Artificial Intelligence (AI) Applications in Personalized Learning for Autistic Students: A Systematic Literature Review

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ABSTRACT

Personalized learning is a significant approach in the education of autistic students due to the diversity of their learning profiles, particularly in terms of social communication, interaction, and sensory sensitivity. However, the optimal implementation of personalized learning in classrooms continues to face multiple constraints, including teacher workload and challenges in providing interventions that are truly individualized on a consistent basis. While Artificial Intelligence (AI) technology is seen as having the potential to support this process through more adaptive applications, existing literature on its implementation remains varied, fragmented, and highlights research gaps. Therefore, this study was conducted as a Systematic Literature Review (SLR) with the objectives of identifying the types of AI instruments commonly used, assessing their impact on social communication, emotion management, and student engagement, and examining the challenges and research gaps in the use of AI within special education. The study employed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines and searched six major databases: Scopus, Web of Science (WoS), ERIC, IEEE Xplore, ACM Digital Library, and Google Scholar. From a total of 226 identified articles, 24 publications from 2019 to 2026 met the inclusion criteria and were analyzed thematically. The findings indicate that the most frequently used AI instruments include Intelligent Tutoring Systems (ITS), social robots such as NAO, adaptive learning systems, and emotion recognition technologies. The use of these technologies has been shown to positively impact student focus and engagement, support social communication, and assist in emotion management through personalized activities. Nevertheless, the implementation of AI interventions also faces major challenges, including technical constraints, high training demands for teachers, and concerns regarding data privacy and ethics. Accordingly, this study recommends that AI should be employed as a pedagogical support tool, integrated with human interaction and professional teacher training. The findings are expected to provide meaningful contributions to inclusive pedagogical practices and to the development of safer, more equitable educational technology policies that respect and accommodate the neurodiversity of autistic students.

Keywords: Artificial Intelligence (AI), Personalized Learning, Autistic Students, Social Communication, Inclusive Education.

INTRODUCTION

The education of autistic students demands an inclusive, flexible, and individual-needs-based pedagogical approach, as Autism Spectrum Disorder (ASD) involves a complex diversity of developmental profiles. Differences in social communication, interaction, behavior, sensory sensitivity, and information processing make uniform teaching approaches insufficient to effectively support student learning. Consequently, personalized learning has become an essential requirement, as this pedagogy allows teaching strategies, support, learning rates, and feedback to be tailored to the unique strengths and challenges of each student. Frolli et al. (2024) emphasize that personalized learning environments can significantly assist autistic students in developing according to their potential and individual needs.

In line with advancements in educational technology, Artificial Intelligence (AI) has opened new avenues for supporting personalized learning within autism education. Smart instruments, such as Intelligent Tutoring Systems (ITS), social robots, and emotion recognition applications, are capable of adjusting learning experiences based on the responses, behavior, and developmental stages of ASD students. Kotsi et al. (2025) report that AI interventions have the potential to support ASD students across academic, cognitive, and social domains through more individual-centered approaches. Empirical evidence further supports this potential; Yang et al. (2024) found that the use of NAO robots in classrooms increased the focus and engagement of autistic students, while La Fauci De Leo et al. (2025) demonstrated that emotion recognition-based AI applications help autistic children develop emotional awareness and socio-emotional skills through interactive activities.

Problem Statement

Although AI is gaining increasing attention in autism education, its potential must be critically evaluated because previous research findings remain inconsistent regarding instruments, contexts, designs, and efficacy measures. Existing studies examine various technologies such as social robots, Intelligent Tutoring Systems (ITS), emotion recognition applications, and adaptive learning systems. This diversity creates a knowledge gap, as it remains unclear which AI technologies are most frequently used, to what extent they impact the learning and development of autistic students, and how these technologies support the principles of personalized learning.

Furthermore, the implementation of AI in autism education still faces challenges such as technical constraints, teacher readiness, technology costs, data privacy, ethical issues, and a lack of evidence regarding long-term efficacy. Guang Li et al. (2024) found that while educators recognize the potential of AI to enhance student engagement and personalized learning for ASD students, its usage is still limited by technical issues, training requirements, and concerns regarding data privacy. Kotsi et al. (2025) also emphasize that research on AI interventions for ASD students still possesses gaps regarding long-term efficacy evidence and the standardization of educational practices.

Therefore, this study was conducted to systematically synthesize past evidence to identify the types of AI technologies used, evaluate their impact on social communication, emotion management, focus, and engagement among autistic students, and clarify implementation challenges and future research directions. The findings are expected to contribute to the strengthening of inclusive pedagogical practices that are more evidence-based, ethical, and responsive to the individual needs of autistic students.

Research Objectives

This SLR aims to synthesize and deeply examine past research related to the application of Artificial Intelligence (AI) in personalized learning for autistic students. Specifically, the objectives of this study are as follows:

1. To identify the types of Artificial Intelligence (AI) technology instruments most frequently used in personalized learning for autistic students.

2. To analyze the impact of AI technology usage on social communication, emotion management, focus retention, and engagement of autistic students in the learning process.

3. To evaluate implementation challenges and identify research gaps in the use of AI to support personalized learning for autistic students.

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Research Questions

Based on the issues presented, this systematic literature review will address the following questions:

1. What types of Artificial Intelligence (AI) technology instruments are most frequently used in personalized learning for autistic students?

2. How does the use of AI technology impact the social communication, emotion management, focus, and engagement of autistic students in learning?

3. What are the implementation challenges and research gaps in the use of AI to support personalized learning for autistic students?

METHODOLOGY

This study employs a Systematic Literature Review (SLR) approach to identify, select, evaluate, and synthesize existing research regarding AI applications in personalized learning for autistic students. This approach was chosen because an SLR facilitates the systematic and transparent collection of research evidence based on predefined research questions, thereby supporting critical and evidence-based analysis of findings (Page et al., 2021).

The article selection process was guided by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines and PRISMA-S principles, which emphasize transparency, consistency, and reliability through four main phases: identification, screening, eligibility, and inclusion. PRISMA-S details the literature search strategy, including database selection, keywords, Boolean operators, and search strings (Rethlefsen et al., 2021), ensuring that only relevant, current, and academically valid articles are included. Following the rigorous screening and quality assessment process, 24 articles were selected for in-depth analysis to ensure the findings are focused and highly relevant to the study's objectives.

Research Design

The research design is qualitative, utilizing document analysis of academic journals and proceedings that met the inclusion and exclusion criteria. Data from the 24 selected articles were analyzed thematically based on three main focuses: the types of AI instruments used, the impact of AI on social communication, emotion management, focus, and engagement of autistic students, as well as implementation challenges and research gaps in this field. This approach allows findings to be synthesized critically, objectively, and based on evidence, in alignment with the SLR objectives. By utilizing thematic analysis and narrative synthesis, this study provides a structured overview of the current state of AI technology in autism education, identifying not only the potential of these tools but also the methodological and contextual gaps that warrant further investigation.

Data for this study were sourced from academic databases relevant to the fields of special education and technology, namely Scopus, Web of Science (WoS), ERIC, IEEE Xplore, ACM Digital Library, and Google Scholar. The selection of these databases ensures that the search encompasses a broad range of high-quality international literature as well as regional studies related to AI and personalized learning for autistic students.

