitative research will be essential to help validate the qualitative insights and support evidence-based decision-making.

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

This dominance of qualitative research suggests a strong foundation for the social, ethical, and practical dimensions of understanding AI and assistive technologies. As such, a future study should employ a combination of quantitative research to establish statistical evidence for the effectiveness of these tools. In this respect, it would include large-scale trials, performance studies, and longitudinal studies testing for long-term impacts. Therefore, such a gap in the interdisciplinary collaborative work time between technologists, clinicians, and statisticians may be overcome in establishing a more functional understanding of AI's potential and its limitations within autism care.

Figure 3. Methodology Used.

Figure 4 illustrates the distribution of publications across the two major data providers, Scopus and ISI. Of the identified studies, 30 publications were from Scopus, and only a few studies, three journals, were indexed by ISI. Thus, it is evident that Scopus has been a critical database for research on AI and assistive technologies in autism care. The high coverage of Scopus represents its excellent coverage and multidisciplinary approach to technology and healthcare. On the other hand, the minimal contribution by ISI reflects a narrow scope or low emphasis on this budding field. This imbalance may also indicate a preference for Scopus over ISI among AI and autism care researchers, particularly in terms of accessibility and the vast array of high-impact journals indexed therein.

Future research should be conducted in a manner that incorporates more diverse databases, such as PubMed or IEEE Xplore, to ensure comprehensive coverage and representation of the field. This can help extend the data sources from which the researcher gains an overall view of progressions and gaps in this domain. In general, Scopus is the primary database feed for AI research in autism care and provides a substantial source repository. Although this is a good concentration, there is a need to diversify data sourcing to fully capture the spectrum of academic contributions due to the underrepresentation of other databases, such as ISI.

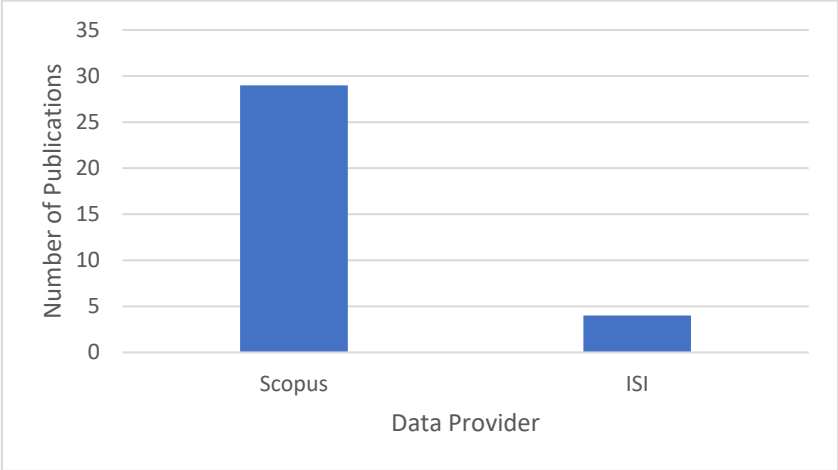

Figure 4. Data Provider Frequency Analysis.

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

3.1. AI and Machine Learning in Autism Diagnosis

Artificial Intelligence and the use of machine learning in diagnosis have brought a new perspective to the early detection and diagnosis of ASD, with significantly greater accuracy. This thematic analysis reviews studies that demonstrate how AI-based systems enhance diagnostic tools and the challenges associated with their implementation, as outlined in Table 4. Pandya et al. (2023) conducted an extensive review of AI-related approaches. They indicated that behavioral and physiological data, such as eye gaze, motor skills, and EEG, were used to classify ASD with high precision. On the other hand, Shahamiri et al. (2022) and Thabtah (2019) developed AI-based classification and screening systems that save time, are cost-effective, and are accessible. These modes utilize machine learning algorithms to detect behavioral patterns, which are also easy to handle for an early screening of ASD.

Deveau et al. (2022) investigated the collection and classification of behavioral data from children using gamified mobile applications, presenting promising results in ecologically valid settings. These AI-driven solutions show flexibility and effectiveness in various settings, ranging from clinically relevant to home-based assessments.

Machine learning has been instrumental in uncovering insightful information from complicated datasets. Alam et al. (2022) evaluated various machine learning models for predicting neurodevelopmental disorders at an earlier stage and assessed their precision in recognizing ASD-related patterns. Kohli et al. (2022) conducted a literature review on intelligent technologies, highlighting the application of machine learning in processing massive volumes of data related to behavior and genetics to achieve better diagnostic reliability.

Joudar et al. (2022) conducted a literature review on ASD diagnosis based on triage, which considers gene-related assessments in collaboration with AI tools. This approach utilizes machine learning to integrate various datasets, thereby enhancing the precision of autism diagnostics.

Vashisht & Jatain (2023) investigated AI techniques that would enable early intervention by diagnosing neurodevelopmental disorders during early childhood. Their findings align with those of Uddin, Wang, and Woodbury-Smith (2019), who highlighted the role of precision medicine powered by AI in diagnosing ASD, particularly in addressing issues of comorbidities and heterogeneous symptoms.

These collectively suggest that AI and machine learning can transform ASD diagnostics into early, data-driven, and reliable methodologies, facilitating timely interventions and improving developmental outcomes.

Despite those advances, there are still many challenges. In this respect, Uddin, Wang, & Woodbury-Smith (2019) pointed to such a difficulty as an agreement of AI systems within clinical workflow because of the lack of standardization in protocols and the quality of data sets. Joudar, Albahri, & Hamid (2022) and Kohli et al. (2022) are also concerned about ethical issues with data privacy and model bias that can affect diagnostic outcomes.

Moreover, it was also pointed out in the literature of Shahamiri & Thabtah (2020) that developing and deploying AI diagnostic tools is equally resource-intensive and may, therefore, remain inaccessible to low-resource settings.

The paper focuses on AI and machine learning for their transformative power to improve the accuracy, reliability, and accessibility of ASD diagnosis. Although many examples indicate considerable advances in diagnostic systems, the analysis of behavioral data, and early detection methods, several implementation issues and ethical considerations underscore the need for further

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

research in standardization. These findings lay a strong foundation for leveraging AI in autism care, addressing its limitations to widespread adoption.

Table 4. AI and Machine Learning in Autism Diagnosis.