The search strategy was constructed using specific and focused terms to address the multidimensional nature of AI and autism education, including assistive technology and digital learning. Directed keyword chains were utilized to ensure search results aligned strictly with the study's focus—personalized learning for autistic students within the context of special education pedagogy.

Search keywords were developed in both English and Malay to ensure comprehensive coverage. These included "Artificial Intelligence," "AI," "Machine Learning," "Personalized Learning," "Adaptive Learning," "Autism,"

"Autism Spectrum Disorder," "autistic students," "social robot," "intelligent tutoring system," "emotion recognition," "kecerdasan buatan," "pemperibadian pembelajaran," and "murid autistik." These keywords were systematically organized according to the specific search structure of each database. Boolean operators were employed to enhance search precision: (AND) was used to combine main concepts, while (OR) was used to include relevant terminology variations.

The search was limited to articles published between 2019 and 2026 to capture the most recent technological advancements, written in either English or Malay, and consisting of empirical journal articles, academic proceedings, or peer-reviewed literature reviews. This specification ensures that the selected articles are current, relevant, and possess the academic validity required for analysis. Table 1 illustrates the databases and sample search strings used in this study.

Table 1 Databases and sample search strings

Database	**Sample Search String**
Scopus	− ("Artificial Intelligence" OR "Machine Learning" OR "Intelligent Tutoring System") AND ("Personalized Learning" OR "Adaptive Learning") AND ("Autism" OR "ASD") AND ("Social Skills" OR "Communication") − ("Social Robotics" OR "Affective Computing") AND ("Inclusive Education" OR "Individualized Instruction") AND ("Autism Spectrum Disorder")
Web of Science (WoS)	− ("Artificial Intelligence" OR "AI" OR "Deep Learning") AND ("Personalized Learning" OR "Adaptive Learning" OR "Individualized Instruction") AND ("Autism" OR "Autistic" OR "ASD" OR "Autism Spectrum Disorder") − ("Artificial Intelligence" OR "Machine Learning") AND ("Autism" OR "ASD") AND ("Emotion Recognition" OR "Attention Span" OR "Social Interaction")
ERIC	− ("Artificial Intelligence" OR "AI") AND ("Autism" OR "Autistic") AND ("Personalized Learning" OR "Adaptive") AND ("Communication" OR "Social Skills")
IEEE Xplore / ACM Digital Library	− ("Artificial Intelligence" OR "Robot") AND ("Autism") AND ("Personalized" OR "Adaptive")
Google Scholar	− "Kecerdasan Buatan" AND "pemperibadian pembelajaran" AND "murid autistik" − "*AI interventions*" AND "*autism*" AND "*social skills*" AND "*emotion recognition*"

Inclusion and Exclusion Criteria

The selection of articles for this study was determined through rigorous inclusion and exclusion criteria to ensure the screening process was highly directed and aligned with the SLR objectives. These criteria encompass the type of literature, language, publication period, indexing, study focus, and target population.

Regarding the type of literature, this study accepts peer-reviewed academic journal articles, conference proceedings, empirical studies, and literature reviews. Conversely, non-academic sources such as blogs, news articles, opinion pieces, theses, book chapters, and non-scientific reports are excluded. Conceptual articles or literature reviews are only accepted if they have undergone a peer-review process and are directly related to AI applications in personalized learning for autistic students.

Furthermore, regarding the publication period and language, accepted articles are limited to those published between 2019 and 2026 in either English or Malay. This constraint was established to ensure that the selected literature reflects the most recent and foundational developments in AI technology, while simultaneously reducing the risk of misinterpretation during the data extraction and synthesis processes.

Regarding indexing, the selected articles must be sourced from recognized academic databases such as Scopus, Web of Science (WoS), ERIC, ScienceDirect, SpringerLink, IEEE Xplore, ACM Digital Library, and Google

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Scholar. This criterion is essential to guarantee that the analyzed sources are traceable, possess strong academic credibility, and are highly relevant to the intersections of education, special education, and technology.

Finally, regarding the focus of the study, the selected articles must explicitly discuss the use of AI technology within the context of educational or personalized learning interventions for autistic students. Studies focusing solely on clinical diagnosis or general special needs populations, without a specific analysis of autistic students, are excluded. Furthermore, the selected articles must report empirical findings related to social communication, emotion management, engagement, or the learning development of autistic students.

Overall, these criteria ensure that the article selection process is focused, transparent, and strictly aligned with the research questions. Articles meeting these criteria were then analyzed thematically, as summarized in Table 2.

Table 2 Article selection criteria

No.	Criteria	Inclusion (Accepted)	Exclusion (Rejected)
1.	Type of Literature	Peer-reviewed academic journals, proceedings, empirical studies, SLR, or conceptual articles related to AI in personalized learning for autistic students.	Blogs, news, opinion pieces, or non-academic sources.
2.	Language	English and Malay.	Languages other than English or Malay.
3.	Timeframe	Articles published between 2019 and 2026.	Articles published in 2018 or earlier.
4.	Index	Articles from Scopus, WoS, ERIC, IEEE Xplore, ACM Digital Library, ScienceDirect, Springer Link, or Google Scholar.	Unindexed sources or sources with unverified credibility.
5.	Study Population	Studies involving autistic students or special education teachers directly related to personalized learning for autistic students.	Studies on special needs students in general without specific ASD analysis.
6.	Study Focus	AI studies such as social robots, intelligent tutoring systems, adaptive learning, or emotion recognition for personalized learning of autistic students.	Technology without AI or AI for clinical diagnosis only.
7.	Study Finding	Studies reporting the impact of AI usage on autistic students' development, particularly in social communication, emotion management, focus, or learning engagement.	Studies measuring purely academic subject achievement without social/emotional elements.

Article Selection Process

The article selection process was executed systematically, guided by the PRISMA (*Preferred Reporting Items for Systematic Reviews and Meta-Analyses*) model to ensure that the search, screening, and selection of articles were transparent, structured, and reproducible. This process involved four primary phases: identification, screening, eligibility, and inclusion.

In the Identification phase, a comprehensive search utilizing targeted keyword chains yielded 226 articles across the primary databases: Scopus (n=106), Web of Science (n=3), ERIC (n=8), IEEE Xplore (n=28), ACM Digital Library (n=14), and Google Scholar (n=67). From this initial pool, 34 duplicate articles were removed to prevent data repetition. Subsequently, 75 articles were excluded for failing to meet the basic inclusion criteria, specifically regarding the expanded publication timeframe (2019–2026), literature type, or academic suitability. Following this initial culling, 117 articles were retained for further screening.

During the Screening phase, the remaining 117 articles were evaluated based on their titles and abstracts. The screening revealed that 49 articles did not align with the research focus, either discussing AI in a generalized context without focusing on autism education or concentrating exclusively on clinical diagnoses and medical applications. Furthermore, 23 articles failed to meet the target population criteria, as they involved general special needs populations without specific analysis of students with Autism Spectrum Disorder (ASD). Consequently, 72 articles were excluded during this phase, allowing the remaining 45 articles to proceed to the Eligibility phase.

In the Eligibility phase, the full texts of the 45 articles were comprehensively analyzed against the strict inclusion and exclusion criteria. Twenty-one articles were excluded at this stage: 14 did not report empirical findings on the impact of AI on the study's target outcomes—such as social communication, emotion management, focus, or the engagement of autistic students—while 7 articles were excluded due to inaccessible or incomplete full texts.

Finally, in the Inclusion phase, 24 articles successfully met all criteria and were selected for data extraction and thematic analysis. This final selection represents approximately 10.6% of the total articles identified at the initial stage, demonstrating that the selection process was conducted with rigorous selectivity in strict accordance with the study's objectives.

Figure 1 illustrates the PRISMA flow diagram detailing the article selection process, while Table 3 and Table 4 present the distribution of the selected articles by database and publication year, respectively.

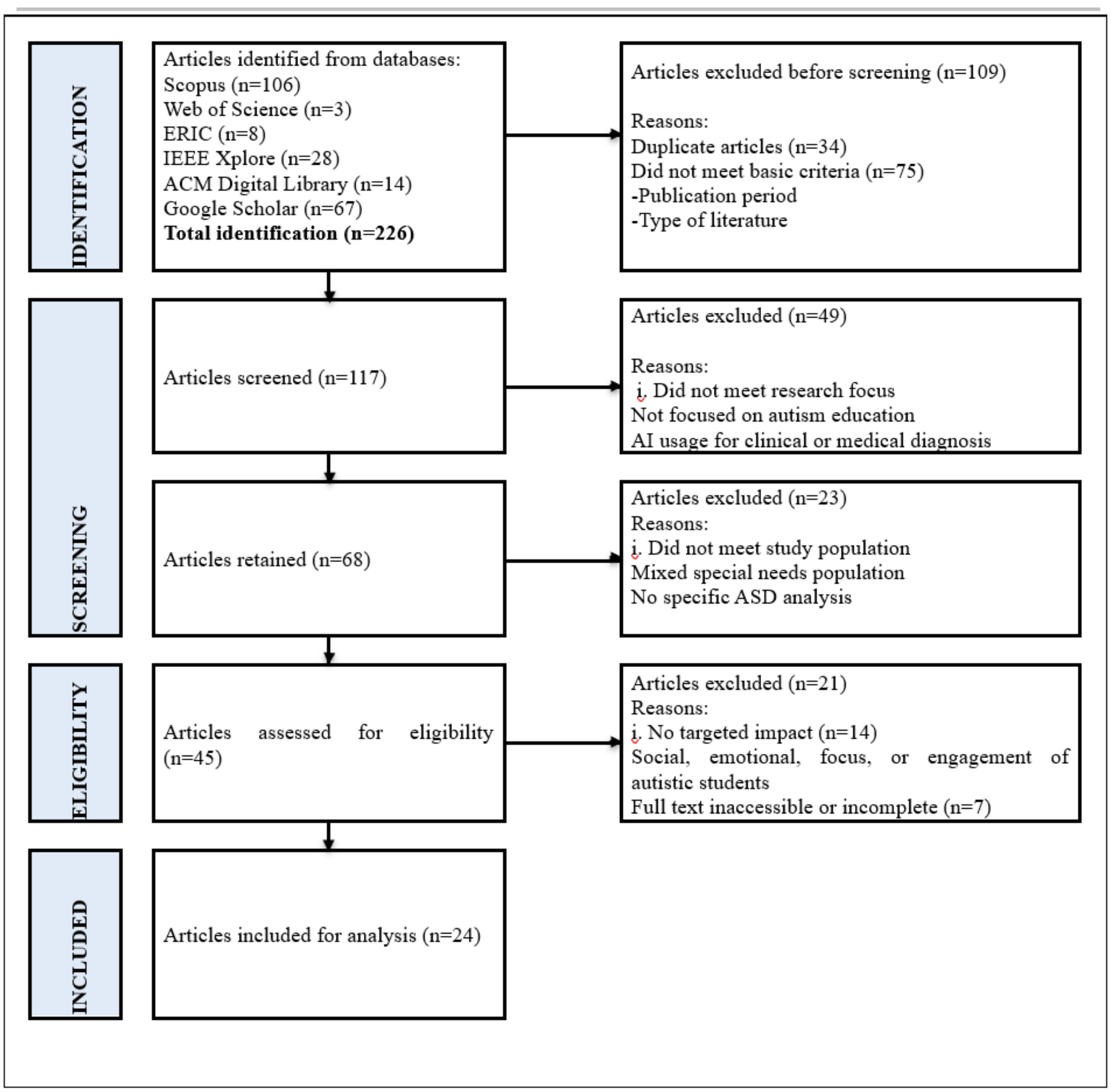

Figure 1 PRISMA flow diagram for the article selection process

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Table 3 Distribution of selected articles by database

Database	Number of Selected Articles
Scopus	8
Web of Science (WoS)	3
ERIC	1
IEEE Xplore	2
ACM Digital Library	1
Google Scholar	9
Total	**24**

Table 4 Distribution of selected articles by publication year

Publication Year	Number of Selected Articles
2019	1
2020	2
2021	0
2022	2
2023	0
2024	5
2025	11
2026	3
Total	**24**

Based on Table 3 and Table 4, the selected articles demonstrate a diversity of database sources as well as recent publication trends in the field of AI and autism education. This distribution strengthens the relevance of the research materials used before their contents were analyzed thematically.

Data Analysis

The research data were analyzed using thematic analysis based on the six phases proposed by Clarke and Braun (2013), supported by a narrative synthesis to present the findings in a structured manner. This approach is highly suitable because the analyzed articles feature diverse research designs, including empirical, experimental, and conceptual studies, as well as literature reviews. Through a combination of thematic analysis and narrative synthesis, the findings from the 24 selected articles could be compared, grouped, and systematically elaborated in accordance with the research objectives.

The analysis process commenced with the phase of familiarizing with the data, which involved a comprehensive reading of the 24 articles that met the inclusion criteria. During this phase, key information such as the author(s), publication year, methodology, study population, types of AI instruments, main findings, and implementation challenges were identified and extracted into an analysis matrix table. All extracted data and initial codes were systematically organized and managed using Microsoft Excel to facilitate an efficient analysis process. Subsequently, the phase of generating initial codes was conducted by identifying critical findings related to the research questions, particularly those concerning the types of AI technology, their impact on autistic students, and implementation challenges. To enhance the transparency and replicability of the methodology, a structured coding framework was developed based on the research objectives. Furthermore, to ensure analytical rigor, inter-rater reliability measures were implemented. A high level of agreement was established among the researchers, wherein the initial codes and data extracts were independently reviewed and cross-checked by the co-authors. Any minor discrepancies in code definitions or thematic categorization were resolved through consensus discussions, ensuring that the final themes accurately and objectively represented the extracted data.

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The following phase involved searching for themes, where initial codes that shared similarities were combined to form provisional themes. These themes were then reviewed to ensure their alignment with the extracted findings, the research objectives, and the central focus of this systematic literature review. Once the review process was completed, the themes were defined and named more explicitly. The analysis yielded three main themes: the types of AI instruments used in personalized learning; the impact of AI on the social communication, emotion management, focus, and engagement of autistic students; and implementation challenges and research gaps.

Finally, the findings for each theme were synthesized narratively to elucidate the patterns, similarities, differences, limitations, and future research directions regarding the use of AI in personalized learning for autistic students. Figure 2 illustrates the theme development process based on the thematic analysis by Clarke and Braun (2013), while Table 5 compiles the SLR analysis matrix for the 24 selected articles based on author, publication year, methodology, type of AI instrument, main findings, and implementation challenges.