Focus Area	Key Contributions	Representative Studies
AI-Based Diagnostic Systems	Development of accessible and accurate AI systems for ASD classification and screening.	Pandya et al. (2023); Thabtah (2019); Deveau et al. (2022)
Behavioral Data Analysis	Machine learning is used to analyze behavioral and genetic data for precision diagnosis.	Alam et al. (2022); Kohli, Kar, & Sinha (2022)
Early Detection Screening Methods	AI-driven tools for early ASD diagnosis and intervention strategies.	Vashisht & Jatain (2023); Uddin, Wang, & Woodbury-Smith (2019)
Challenges in Implementation	Ethical concerns, data privacy issues, and technological barriers to clinical integration.	Joudar, Albahri, & Hamid (2022); Shahamiri & Thabtah (202

Figure 5 below presents a thematic cluster map that visually organizes these insights into three major conceptual zones: Diagnosis Methods, AI Tools, and Implementation Challenges. Each cluster contains keywords drawn from the literature. Overlapping regions illustrate how machine learning applications (such as mobile apps or neural networks) intersect with diagnostic inputs (e.g., eye-tracking, EEG), while also being constrained by ethical, technical, and logistical barriers, including data bias and limited access in low-resource settings.

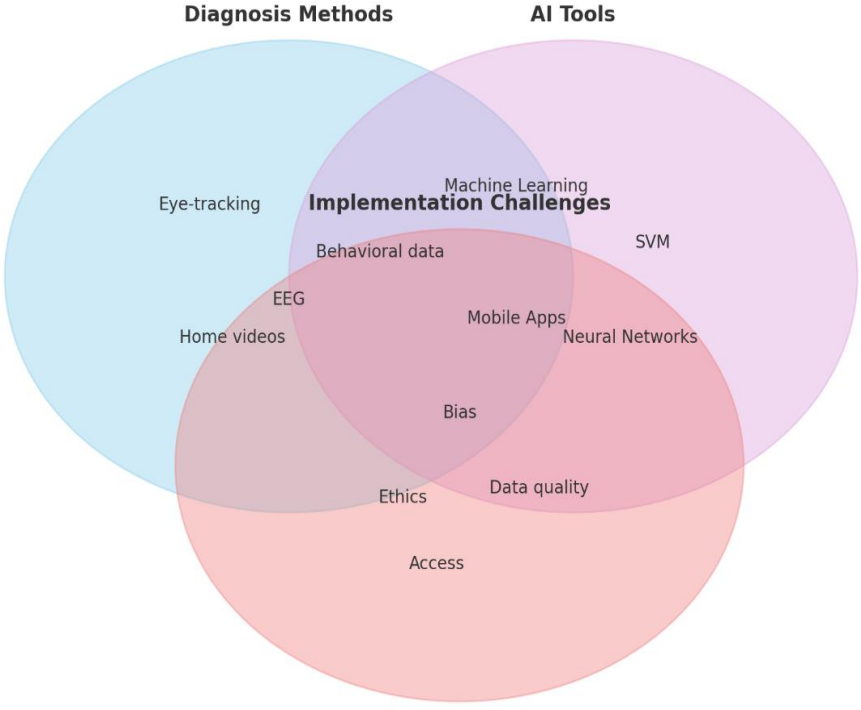

Figure 5. Thematic cluster map of AI applications in autism diagnosis.

Despite the promise of these technologies, several obstacles hinder full-scale integration. As Uddin et al. (2019) note, inconsistency in clinical implementation protocols remains a major barrier. Ethical issues such as data privacy and algorithmic bias—discussed by Joudar, Albahri, & Hamid (2022) and Kohli et al. (2022)—raise important concerns about the trustworthiness of AI-driven tools in

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

healthcare contexts. Furthermore, the development of these tools remains resource-intensive, potentially limiting access in underfunded or rural settings (Shahamiri & Thabtah, 2020).

AI and machine learning technologies offer powerful tools for advancing autism diagnosis through early detection, data-driven screening, and personalized care planning. These systems demonstrate significant potential in translating complex behavioral and physiological data into actionable diagnostic outcomes. However, challenges related to ethical, infrastructural, and clinical integration must be addressed through standardization, regulatory oversight, and equitable access planning. This thematic synthesis underscores the dual nature of AI's role in autism care, offering both groundbreaking potential and significant hurdles to overcome.

3.2. Assistive Technology and Therapeutic Tools

As shown in Table 5, assistive technology is essential as a treatment and management tool for ASD because it offers new interventions that improve outcomes and enhance the quality of life of persons with autism. Currently, the thematic analysis discusses research on the design and implementation of assistive technologies for ASD therapy.

Robotics has been one of the most explored systems for making therapeutic activity engagement more accessible to children with ASD. Lancioni and Singh (2014) have demonstrated the use of assistive robotics to enhance communication skills and foster social interaction in individuals affected by ASD. Mohan et al. (2019) demonstrated that robots can be utilized to enhance interaction and communication skills through structured interventions.

While Pennisi et al. (2016) and Saleh et al. (2021) emphasize the importance of NAO for emotional and social development, Bartl-Pokorny et al. (2021) suggest that its use facilitates the development of better emotion recognition and regulation. Together, these studies highlight the potential role of robotics as a personalized and engaging therapeutic intervention.

AR and mobile applications have shown specific potential for facilitating more accessible access to and greater efficiency of autism therapy. Cavus et al. (2021) investigated AR-based tools in sustainable skill development by creating interactive learning environments for children with ASD. Haoues & Mokni (2023) analyzed user feedback on autism-friendly mobile applications, demonstrating their potential to improve daily interactions and make public spaces more accessible.

These technologies enable the delivery of immersive and adaptive learning, developing skill sets relevant to different individual needs in a controlled yet engaging manner.

Personalization and assistive technology also play a significant role in the treatment of ASD. Damianidou et al. (2020) reviewed robot-mediated interventions, highlighting the capacity for personalization to be extended in unique ways to each individual. Lancioni & Singh (2014) and Bartl-Pokorny et al. (2021) have underlined how this personalized therapeutic tool leads to heightened engagement and fosters actual development in attaining significant state-of-the-art developmental milestones. Further research by Mohan et al. (2019) and Pennisi et al. (2016) integrated robotics and assistive tools with more traditional therapeutic practices, thus achieving better outcomes for individuals with autism.