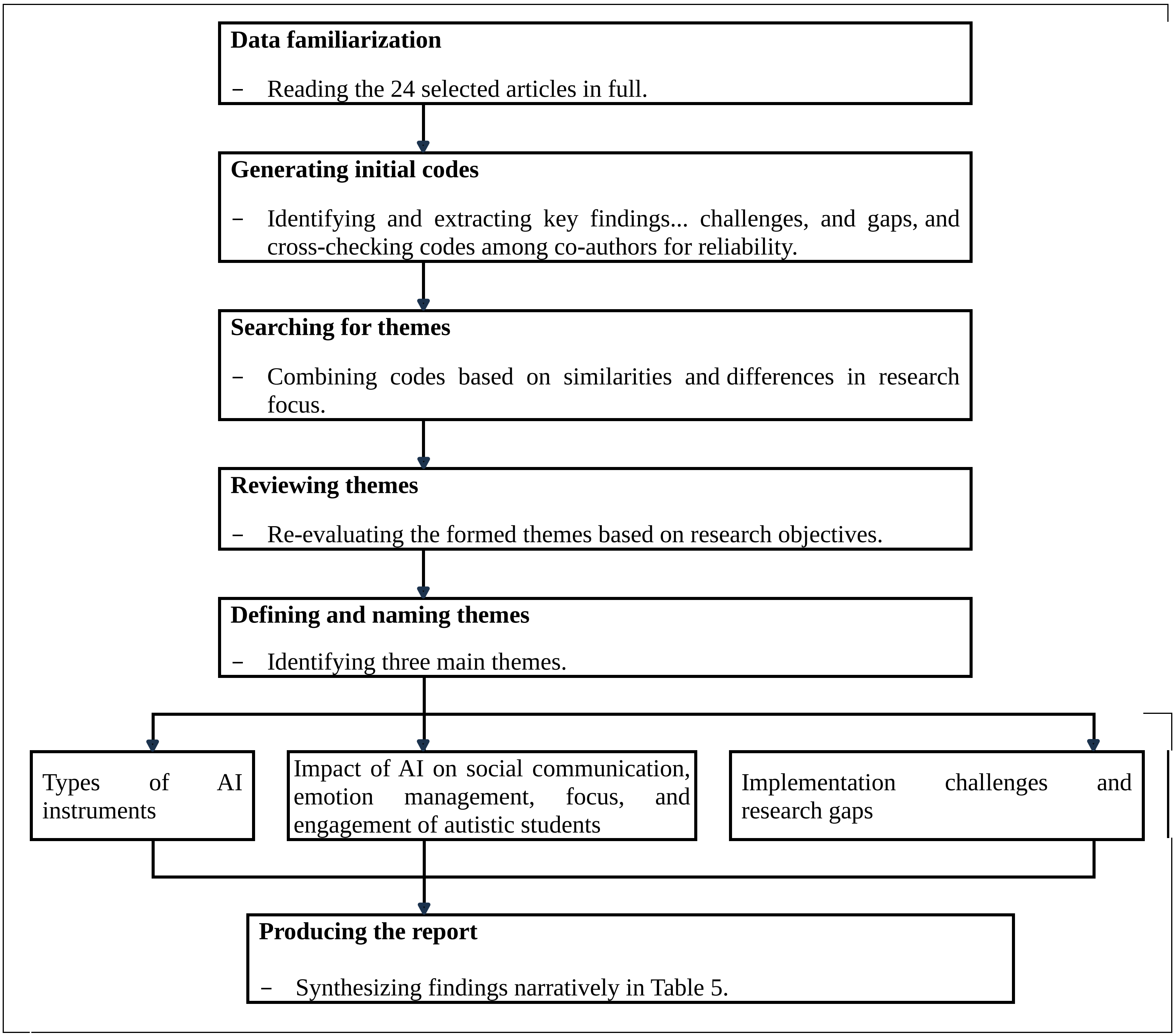

Figure 2 Theme development process

Table 5 SLR Analysis

Article	**Research Methodology**	**AI Instruments (Objective 1)**	**Impact on Autistic Students (Objective 2)**	**Implementation Challenges (Objective 3)**	**Research Gaps (Objective 3)**
A1: Barua, P. D., Vicnesh, J., Gururajan, R., Oh, S. L., Palmer, E., Azizan, M. M., Kadri, N. A., & Acharya, U. R. (2022). **Artificial intelligence enabled personalised assistive tools to enhance education of children with neurodevelopmental disorders: A review**. *International Journal of Environmental Research and Public Health*, *19*(3), 1192	1. **Study Type:** Literature review 2. **Research Design:** Review related to AI-based learning assistive tools 3. **Study Sample:** No specific field sample as the study is a review	1. Artificial intelligence-based learning assistive tools that use machine learning to tailor learning support according to student needs. 2. This system functions to assist personalized learning, communication support, and social interaction.	1. **Social Communication:** AI has the potential to support the social interaction of students with neurodevelopmental disorders, including ASD. 2. **Emotion Management:** Not explicitly discussed. 3. **Focus Retention:** AI helps provide learning support that is more responsive to student needs.	1.0 AI tool design still needs to be adapted to individual learning profiles. 2.0 Not all AI systems consider the diverse needs of autistic students.	The study remains general to neurodevelopmental disorders and lacks specific focus on autistic students.
A2: Frolli, A., Cavallaro, A., La Penna, I., Sica, S. L., & Bloisi, D. (2024). **Artificial intelligence and autism spectrum disorders: A new perspective on learning**. *Proceedings of the Digital*	1. **Study Type:** Conceptual article / review 2. **Research Design:** Literature discussion related to AI and ASD learning 3. **Study Sample:** No specific field sample	1. Artificial intelligence technology in ASD learning that functions to support learning based on the student's individual profile. 2. AI is used to support a more flexible and	1. **Social Communication:** Autistic students require support because ASD involves social communication challenges. 2. **Emotion Management:** Not discussed in depth. 3. **Focus Retention:** Personalized learning is seen as important	1. The article emphasizes the needs and potential of AI rather than actual implementation in the classroom.	Lack of empirical evidence regarding the effectiveness of AI on the learning outcomes of autistic students.

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Innovations for Learning and Neurodevelopmental Disorders.		personalized learning environment.	to support individual learning needs.		
A3: Adako, O. P., Adeusi, O. C., & Alaba, P. A. (2024). **Revolutionizing autism education: Harnessing AI for tailored skill development in social, emotional, and independent learning domains.** *Journal of Computational and Cognitive Engineering*, *3*(4), 348–359.	1. **Study Type:** Literature review 2. **Research Design:** Interdisciplinary review involving education, psychology, and technology. 3. **Study Sample:** No original empirical data.	1. Virtual reality, natural language processing, and adaptive learning. 2. These technologies function to provide social training scenarios, emotional regulation support, and learning pathways customized to the needs of autistic students.	1. **Social Communication:** AI helps students practice social interactions in a safer and controlled environment. 2. **Emotion Management:** AI technology has the potential to support emotional regulation through real-time feedback. 3. **Focus Retention:** Adaptive learning helps students follow activities at their own pace.	1. Ethical and privacy issues need attention. 2. Practical effectiveness still depends on the suitability of the intervention design.	Lack of original empirical data to confirm the effectiveness of AI interventions in an actual classroom context.
A4: Abu-Amara, F., Mohammad, H., & Bensefia, A. (2024). **Robot-based therapy for improving academic skills of children with autism**. *International Journal of Information Technology (Singapore)*, *16*(6), 3371–3380.	1. **Study Type:** Empirical study 2. **Research Design:** Robot-based intervention 3. **Study Sample:** 9 ASD children	1. NAO robot and the AutisPlay mobile application. 2. The robot is used as a learning interaction mediator, while the application helps execute academic activities in a more engaging and structured manner.	1. **Social Communication:** Interaction with the robot can increase student response during therapy sessions. 2. **Emotion Management:** Not the main focus of the study. 3. **Focus Retention:** Some students showed attention and enjoyment while interacting with the robot.	1. Small sample size. 2. The study's focus is more geared towards academic skills rather than social and emotional aspects.	Further studies are needed to evaluate the impact of robots on social communication, emotions, and focus more clearly.

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A5: Yang, Q., Lu, H., Liang, D., Gong, S., & Feng, H. (2024). **Surprising performances of students with autism in classroom with NAO robot.** *arXiv*.	1. **Study Type:** Classroom experimental study 2. **Research Design:** Robot-assisted classroom activities 3. **Study Sample:** ASD students in a special education school	1. NAO social robot. 2. The robot functions as a teacher's assistant to attract students' attention, give instructions, and facilitate interaction during class activities.	1. **Social Communication:** Teacher-robot-student interaction helps improve students' social responses. 2. **Emotion Management:** Not the main focus of the study. 3. **Focus Retention:** Students showed higher focus and engagement as well as a reduction in repetitive behaviors.	1. The study is still in its preliminary stages. 2. The intervention period and study context are limited.	Needs long-term studies on the use of social robots in actual classrooms.
A6: Li, G., Zarei, M. A., Alibakhshi, G., & Labbaf, A. (2024). **Teachers and educators' experiences and perceptions of artificial-powered interventions for autism groups**. *BMC Psychology, 12*, 199.	1. **Study Type:** Qualitative phenomenology 2. **Research Design:** Semi-structured interviews and focus groups 3. **Study Sample:** 20 educators and parents	1. Artificial intelligence-based interventions. 2. AI functions to personalize learning and increase the engagement of autistic students.	1. **Social Communication:** AI is seen to assist in learning support and interaction. 2. **Emotion Management:** Not explicitly discussed. 3. **Focus Retention:** Educators reported an increase in student engagement.	1. Technical issues. 2. Teacher training requirements. 3. Concerns regarding data privacy.	Needs technical support, professional training, and clearer privacy policies.

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A7: La Fauci De Leo, A., Bagheri Zadeh, P., Voderhobli, K., & Akbari, A. S. (2025). **A new AI framework to support social-emotional skills and emotion awareness in children with autism spectrum disorder**. *Computers, 14*(7), 292.	1. **Study Type:** AI framework development 2. **Research Design:** Emotion-aware technology-based application design 3. **Study Sample:** Does not involve a large field sample	1. Emotion recognition technology using Google Cloud Vision. 2. AI functions to identify facial expressions and help students understand emotions through interactive activities.	1. **Social Communication:** Supports socio-emotional skills through guided activities. 2. **Emotion Management:** Helps students recognize, reflect, and match emotions. 3. **Focus Retention:** Serious gaming activities have the potential to increase engagement.	1. The accuracy of the emotion model still needs improvement. 2. Needs further testing with actual autistic students.	Future studies need to involve empirical validation and customized AI models.
A8: Kotsi, S., Handrinou, S., Iatraki, G., & Soulis, S. G. (2025). **A review of artificial intelligence interventions for students with autism spectrum disorder**. *Disabilities, 5*(1), 7.	1. **Study Type:** Literature review 2. **Research Design:** Analysis of 13 empirical studies 3. **Study Sample:** AI studies for ASD students	1. Intelligent tutoring systems, educational robotics, and adaptive learning. 2. AI functions to tailor tasks, support, and feedback based on student profiles.	1. **Social Communication:** AI has the potential to support the social domain of ASD students. 2. **Emotion Management:** Discussed as one aspect of intervention support. 3. **Focus Retention:** AI helps increase engagement through adaptive support.	1. Inconsistent study methodologies. 2. Long-term efficacy remains unclear.	Needs standardization of practices and longitudinal studies in autism education.

A9: Devadas, R. S. (2025). **AI augmented education for children with special needs: A scholarly perspective**. *World Journal of Advanced Engineering Technology and Sciences, 15*(3), 2000-2008.	1. **Study Type:** Scholarly perspective article 2. **Research Design:** Conceptual discussion based on literature 3. **Study Sample:** No field sample	1. Intelligent tutoring systems, natural language processing, computer vision, and predictive analytics. 2. AI functions to adapt content, pace, and delivery format of learning.	1. **Social Communication:** AI has the potential to support communication through language technology and smart interaction. 2. **Emotion Management:** Discussed generally through responsive technology support. 3. **Focus Retention:** AI helps tailor learning to individual patterns.	1. Issues of access, privacy, algorithm bias, and teacher readiness. 2. Risk of replacing human interaction if uncontrolled.	Needs an implementation framework that balances technology and educational values.
A10: Nasir, H. M., Brahin, N. M. A., Zainuddin, S., Isa, I. S. M., Azhar, M. A., Syazwani, N., & Jamal, N. (2025). **AI-powered mobile application 'Play Home' for autism education**. *International Journal of Research and Innovation in Social Science, 9*(IIIS), 6618-6626.	1. **Study Type:** Application development 2. **Research Design:** AI mobile app design 3. **Study Sample:** Initial app testing	1. The Play Home application uses machine learning, image classification, and object recognition. 2. AI functions to provide real-time responses and adapt activities to student progress.	1. **Social Communication:** Not the main focus. 2. **Emotion Management:** Not explicitly discussed. 3. **Focus Retention:** Interactive modules help improve attention, object recognition, and student participation.	1. Still in the preliminary testing stage. 2. Needs validation at actual autism centers.	Needs field studies to assess educational impact and application usability.

A11: Rofidi, M. R. Z., Asmai, S. A., Fauadi, M. H. F. M., Masdzarif, N. D. I., & Jaya, A. S. M. (2025). AISTY: **An explainable AI-driven vision-based adaptive learning system for children with autism spectrum disorder**. *International Journal of Research and Innovation in Social Science, 9*(10), 4777-4783.	1. **Study Type:** System development and usability evaluation 2. **Research Design:** Computer vision-based adaptive learning system 3. **Study Sample:** Parents and special education teachers	1. AISTY uses Convolutional Neural Networks and Explainable AI. 2. AI functions to detect facial expressions, emotional states, and student engagement to tailor learning content.	1. **Social Communication:** Supports learning responses through expression and emotion monitoring. 2. **Emotion Management:** The system identifies emotions such as happiness, sadness, anger, and fear. 3. **Focus Retention:** Content is adjusted based on the student's engagement level.	1. Model accuracy is around 78%. 2. User testing is still limited.	Needs larger-scale testing and validation of effectiveness with autistic students.
A12: Singh, S., & Wadhwa, P. (2025). **Artificial intelligence for implementing universal design for learning in inclusive education**. *International Journal of Social Impact, 10*(4), 58-68.	1. **Study Type:** Conceptual article 2. **Research Design:** Proposed AI-UDL framework 3. **Study Sample:** No field sample	1. AI for UDL, real-time analytics, personalized feedback, and communication support. 2. AI functions to assist teachers in providing flexible, multimodal learning materials.	1. **Social Communication:** AI can support communication through adaptive assistive tools. 2. **Emotion Management:** Not the main focus. 3. **Focus Retention:** The engagement principle in UDL is supported through adaptive content.	1. Algorithm bias, data privacy, cybersecurity, and technology access.	Needs empirical studies to evaluate the effectiveness of the AI-UDL framework in autism education.