These findings highlight the importance of supportive technologies for transforming therapies in autism, particularly robotics and augmented reality, as key tools in developing skills and enhancing engagement. Personalization of interventions and interactive design of therapeutic environments ensure the quality of life for ASD individuals. However, further studies will be required so that these tools are optimized and destined for broader use, becoming accessible to different groups of people.

The use of assistive technologies in autism therapy demonstrates a clear evolution toward more interactive, personalized, and effective interventions. Robotics play a vital role in enhancing social

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

and emotional development, offering structured engagement that improves communication and behavior. Augmented reality and mobile applications expand therapy beyond clinical settings, enabling immersive learning and real-time support for daily interactions. Moreover, personalized systems that integrate technology with traditional methods offer adaptable solutions tailored to individual needs, significantly improving therapeutic outcomes. Collectively, these innovations reflect a shift toward user-centered, technology-enhanced care for individuals with ASD.

Table 5. Thematic Analysis of Assistive Technology and Therapeutic Tools.

Thematic Category	Technological Application	Therapeutic Impact	Key Insights from Literature
Robotics for Social Engagement	Social robots (e.g., NAO, programmable bots)	Enhances social interaction, turn-taking, emotional communication	Robots support structured social skill development and improve emotional expression in children with ASD (Lancioni & Singh, 2014; Pennisi et al., 2016).
	Robot-assisted learning environments	Improves attention span, emotion recognition, and behavioral regulation	Personalized robotic tools increase therapeutic responsiveness and engagement (Bartl-Pokorny et al., 2021).
Augmented and Mobile Interfaces	AR tools and immersive apps	Supports sustainable skill development, promotes daily life integration	AR enables interactive learning tailored to ASD learners, while apps improve autonomy in public/social settings (Cavus et al., 2021; Haoues & Mokni, 2023).
	Mobile health and feedback platforms	Enables real-time caregiver support and consistent therapeutic input	Apps offer continuous support beyond clinical settings, increasing accessibility and adaptive monitoring (Haoues & Mokni, 2023)
Personalized and Adaptive Systems	Robot-mediated individualized programs	Tailors therapy to behavioral profiles, enhancing motivation and developmental gains	Personalization fosters deeper engagement and milestone achievement (Damianidou et al., 2020; Mohan et al., 2019)
	Integration with traditional therapies	Bridges gaps in standard practice with technology-enhanced treatment	Combining robotics with conventional interventions leads to improved therapeutic outcomes (Mohan et al., 2019; Pennisi et al., 2016)

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

3.3. Ethical, Societal, and Implementation Challenges

This integration of AI and assistive technologies in diagnosing and treating autism is, therefore, riddled with critical ethical, social, and implementation challenges. Data privacy, access to technology in terms of equity, and the impact of work with advanced tools in diverse socio-economic and cultural settings are concerns. This section will critically review the studies conducted on these issues.

Equally important to note are ethical issues in deploying AI and assistive technologies in treating autism. Fiske, Henningsen, and Buyx (2019) cite privacy risks associated with collecting and processing sensitive behavioral and genetic information, emphasizing the need for enhanced regulatory frameworks that will ensure the protection of patient information while guaranteeing transparency and accountability in AI algorithms. Frost & Carter note that mass media framing has ethical consequences because it influences how the general public perceives the role of AI in healthcare. They thus support balanced reporting of the benefits of AI adoption and its potential drawbacks, ensuring appropriate decision-making by stakeholders.

Other research, such as that by Joudar et al. (2022), extends this analysis into the ethical dimensions of gene-based triage systems for autism diagnosis, warning against biases and inequities that could arise from these systems. These findings underline the importance of ethical safeguards in AI development and deployment.

The societal impact of AI and assistive technologies in treating autism is fair, addressing issues such as disparities in access. Guerrero-Vásquez et al. (2022) discuss the need for culturally sensitive designs that appreciate the diverse needs of global populations. They recognize the risk of excluding non-Western contexts in technology development, which may exacerbate inequities in autism care.

Kumm et al. (2022), who discuss digital divide issues, are concerned about poor access to advanced technologies in low—and middle-income countries. They underline the need for solutions suitable for cost-effective, scaled implementation so that people with ASD can benefit from technological advances even in under-resourced settings.

More significant societal implications involve acceptance and usability. As depicted by Scarcella et al. (2023) and Hus & Segal (2021), the nature of this interface is user-friendly, hence engagement with the community to achieve acceptance and uptake of the AI-driven system.

Most challenges in implementing AI and assistive technologies into autism care include several obstacles. This is because, as Uddin, Wang, & Woodbury-Smith (2019) note, AI tools are relatively complex to integrate into the existing healthcare system, requiring some training and infrastructure development. Kohli et al. (2022) highlight the resource-intensive nature of implementing AI solutions, particularly in settings with limited technological expertise.

The other important domain is regulatory challenges. Guerrero-Vásquez et al. (2022) and Frost & Carter (2020) demonstrate a pressing need for proper guidelines and standards to facilitate and streamline the development and deployment of AI systems. These should cover safety, efficacy, and ethical issues, stipulating that the tools provide the highest standard of care.

Among others, Scarcella et al. (2023) indicated that there are logistical complications in the infusion of AI into therapeutic programs with assistive technologies, especially for non-verbal individuals with ASD. They concluded that adaptive and inclusive designs are fundamental for many needs.

Several works make actionable suggestions in response to these challenges. Fiske, Henningsen, and Buyx (2019) advocate for ethical guiding principles in AI design that prioritize transparency and inclusivity, with a focus on accountability. Guided by such principles, developers and policymakers can create more effective tools that respect user rights and foster greater trust in AI systems.

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

For their part, Kumm, Viljoen, and de Vries (2022) suggest that programs or policies aimed at reducing the digital divide may include subsidized access to technology and international collaboration to achieve low-cost solutions. By contrast, Guerrero-Vásquez et al. (2022) note that useful technologies must be effectively taught in communities through participatory design and engagement, considering the diverse needs and values of different populations.

The integration of AI and assistive technologies into autism care is accompanied by substantial ethical, societal, and implementation challenges that must be addressed for effective adoption. Core ethical concerns include data privacy, bias in algorithms, and the absence of robust regulatory frameworks, all of which threaten transparency and public trust. Societally, disparities in access—especially in low-resource and culturally diverse contexts—create barriers to equitable care, emphasizing the need for inclusive design and participatory development. Implementation issues, such as technological complexity, infrastructure demands, and a lack of professional training, further complicate the widespread integration into healthcare systems. Collectively, these challenges underscore the urgent need for transparent and ethical principles, scalable solutions, and context-aware deployment strategies to ensure that AI in autism care is both practical and equitable.

Table 6. Ethical, Societal, and Implementation Challenges.

Challenge Domain	Specific Issues Identified	Impact on ASD Care	Key Studies
Ethical Concerns	- Privacy risks in behavioral and genetic data use - Algorithmic bias and lack of transparency - Absence of regulatory oversight	Undermines patient trust, raises accountability concerns, may perpetuate inequities	Fiske et al. (2019); Frost & Carter (2020); Joudar et al. (2022)
Societal Implications	- Digital divide in low- and middle-income regions - Exclusion of non-Western cultural contexts - Public perception shaped by media narratives	Limits access to AI-based care, reduces relevance for diverse populations, affects public acceptance	Guerrero-Vásquez et al. (2022); Kumm et al. (2022); Hus & Segal (2021)
Implementation Barriers	- Difficulty integrating AI into clinical workflows - Infrastructure and training limitations - Cost and logistical complexity	Delays adoption, reduces efficiency, and risks ineffective deployment in practice	Uddin et al. (2019); Kohli et al. (2022); Scarcella et al. (2023)
Ethical & Societal Solutions	- Need for participatory and culturally sensitive design - Ethical AI principles promoting fairness and transparency - Calls for low-cost, inclusive tech access	Promotes trust, accessibility, and global usability of AI interventions	Fiske et al. (2019); Guerrero-Vásquez et al. (2022); Kumm et al. (2022)

3.4. AI and Assistive Technology in Autism: Innovations, Barriers, and Pathways Forward

The introduction of innovative diagnosis, treatment, and daily support using AI and assistive technologies has transformed ASD care. Despite such significant advances, a range of barriers mitigates the complete realization of their potential. The following analysis will explore innovations,

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

barriers, and possible pathways forward, synthesizing knowledge from critical studies, as seen in Table 7.

AI-innovated medicines and assistive technologies have developed new tools to help care for individuals with autism disorders in diagnostics, engagement, and therapy. Pandya et al. (2023) and Shahamiri, Thabtah, and Abdelhamid (2022) have identified AI-based diagnostic systems that utilize eye gaze and other behavioral data to classify motor status in ASD cases with high accuracy. These enhance the speed and accuracy of diagnosis, particularly in conjunction with various clinical evaluations. Thabtah designed an easily accessible, cost-effective, and adaptable autism screening tool for various age groups, democratizing access to early diagnosis.

On the therapeutic side, Lancioni and Singh (2014) and Mohan et al. (2019) focused on using robotics and interactive devices to promote communication and socialization skills in children with ASD. Indeed, social robots have made significant contributions to the development of personalized and engaging therapeutic interventions, as reported, for example, by Bartl-Pokorny et al. (2021) and Saleh, Hanapiah, and Hashim (2021). These tools use human-like interactions to help children develop emotional regulation and social connectivity.

AR and mobile applications take this use of assistive technologies even further. Cavus et al. (2021) demonstrated the potential of AR in developing sustainable skills, while Haoues & Mokni (2023) highlighted that the accessibility and usability of mobile apps are confirmed in daily autism care. Such innovations align with the broader goal of creating inclusive, scalable solutions for people with ASD.

While these technologies hold great promise, their adoption is hindered by several challenges. The most debated issues include concerns over privacy and ethics. Fiske, Henningsen, and Buyx (2019) highlight the potential misuse of sensitive data from AI systems, particularly in behavioral and genetic assessments. They stress that the algorithms must be transparent and accountable to ensure users' trust in AI systems.

Another key barrier is accessibility, especially in resource-poor settings. Kumm, Viljoen, and de Vries (2022) emphasize the digital divide, where socio-economic inequalities restrict access to highly specialized technologies. They liken it to high AI tool costs and poor infrastructure, which make it challenging for underprivileged populations to benefit from that progress. The same sentiment is shared by Guerrero-Vásquez et al. (2022), who indicate that it has become imperative to provide culturally sensitive designs to ensure the ultimate impact of AI tools in any differentiated socio-economic and cultural context.

Additionally, there are operational challenges, including integration into the existing healthcare system. Uddin et al. (2019) state that healthcare providers need training and technical expertise to implement AI solutions. Kohli, Kar, and Sinha (2022) also emphasized that most AI systems require substantial resources during deployment, given the high computational demands and the quality of datasets required.

Meanwhile, innovations and barriers offer a contrasting analysis of advanced technologies versus the actual reality of their practices. AI-based diagnostic tools, as noted in the works by Pandya et al. (2023) and Shahamiri & Thabtah (2020), facilitate the early detection of autism, a research area often hindered by accessibility conditions, as described by Kumm, Viljoen, & de Vries (2022). While robotics and AR improve treatment effects, the high cost and infrastructure requirements make them less viable for general application in low-income countries. Another difference is related to privacy issues. While advanced AI systems, as discussed by Thabtah, ensure that the data is both efficient and accurate, studies like those of Fiske, Henningsen, and Buyx indicate the potential misuse of data and, therefore, pose severe ethical considerations.

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

Despite these barriers, several technologies have struck a balance between innovations and access, such as mobile apps, providing scalable solutions for varied needs. Several pathways have been put forth that show how these challenges can be overcome and the full potential of AI and assistive technologies leveraged to meet the growing care requirements in autism:

• Ethical Design and Regulation: Fiske et al. (2019) advocate for the development of transparent AI systems that prioritize data privacy and user trust. Establishing clear regulatory frameworks can ensure the responsible implementation and mitigate ethical concerns.

• Bridging the Digital Divide: Kumm et al. (2022) suggest subsidized technology programs and international collaborations to make AI tools affordable and accessible in low-resource settings. This includes developing cost-effective, low-tech solutions that cater to underserved populations.

• Culturally Sensitive Design: Guerrero-Vásquez et al. (2022) emphasize the importance of involving local communities in designing and developing AI tools to ensure they meet the specific needs of different cultural and socio-economic groups.

• Capacity Building: Uddin et al. (2019) recommend targeted training programs for healthcare professionals to enhance their technical expertise in using AI and assistive technologies. This includes integrating AI education into medical and therapeutic training curricula.