A13: Pontillo, A. L., & Oliva, P. (2025). **Artificial intelligence, universal design for learning, and adaptive learning for students with specific learning disorders: A possible synergy?** *Giornale Italiano di Educazione alla Salute, Sport e Didattica Inclusiva, 9*(2).	1. **Study Type:** Conceptual article 2. **Research Design:** Discussion on AI, UDL, and adaptive learning 3. **Study Sample:** No field sample	1. AI and adaptive learning within the UDL framework. 2. AI functions to support learning personalization and inclusive access.	1. **Social Communication:** Not specifically discussed. 2. **Emotion Management:** Not specifically discussed. 3. **Focus Retention:** Adaptive learning has the potential to support student engagement.	Focuses on Specific Learning Disorders, not ASD specifically. 2. The discussion is more conceptual.	Needs specific studies on autistic students and empirical evidence on AI-UDL implementation.
A14: Nair, A. B., Madhuvanthi, M., & Sathyamurthi, K. (2025). **Effectiveness of AI-based learning tools for autistic children: A study on special educators in Chenna**i. *GAP Bodhi Taru: A Global Journal of Humanities*, *8*, 83-89.	1. **Study Type:** Survey study 2. **Research Design:** Special educators' perceptions of AI tools 3. **Study Sample:** Special educators	1. AI learning tools such as speech recognition software, virtual reality, and adaptive learning systems. 2. AI functions to support communication, cognitive skills, and personalized learning experiences.	1. **Social Communication:** AI is perceived to aid communication and social interaction. 2. **Emotion Management:** Not the main focus. 3. **Focus Retention:** Some respondents reported an increase in student engagement.	1. Screen dependency. 2. Reduction in human interaction. 3. Teacher training needs.	Needs direct empirical studies on students, not just educator perceptions.

A15: Atturu, H., Naraganti, S., & Rao, B. R. (2025). **Effectiveness of artificial intelligence-based platform in administering therapies for children with autism spectrum disorder: 12-month observational study**. *JMIR Neurotechnology*, *4*, Article e70589.	1. **Study Type:** Longitudinal observational study 2. **Research Design:** 12-month observation 3. **Study Sample:** 43 ASD children	1. CognitiveBotics AI platform. 2. AI functions to support structured therapy, monitor progress, and provide continuous learning activities.	1. **Social Communication:** Improvements in social age and social quotient were reported. 2. **Emotion Management:** A decrease in CARS scores indicates a general reduction in symptoms. 3. **Focus Retention:** The platform increases engagement and continuous therapy usage.	1. Needs language expansion, accessibility, and cultural sensitivity. 2. The study relies on platform usage compliance.	Needs cross-cultural studies and school contexts to test broader usability.
A16: Haque, S., Islam, M. S., Islam, M. I., Islam, M. S., Khan, R., Tarafder, M. T. R., & Mohammad, N. (2025). **Enhancing adaptive learning, communication, and therapeutic accessibility through the integration of artificial intelligence and data-driven personalization in digital health platforms for students with autism spectrum disorder**. *Journal of Posthumanism*, *5*(8),	1. **Study Type:** Experimental simulation study 2. **Research Design:** Data-driven adaptive therapy and learning system 3. **Study Sample:** Simulation data	1. Machine learning, natural language processing, and reinforcement learning. 2. AI functions to customize learning pathways and therapy based on the student's cognitive and communication profile.	1. **Social Communication:** The system showed improved communication skills in simulation. 2. **Emotion Management:** Not directly elaborated. 3. **Focus Retention:** AI increases engagement through content adaptation.	1. The study uses simulation data, not actual field data.	Needs empirical testing on real autistic students in an educational context.

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A17: Wang, J. (2026). **The impact of artificial intelligence-based personalized learning systems on the cognitive ability enhancement of children with special needs**. *International Journal of Cognitive Informatics and Natural Intelligence, 20*(1).	1. **Study Type:** Longitudinal study 2. **Research Design:** 12-month experiment 3. **Study Sample:** 360 special needs children	1. AI-based personalized learning system. 2. AI functions to adapt cognitive training through multimodal data and adaptive algorithms.	1. **Social Communication:** Not the main focus. 2. **Emotion Management:** Not the main focus. 3. **Focus Retention:** There was an improvement in attention, memory, and problem-solving.	1. 1. Challenges in resource equity and teacher adaptation. 2. The study population involves special needs children generally.	Needs specific analysis on the subgroup of autistic students.
A18: Daud, N., Ghazali, J. M., & Ahmad, S. N. (2025**). A review of AI-driven approaches in autism education**. *Malaysian Journal of Information and Communication Technology, 10*(2), 167-186.	1. **Study Type:** Conceptual article 2. **Research Design:** Literature discussion on AI and personalized learning 3. **Study Sample:** No field sample	1. Smart systems, learning analytics, behavior monitoring, and adaptive content delivery. 2. AI functions to provide real-time feedback and individual learning pathways.	1. **Social Communication:** AI has the potential to support disabled students' communication access. 2. **Emotion Management:** Discussed via emotional learning analytics. 3. **Focus Retention:** Adaptive content can support student engagement.	1. Ethical issues, data privacy, and teacher readiness.	Needs empirical evidence specific to autistic students.

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A19: Gadzhimusieva, D., Meliá, S., Lledó, G. L., & Nasabeh, S. S. (2026). **Development and pilot evaluation of an AI-driven learning management system for personalized education for autistic students**. *Education and Information Technologies*.	1. **Study Type:** Development and pilot evaluation study 2. **Research Design:** Technology acceptance model 3. **Study Sample:** 30 special education teachers	1. SpectrumSphere, an AI-based learning management system combining virtual reality, augmented reality, robotics, and alternative communication. 2. The system functions to personalize learning and monitor student progress in a data-driven manner.	1. **Social Communication:** Supports communication via AAC and teacher-parent collaboration. 2. **Emotion Management:** Has the potential to support self-monitoring and behavioral regulation. 3. **Focus Retention:** Adaptive LMS enhances responsive learning experiences.	1. Teacher acceptance is influenced by usefulness, ease of use, computer efficacy, and institutional support.	Needs broader implementation with autistic students and long-term impact measurement.
A20: Anwar, M., Karsidi, R., Sunardi, & Widyastono, H. (2026). **The effects of universal design for learning and AI-AT on the engagement and academic outcomes of students with disabilities**. *International Journal of Learning, Teaching and Educational Research, 25*(3), 557–581.	1. **Study Type:** Quasi-experiment 2. **Research Design:** Pretest-posttest with a control group 3. **Study Sample:** 143 students with disabilities	1. AI-based assistive technology within the UDL framework. 2. AI functions to provide feedback, multimodal content access, and communication support.	1. **Social Communication:** AI-AT supports communication in inclusive learning. 2. **Emotion Management:** Not the main focus. 3. **Focus Retention:** AI-AT and UDL increase student engagement.	1. Teacher readiness and technology usage remain limited. 2. Requires further training and adaptive pedagogical models.	Needs specific analysis on the subgroup of autistic students.