• Scalable Innovations: Technologies like mobile apps and cloud-based platforms (Haoues & Mokni, 2023) offer scalable solutions that can be deployed in diverse settings. Due to their cost-effectiveness and user-friendly design, these tools should be prioritized for widespread adoption.

Table 7. Thematic Analysis of Innovations, Barriers, and Pathways Forward.

Innovation Area	Core Barrier	Strategic Pathway Forward	Key Studies
AI-based Diagnostics	Data privacy risks and lack of algorithm transparency	Ethical AI design and regulatory frameworks to ensure accountability and user trust	Pandya et al. (2023); Fiske et al. (2019); Joudar et al. (2022)
Social Robots & AR Tools	High implementation costs and limited infrastructure in low-resource areas	Scalable, low-cost tech development and subsidized access programs	Lancioni & Singh (2014); Saleh et al. (2021); Kumm et al. (2022)
Mobile Applications	Uneven access due to the digital divide and cultural mismatches	Culturally sensitive, user-centered design processes that involve local communities	Haoues & Mokni (2023); Guerrero-Vásquez et al. (2022)
Healthcare System Integration	Lack of training and technical expertise among professionals	Capacity building through AI-focused training in clinical education and practice	Uddin et al. (2019); Kohli et al. (2022)
Personalized Therapeutics	Societal resistance or misunderstanding of AI applications in autism care	Media literacy and awareness campaigns to reshape public perception and increase acceptance	Bartl-Pokorny et al. (2021); Frost & Carter (2020)

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

In these novel diagnostic and therapeutic solutions, AI and assistive technologies are revolutionizing care for individuals with autism. However, substantial barriers remain to their uptake, including ethical dilemmas, access issues, and operational obstacles. These barriers will be addressed by developing ethical frameworks, inclusive designs, and scalable solutions that aim to unlock the full potential of AI, enabling proper care in autism to be equitably and effectively afforded to all. The analysis serves as a roadmap, enabling researchers, practitioners, and policymakers to leverage the gaps in realizing AI's promise for transforming the diagnosis and treatment of autism.

AI and assistive technologies have introduced groundbreaking innovations in autism diagnosis and therapy, from intelligent screening tools to socially interactive robots and mobile platforms. However, their full potential remains constrained by privacy risks, socio-economic divides, infrastructural limits, and resistance to clinical integration. Table 7 presents a thematic synthesis connecting each innovation with its corresponding barriers and outlines practical strategies for overcoming them. These include ethical AI design, community-driven development, capacity building in healthcare, and equitable access to technology. By bridging innovation with action, this section maps a viable path forward for deploying AI technologies that are both transformative and inclusive in ASD care.

4. Theoretical, Practical, and Policy Contributions

4.1. Theoretical Contributions

This review significantly advances the theoretical landscape of AI in autism research by integrating findings across diagnostic, therapeutic, and ethical domains. It clarifies how AI systems—particularly those using behavioral and physiological data—can support new models of early detection, offering a theoretical basis for data-driven, personalized diagnostic frameworks. The thematic synthesis of AI applications reveals patterns in how machine learning algorithms process complex autism-related datasets, thus contributing to theoretical discussions around precision diagnostics and the evolving paradigm of neurodevelopmental assessment.

Equally important is the review's contribution to the theory of ethical AI in healthcare. By examining privacy concerns, data bias, and algorithmic opacity, the review supports the development of ethical models that emphasize transparency, inclusivity, and accountability. The juxtaposition of ethical risks with proposed safeguards (e.g., participatory design and data governance) informs emerging frameworks for responsible innovation. These insights contribute to a broader theoretical understanding of how AI technologies intersect with bioethics and neurodiversity, suggesting a model of value-sensitive AI design tailored for autism care.

4.2. Practical Contributions

This review offers practical value for clinicians, educators, technologists, and caregivers seeking to apply AI and assistive technologies in real-world autism interventions. It identifies specific tools—such as mobile applications, augmented reality systems, and social robots—that are already enhancing therapy, communication, and daily functioning for individuals with ASD. The review also outlines implementation strategies, including the integration of AI into clinical workflows and educational programs, thereby offering a practical framework for adoption across diverse care environments.

Furthermore, the discussion on operational barriers—such as limited infrastructure, training gaps, and usability challenges—provides actionable insights for practitioners and developers. The emphasis on scalable, culturally sensitive, and low-resource-friendly solutions highlights best practices in user-centered design. By linking research findings to implementation realities, this review enables practitioners to tailor interventions to specific populations and settings, ultimately enhancing therapeutic outcomes and improving the quality of life for individuals on the autism spectrum.

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

4.3. Policy Contributions

From a policy perspective, this review underscores the need for comprehensive guidelines to govern the development and deployment of AI in autism care. It draws attention to ethical imperatives such as data privacy, algorithmic fairness, and transparency, all of which require regulation through national and international standards. The evidence presented supports calls for frameworks that ensure AI systems in healthcare uphold patients' rights, foster trust, and minimize harm, particularly for vulnerable populations like individuals with ASD.

In addition, the review highlights critical equity concerns that demand policy intervention, such as the global digital divide and socioeconomic disparities in access to AI tools. It advocates for subsidized technology programs, international collaborations, and capacity-building initiatives to ensure that the benefits of AI are equitably distributed. These recommendations contribute to policy debates around digital inclusion and suggest strategic pathways for making AI-based autism care more accessible, scalable, and.

5. Academic Implications

Academically, the study provides a roadmap for interdisciplinary research, encouraging collaboration between AI researchers, healthcare professionals, and policymakers. By showcasing the multifaceted applications of AI and assistive technologies in autism care, the study highlights the need for new academic programs and training modules that bridge the gap between technology development and its real-world application. For example, courses on AI ethics, healthcare informatics, and inclusive design could prepare future researchers and practitioners to address the challenges identified in the study.

The study also enriches academic literature by identifying underexplored areas, such as the digital divide and culturally sensitive AI applications. These gaps offer opportunities for future research to examine the scalability of AI tools in low-resource settings and the development of inclusive technologies for diverse populations. Moreover, this research's methodology and thematic analysis can serve as a template for systematic reviews in other emerging domains, further enhancing its academic value.

6. Limitations and Future Work

Although this systematic review provides valuable insights into the intersection of AI and assistive technologies in autism care, several limitations should be acknowledged. First, the study relies solely on secondary data drawn from published literature. This limits the ability to evaluate real-time applications, stakeholder feedback, or implementation success in diverse clinical settings. The absence of primary data also constrains the capacity to observe evolving technological trends or challenges as they emerge in practice. Future research should prioritize empirical investigations—particularly experimental, observational, or longitudinal studies—that examine the effectiveness, usability, and outcomes of AI-based interventions in real-world contexts.

A second limitation involves the methodological profile of the included studies. While qualitative analyses dominate the current literature, there is a relative lack of robust quantitative or mixed-methods research that could validate findings across populations and settings. The predominance of exploratory studies, while valuable, restricts generalizability. Future work should include large-scale evaluations and randomized trials that provide stronger evidence on efficacy, equity, and scalability, particularly across socioeconomic and cultural contexts.

Additionally, the review is limited by language and database scope. Only peer-reviewed English-language articles indexed in major academic databases were considered, potentially excluding relevant regional studies, grey literature, or innovations documented in languages other than English.

https://doi.org/10.22521/edupij.2025.17.350 Published online by Universitepark Press

Expanding future reviews to include more diverse sources may reveal underrepresented perspectives and practices in the adoption of autism technology.

Ethical considerations are also worth noting. Since this review did not involve human subjects or the collection of new data, formal ethics committee approval was not required. However, the study adhered rigorously to principles of publication ethics, including accurate representation of sources, transparency in synthesis, and acknowledgment of potential biases. The ethical concerns raised by the literature—such as data privacy, bias in AI algorithms, and access to technology—have been addressed with careful attention and should be explored further in both conceptual and empirical research.

Finally, this study identifies the digital divide, particularly in low- and middle-income countries, as a persistent and underexplored barrier to equitable AI deployment. Future research should not only document these inequities but also propose, test, and evaluate strategies for overcoming them. This includes policy frameworks, culturally adapted interventions, and inclusive design approaches that ensure emerging technologies serve diverse populations effectively and ethically.

7. Conclusions and Recommendations

This review highlights the potential of both AI and assistive technologies to transform and enhance diagnostic precision, ultimately improving therapeutic outcomes in autism care. At the same time, however, it highlighted substantial protection regarding privacy, access, and regulatory frameworks. Each of these issues must be considered if further innovations are to be both equitable and practical, with assured mainstream uptake.

The presented study calls for "[i]interdisciplinary collaboration, investment in scalable and culturally inclusive technologies, and development of ethical guidelines for AI to support broad adoption, implemented by policymakers, educators, and technology developers to create an enabling ecosystem that promotes innovation while addressing societal and operational challenges." With such strategies in place, AI's full potential will be realized in the treatment of autism, benefiting individuals and societies worldwide.

Declarations

Author Contribution. The author conceived and designed the study, performed the material preparation, data collection, and analysis, and wrote the manuscript. The author reviewed and approved the final version of the manuscript.

Conflicts of Interest. (as applicable), or the authors declare no conflict of interest.

Funding. This research did not receive a specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical Approval. The authors declare no conflicts of interest in this research.

Data Availability Statement. Raw data supporting this study's findings were generated during the research process and are available from the author upon reasonable request. Derived data that underpin the results of this study can also be provided upon request.

Acknowledgements. The authors would like to thank all participants and their families for their cooperation and support throughout the study. Special thanks are extended to everyone who contributed to the completion of this research.

References

Adako, O. P., Adeusi, O. C., & Alaba, P. A. (2022). Revolutionizing Autism Education: Harnessing AI for Tailored Skill Development in Social, Emotional, and Independent Learning Domains. Journal of Computational and Cognitive Engineering. https://doi.org/10.47852/bonviewJCCE42023414

Alam, S., Raja, P., & Gulzar, Y. (2022). Investigation of machine learning methods for early prediction of neurodevelopmental disorders in children. Wireless communications and mobile computing, 2022(1), 5766386. https://doi.org/10.1155/2022/5766386 .

Alarifi, H. (2023). Machine learning for distinguishing Saudi children with and without autism via eye-tracking data. Child and Adolescent Psychiatry and Mental Health, 17(1). https://doi.org/10.1186/s13034-023-00662-3 .

Albahri, A., Zaidan, A., Alsattar, H., Hamid, R., Albahri, O., Qahtan, S., … & Alamoodi, A. (2022). Towards physician's experience: development of machine learning model for the diagnosis of autism spectrum disorders based on complex t-spherical fuzzy-weighted zero-inconsistency method. Computational Intelligence, 39(2), 225-257. https://doi.org/10.1111/coin.12562 .

Alsaidi, M. (2024). A convolutional deep neural network approach to predict autism spectrum disorder based on eye-tracking scan paths. Information, 15(3), 133. https://doi.org/10.3390/info15030133 .

Anzulewicz, A., Sobota, K., & Delafield-Butt, J. (2016). Toward the autism motor signature: gesture patterns during smart tablet gameplay identify children with autism. Scientific Reports, 6(1). https://doi.org/10.1038/srep31107 .

Arshad, N. I., Hashim, A. S., Ariffin, M. M., Aszemi, N. M., Low, H. M., & Norman, A. A. (2020). Robots are assistive technology tools to enhance cognitive abilities and foster valuable learning experiences among young children with autism spectrum disorder. Ieee Access, 8, 116279-116291.

Bartl-Pokorny, K. D., Pykała, M., Uluer, P., Barkana, D. E., Baird, A., Kose, H., ... & Landowska, A. (2021). Robot-based intervention for children with autism spectrum disorder: a systematic literature review. IEEE Access, 9, 165433-165450.

Barua, P. D., Vicnesh, J., Gururajan, R., Oh, S. L., Palmer, E., Azizan, M. M., ... & Acharya, U. R. (2022). Artificial intelligence-enabled personalized assistive tools to enhance children's education with neurodevelopmental disorders—a review—International Journal of Environmental Research and Public Health, 19(3), 1192.

Begum, M., Serna, R. W., & Yanco, H. A. (2016). Are robots ready to deliver autism interventions? A comprehensive review. International Journal of Social Robotics, 8, 157-181.

Cavus, N., Al-Dosakee, K., Abdi, A., & Sadiq, S. (2021). The utilization of augmented reality technology for sustainable skill development for people with special needs: A systematic literature review. Sustainability, 13(19), 10532.

Chaddad, A., Li, J., Lu, Q., Li, Y., Okuwobi, I., Tanougast, C., … & Niazi, T. (2021). Can autism be diagnosed with artificial intelligence? A narrative review. Diagnostics, 11(11), 2032. https://doi.org/10.3390/diagnostics11112032.