A21: Marino, F., et al. (2020). **Outcomes of a Robot-Assisted Social-Emotional Understanding Intervention for Young Children with Autism Spectrum Disorders.** *Journal of Autism and Developmental Disorders*.	1. **Study Type:** Randomized control trial (RCT) of a group-based Cognitive Behavioural Therapy (CBT) intervention. 2. **Research Design:** Pre- and post-intervention assessment comparing a Robot Group (RG) and a Control Group (CG). 3. **Study Sample:** 14 children diagnosed with Autism Spectrum Disorders (aged 4 to 8 years old).	1. A partially controlled humanoid social robot (NAO) equipped with a rule-based supervisory controller that acts as a co-therapist. 2. The system utilizes a "therapist-in-the-loop" approach for personalization, where a therapist uses a tablet application to adjust the robot's prompts and feedback in real-time based on the children's responses. 3. The robot's software includes an automatic routine for facial and eye recognition to maintain consistent eye contact with the children.	1. **Socio-Emotional Understanding:** Focused on improving contextualized emotion recognition, comprehension, and emotional perspective-taking. 2. **Engagement & Attention:** Maintained high interest, sustained attention, and motivation throughout the sessions without being negatively influenced by technology concerns (e.g., anxiety or specific sensory interests).	1. The Robot-Assisted CBT intervention produced significant improvements in emotional comprehension and emotional lexicon compared to the control group. 2. Children in the robot group successfully generalized learning, recognizing complex emotions like "shame" even though it was not explicitly taught during the sessions.	1. The study has a small sample size (N=14), which limits the generalizability of the findings and the statistical power for single-component analyses. 2. The system is not fully autonomous and relies on an experienced human therapist to operate the interface and tailor the prompts during the intervention.
A22: Anagnostopoulou, P., Alexandropoulou, V., Lorentzou, G., et al. (2020). **Artificial Intelligence in Autism Assessment**. *International Journal of Emerging Technologies in Learning*, 15(06).	1. **Study Type:** Literature review 2. **Research Design:** Analysis of AI applications in ASD assessment and personalized learning 3. **Study Sample:** No field sample	1. Machine learning algorithms and smart diagnostic technologies. 2. AI functions to assess behavioral data and propose individualized learning pathways for autistic students.	1. **Social Communication:** Early AI assessment leads to more targeted communication interventions. 2. **Emotion Management:** Not directly elaborated, but aids in overall personal development. 3. **Focus Retention:** Individualized pathways prevent cognitive overload, helping to sustain attention.	1. Requires large datasets for model training. 2. Ethical concerns regarding data privacy and consent.	Many smart technologies remain in the preliminary or prototype phase and lack extensive real-world validation.

A23: Kouroupa, A., Laws, K. R., Irvine, K., Mengoni, S. E., Baird, A., & Sharma, S. (2022). **The use of social robots with children and young people on the autism spectrum: A systematic review and meta-analysis**. *PLOS ONE, 17*(6), e0269800.	1. **Study Type**: Systematic review and meta-analysis. 2. **Research Design**: Review and meta-analysis of robot-mediated interventions. 3. **Study Sample**: 40 studies (17 were randomized controlled trials) involving children/youth under 18 years old.	1. **Social Robots**: Physically embodied agents (humanoid and animaloid) with some level of autonomy to engage in social interaction. 2. **Robot platforms**: Humanoid (e.g., NAO, QTrobot) and animaloid (e.g., Probo, Pleo, Zoomer) robots used as therapeutic mediators.	1. **Social Communication**: Significant improvement in social functioning (e.g., joint attention, imitation, engagement). 2. **Emotion Management**: Mixed evidence; robot-mediated interventions did not significantly improve emotional outcomes based on the meta-analysis. . **Focus Retention**: Predictable and consistent interaction patterns provided by robots act as scaffolds to sustain attention and master skills.	1. **Standardization**: Lack of consistent intervention protocols (variability in session frequency and duration). 2. **Environment**: Evidence suggests robots are significantly more effective in clinical/center-based settings compared to schools or homes. 3. **Methodological Rigor**: Poor quality of reporting in many studies, including small sample sizes and lack of blinded outcome assessment.	1. **Generalization**: Lack of long-term empirical evidence to assess the generalization of learned skills to daily life settings. 2. **Data Reporting**: Poor reporting on participant characteristics (e.g., IQ, socioeconomic status) and adverse events. 3. **Cultural Diversity**: Significant lack of research from diverse cultural backgrounds beyond the United States and Europe.
A24: Clabaugh, C., et al. (2019). **Long-Term Personalization of an In-Home Socially Assistive Robot for Children With Autism Spectrum Disorders.** *Frontiers in Robotics and AI.*	1. **Study Type:** Long-term in-home intervention study. 2. **Research Design:** Single-subject research design using pre- and post-assessments. 3. **Study Sample:** 17 children diagnosed with Autism (aged between 3 to 7 years old).	1. A fully autonomous Socially Assistive Robot (SAR) system using a hierarchical human-robot learning (hHRL) framework. 2. The system functions using a reinforcement learning algorithm to track student errors and automatically personalize the challenge level of instructions and feedback.	1. **Cognitive Improvement:** Supports significant improvement in math skills, specifically numerical operations and mathematical reasoning. 2. **Engagement Retention:** Capable of fostering and maintaining student engagement with an average of 65% active engagement throughout the month-long intervention.	1. Personalized SAR system intervention is proven effective and feasible for providing long-term developmental support for autistic children. 2. The majority of involved families reported that the SAR system is highly useful and easily adaptable to their children.	Requires a high amount of time and interaction (approximately 100 game rounds) before the AI system successfully identifies and adapts to the optimal profile of each child.

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RESULT

A total of 24 articles were identified that met the criteria to answer the research questions regarding AI applications in personalized learning for autistic students. All 24 detailed articles comprehensively highlight the types of AI instruments used, their impact on social communication, emotion management, and student engagement, as well as the implementation challenges and research gaps that need to be addressed to empower special education in the future.

Objective 1: Types of Artificial Intelligence (AI) Technology Instruments Most Frequently Used in Personalized Learning for Autistic Students

Based on the systematic literature review conducted, the most frequently reported AI instruments are adaptive learning systems and Intelligent Tutoring Systems (ITS), alongside mobile applications, platforms, and AI analytics. These two categories appeared with the highest frequency in the analyzed articles. Adaptive learning systems and ITS function to customize content, difficulty levels, learning pathways, and feedback based on the individual needs of autistic students. Meanwhile, mobile applications, platforms, and AI analytics are utilized to support progress monitoring, the delivery of interactive activities, and more systematic learning adaptations.

The next category involves emotion recognition technology and Computer Vision. These instruments are used to identify facial expressions, emotions, posture, behavior, or student engagement levels, enabling systems to provide more responsive feedback. However, this technology must be interpreted with caution because the accuracy of emotion detection remains dependent on data quality, usage context, and the variance in autistic students' expressions.