Damianidou, D., Eidels, A., & Arthur-Kelly, M. (2020). The use of robots in social communications and interactions for individuals with ASD: A systematic review. Advances in Neurodevelopmental Disorders, 4, 357-388.

Deveau, N., Washington, P., Leblanc, E., Husic, A., Dunlap, K., Penev, Y., ... & Wall, D. P. (2022). Machine learning models using mobile gameplay accurately classify autistic children: intelligence-based Medicine, 6, 100057.

Fiske, A., Henningsen, P., & Buyx, A. (2019). Your robot therapist will see you now: ethical implications of embodied artificial intelligence in psychiatry, psychology, and psychotherapy—Journal of Medical Internet Research, 21(5), e13216.

Frost, E. K., & Carter, S. M. (2020). Screening and diagnostic AI reporting rarely acknowledges ethical, legal, and social implications: a mass media frame analysis. BMC medical informatics and decision making, 20, 1-10.

Gardner-Hoag, J., Novack, M., Parlett-Pelleriti, C., Stevens, E., Dixon, D., & Linstead, E. (2021). Unsupervised machine learning for identifying challenging behavior profiles to explore cluster-based treatment efficacy in children with autism spectrum disorder: retrospective data analysis study. Jmir Medical Informatics, 9(6), e27793. https://doi.org/10.2196/27793.

Ghosh, T., Al Banna, M. H., Rahman, M. S., Kaiser, M. S., Mahmud, M., Hosen, A. S., & Cho, G. H. (2021). Artificial intelligence and Internet of things in screening and management of autism spectrum disorder. Sustainable Cities and Society, 74, 103189.

Guerrero-Vásquez, L. F., López-Nores, M., Pazos-Arias, J. J., Robles-Bykbaev, V. E., Bustamante-Cacao, K. C., Jara-Quito, H. J., ... & Campoverde-Jara, P. X. (2022). A systematic review of technological aids to social interaction in autistic spectrum disorders from transversal perspectives: psychology, technology, and therapy. Review Journal of Autism and Developmental Disorders, 1-30.

Haoues, M., & Mokni, R. (2023). Toward an autism-friendly environment based on mobile apps user feedback analysis using deep learning and machine learning models. PeerJ Computer Science, 9, e1442.

Hus, Y., & Segal, O. (2021). Challenges surrounding the diagnosis of autism in children. Neuropsychiatric disease and treatment, 3509-3529.

Iannone, A., & Giansanti, D. (2023). Breaking Barriers—The Intersection of AI and Assistive Technology in Autism Care: A Narrative Review. Journal of Personalized Medicine, 14(1), 41.

Jacob, S., Sulaiman, M., & Bennet, B. (2023). Feature signature discovery for autism detection: an automated machine learning based feature ranking framework. Computational Intelligence and Neuroscience, 2023(1). https://doi.org/10.1155/2023/6330002.

Joudar, S. S., Albahri, A. S., & Hamid, R. A. (2022). Triage and priority-based healthcare diagnosis using artificial intelligence for autism spectrum disorder and gene contribution: a systematic review. Computers in Biology and Medicine, 146, 105553.

Joudar, S. S., Albahri, A. S., Hamid, R. A., Zahid, I. A., Alqaysi, M. E., Albahri, O. S., & Alamoodi, A. H. (2023). Artificial intelligence-based approaches for improving the diagnosis, triage, and prioritization of autism spectrum disorder: a systematic review of current trends and open issues. Artificial Intelligence Review, 56(Suppl 1), 53-117.

Katsanis, I., Moulianitis, V., & Panagiotarakos, D. (2022). Design, development, and a pilot study of a low-cost robot for child–robot interaction in autism interventions. Multimodal Technologies and Interaction, 6(6), 43. https://doi.org/10.3390/mti6060043.

Kitchenham, B. A., Pfleeger, S. L., Pickard, L. M., Jones, P. W., Hoaglin, D. C., El Emam, K., & Rosenberg, J. (2002). Preliminary guidelines for empirical research in software engineering. IEEE Transactions on Software Engineering, 28(8), 721–734. https://doi.org/10.1109/tse.2002.1027796.

Kohli, M., Kar, A. K., & Sinha, S. (2022). The role of intelligent technologies in early detection of autism spectrum disorder (ASD): A scoping review. IEEE Access, 10, 104887-104913.

Kollias, K., Syriopoulou-Delli, C., Sarigiannidis, P., & Fragulis, G. (2021). The contribution of machine learning and eye-tracking technology in autism spectrum disorder research: a systematic review. Electronics, 10(23), 2982. https://doi.org/10.3390/electronics10232982.

Kosmicki, J., Sochat, V., Duda, M., & Wall, D. (2015). Searching for a minimal set of behaviors for autism detection through feature selection-based machine learning. Translational Psychiatry, 5(2), e514-e514. https://doi.org/10.1038/tp.2015.7.

Kumm, A. J., Viljoen, M., & de Vries, P. J. (2022). The digital divide in technologies for autism: feasibility considerations for low-and middle-income countries. Journal of Autism and Developmental Disorders, 1-14.

Lancioni, G. E., & Singh, N. N. (2014). Assistive technologies for improving quality of life. Assistive technologies for people with diverse abilities, 1-20.

Mohan, V., Kunnath, S. K., Philip, V. S., Mohan, L. S., & Thampi, N. (2019). Capitalizing on technology for developing communication skills in autism spectrum disorder: a single case study. Disability and Rehabilitation: Assistive Technology, 14(1), 75-81.

Nabil, M., Akram, A., & Fathalla, K. (2021). Applying machine learning on home videos for remote autism diagnosis: further study and analysis. Health Informatics Journal, 27(1). https://doi.org/10.1177/1460458221991882.

Nidhra, S., Yanamadala, M., Afzal, W., & Torkar, R. (2013). Knowledge transfer challenges and mitigation strategies in Global Software Development—a systematic literature review and industrial validation. International Journal of Information Management, 33(2), 333–355. https://doi.org/10.1016/j.ijinfomgt.2012.11.004.

Pandya, S., Jain, S., & Verma, J. (2023). A comprehensive analysis towards exploring the promises of AI-related approaches in autism research. Computers in Biology and Medicine, 107801.

Peck, F., Gabard-Durnam, L., Wilkinson, C., Bosl, W., Tager-Flusberg, H., & Nelson, C. (2020). Prediction of autism spectrum disorder diagnosis using nonlinear measures of language-related eeg at 6 and 12 months. https://doi.org/10.1101/2020.12.16.20248200.

Pennisi, P., Tonacci, A., Tartarisco, G., Billeci, L., Ruta, L., Gangemi, S., & Pioggia, G. (2016). Autism and social robotics: A systematic review. Autism Research, 9(2), 165-183.

Piepenburg, K. (2011). Critical analysis of Hofstede's model of cultural dimensions: To what extent are his findings reliable, valid, and applicable to organizations in the 21st century? GRIN Verlag.

Pontikas, C. M., Tsoukalas, E., & Serdari, A. (2022). A map of assistive technology educative instruments in neurodevelopmental disorders. Disability and Rehabilitation: Assistive Technology, 17(7), 738-746.

Rahman, M., Usman, O., Muniyandi, R., Sahran, S., Mohamed, S., & Razak, R. (2020). A review of machine learning feature selection and classification methods for autism spectrum disorder. Brain Sciences, 10(12), 949. https://doi.org/10.3390/brainsci10120949.

Riches, S., Azevedo, L., Vora, A., Kaleva, I., Taylor, L., Guan, P., ... & Hammond, N. (2022). Therapeutic engagement in robot-assisted psychological interventions: A systematic review. Clinical Psychology & Psychotherapy, 29(3), 857-873.

Saleh, M. A., Hanapiah, F. A., & Hashim, H. (2021). Robot applications for autism: a comprehensive review. Disability and Rehabilitation: Assistive Technology, 16(6), 580–602.

Scarcella, I., Marino, F., Failla, C., Doria, G., Chilà, P., Minutoli, R., ... & Pioggia, G. (2023). Information and communication technologies-based interventions for children with autism spectrum conditions: a systematic review of randomized control trials from a positive technology perspective. Frontiers in Psychiatry, 14, 1212522.

Shahamiri, S. R., & Thabtah, F. (2020). Autism AI: a new autism screening system based on artificial intelligence. Cognitive Computation, 12(4), 766-777.

Shahamiri, S. R., Thabtah, F., & Abdelhamid, N. (2022). A new classification system for autism based on machine learning of artificial intelligence. Technology and Health Care, 30(3), 605-622.

Stasolla, F., Lopez, A., Akbar, K., Vinci, L. A., & Cusano, M. (2023). Matching assistive technology, telerehabilitation, and virtual reality to promote cognitive rehabilitation and communication skills in neurological populations: a prospective proposal. Technologies, 11(2), 43.

Tariq, Q., Daniels, J., Schwartz, J., Washington, P., Kalantarian, H., & Wall, D. (2018). Mobile detection of autism through machine learning on home video: a development and prospective validation study. Plos Medicine, 15(11), e1002705. https://doi.org/10.1371/journal.pmed.1002705.

Thabtah, F. (2019). An accessible and efficient autism screening method for behavioral data and predictive analyses. Health informatics journal, 25(4), 1739-1755.

Uddin, M., Wang, Y., & Woodbury-Smith, M. (2019). Artificial intelligence for precision medicine in neurodevelopmental disorders. NPJ digital medicine, 2(1), 112.

Vakadkar, K., Purkayastha, D., & Krishnan, D. (2021). Detection of autism spectrum disorder in children using machine learning techniques. Sn Computer Science, 2(5). https://doi.org/10.1007/s42979-021-00776-5.

Vashisht, P., & Jatain, A. (2023). A novel approach for diagnosing neuro-developmental disorders using artificial intelligence. Inteligencia Artificial, 26(71), 13-24.

Watson, R. T., & Webster, J. (2020). Analyzing the past to prepare for the future: Writing a literature review and a roadmap for release 2.0. Journal of Decision Systems, 29(3), 129–147. https://doi.org/10.1080/12460125.2020.1798591.

Wilson, J., 2014. Essentials of business research: A guide to doing your research project. London, UK: Sage.

Wingfield, B., Miller, S., Yogarajah, P., Kerr, D., Gardiner, B., Seneviratne, S., … & Coleman, S. (2020). A predictive model for pediatric autism screening. Health Informatics Journal, 26(4), 2538-2553. https://doi.org/10.1177/1460458219887823.

Yi, H., Liu, T., & Lan, G. (2024). The critical artificial intelligence technologies in early childhood education: a review. Artificial Intelligence Review, 57(1), 12.

About the Contributor(s)

Mohammad A. Beirat, PhD, is a Professor at the Faculty of Education Science, Department of Special Education, Al-Hussein Bin Talal University, Ma'an, Jordan. His research focuses on special education, inclusive learning strategies, and the integration of technology in special needs education. He has published extensively in peer-reviewed journals and contributed to book chapters in the field.
Email: beirat@ahu.edu.jo
ORCID: 0000-0001-8730-6405

Ahmad Algolaylat, PhD, is a faculty member at the College of Educational Sciences, Counselling and Educational Psychology Department, Yarmouk University, Irbid, Jordan. His research interests include educational psychology, cognitive learning theories, and psychological assessment tools. He has authored multiple studies exploring the psychological dimensions of education and intervention techniques.
Email: ahmad.gh@yu.edu.jo
ORCID: 0000-0001-6261-4428

Hussein Al Njadat, PhD, is a faculty member at the College of Educational Sciences, Department of Educational Psychology, Tafila Technical University, Tafila, Jordan. His research covers cognitive psychology, behavioral analysis, and psychological support systems for special education. He has contributed to numerous research papers and conference presentations.
Email: halnjadat@ttu.edu.jo
ORCID: 0000-0001-8545-1983

Bassam AlAbdallat, PhD, is a Professor in the Department of Counselling and Special Education, School of Educational Sciences, The University of Jordan, Amman, Jordan. His expertise includes special education policies, intervention programs, and inclusive education frameworks. He has collaborated on multiple national and international research projects.
Email: b.alabdallat@ju.edu.jo
ORCID: 0000-0002-2704-7576

Alaa K. Al-Makhzoomy, PhD, is affiliated with the College of Educational Sciences at Yarmouk University, Irbid, Jordan. His work focuses on educational assessment, psychological interventions, and technological advancements in learning methodologies.
Email: makhzoomy@yu.edu.jo
ORCID: 0000-0001-6660-1018