Social robots and educational robotics have also been identified as significant instruments, serving as foundational tools in AI interventions. A comprehensive systematic review and meta-analysis by Kouroupa et al. (2022) confirmed that social robot-mediated interventions (including both humanoid and animaloid platforms) serve as effective therapeutic mediators to enhance social functioning, joint attention, and imitation skills in autistic children. Additionally, Clabaugh et al. (2019) demonstrated the effectiveness of fully autonomous Socially Assistive Robots (SAR) using reinforcement learning frameworks to identify individual student profiles and adapt challenge levels during long-term in-home interventions. Furthermore, Marino et al. (2020) highlighted the use of the NAO robot as a co-therapist in cognitive-behavioral social training. While social robots offer great potential to attract attention and increase engagement, these findings should be interpreted critically, as some studies rely on small sample sizes, short implementation periods, or remain in the pilot stage.

Other reported instruments include virtual reality (VR), augmented reality (AR), natural language processing (NLP), and speech technology. Although these categories do not appear as frequently as adaptive learning systems or AI analytics, these technologies serve as vital complementary components to the AI learning ecosystem. VR and AR provide safer, more interactive environments for social training, while NLP and speech technology support communication, language comprehension, and access to more flexible learning.

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Overall, the findings indicate that personalized learning for autistic students does not rely on a single AI instrument alone; rather, it involves a combination of various technologies to form a holistic learning ecosystem. A detailed analysis of all types of AI technology instruments, along with cross-references for each author, is presented in Table 6 and Figure 3.

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Table 6 Types of AI instruments frequently used in personalized learning for autistic students

AI Instrument Category	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24
Mobile Applications, Platforms & AI Analytics (General)	/	/	-	/	-	/	/	/	/	/	/	/	-	/	/	/	/	/	/	/	-	/	-	/
Adaptive Learning Systems & Intelligent Tutoring Systems (ITS)	/	/	/	-	-	-	-	/	/	-	/	/	/	/	-	/	/	/	/	/	-	/	-	/
Emotion Recognition Technology & Computer Vision	/	-	/	-	-	-	/	/	/	/	/	-	-	/	-	-	/	/	-	-	/	-	-	-
Natural Language Processing (NLP)/ Speech	-	/	/	-	-	-	-	-	/	-	-	/	-	/	-	/	/	/	-	/	-	-	-	-
Social & Educational Robotics	/	-	-	/	/	-	-	/	-	-	-	-	-	/	-	-	-	-	/	-	/	-	/	/
Virtual Reality (VR) & Augmented Reality (AR)	-	/	/	-	-	-	-	/	/	-	-	-	-	/	-	-	-	-	/	-	-	-	-	-

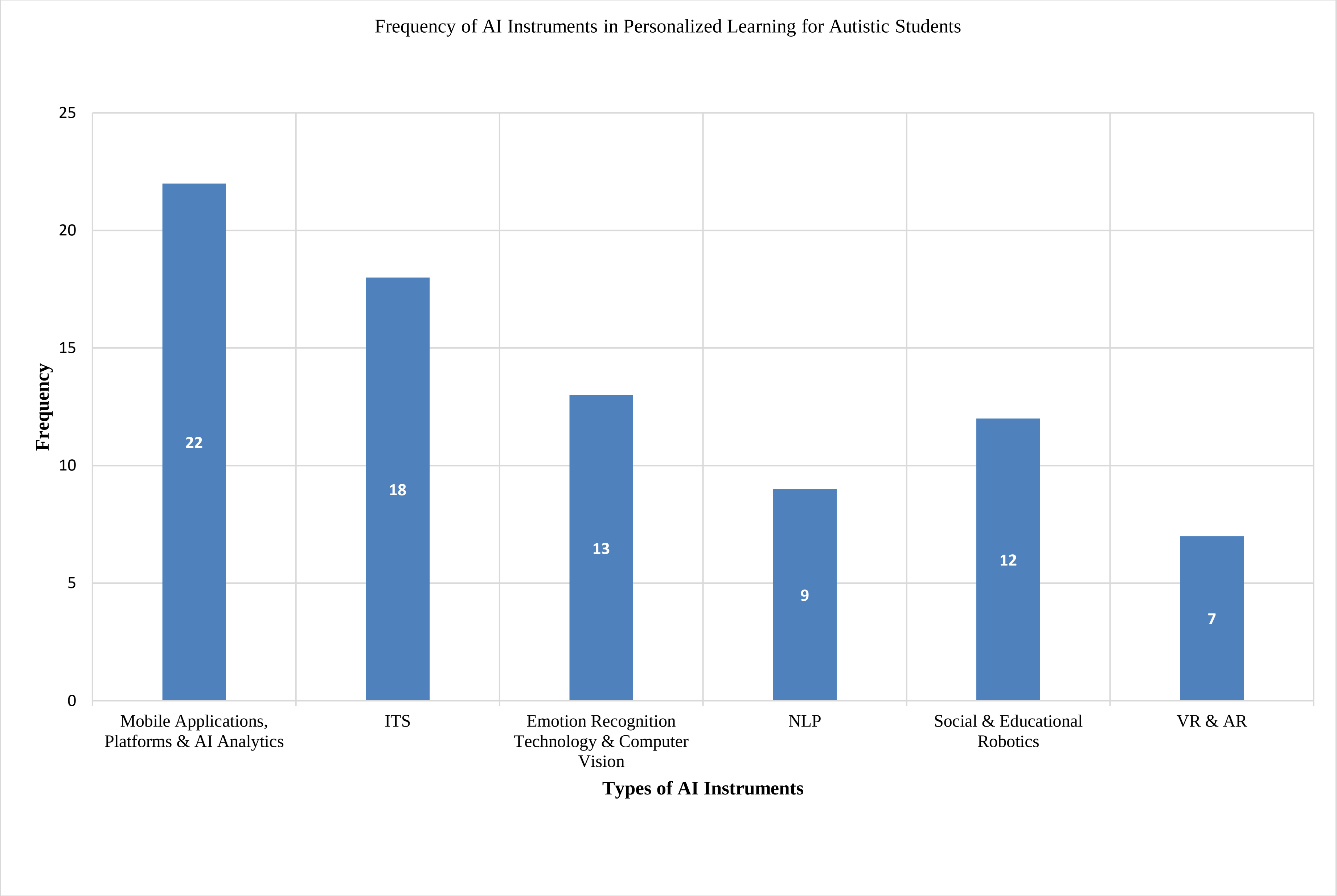

Figure 3 Frequency of AI instruments in personalized learning for autistic students.

Objective 2: The Impact of AI Technology on Social Communication, Emotion Management, Focus Retention, and Learning Engagement of Autistic Students

An analysis of the 24 selected articles indicates that the integration of artificial intelligence technology exerts a broadly positive impact across various developmental domains of autistic students. Overall, these impacts can be categorized into three primary domains: social communication, emotion management, and focus retention along with learning engagement.

The first domain demonstrating the most significant impact is the enhancement of communication and social interaction skills. Studies report that the use of intelligent tutoring systems, social robots, and adaptive learning tools boosts autistic students' confidence in interacting within safe and controlled environments (Atturu et al., 2025; Barua et al., 2022; La Fauci De Leo et al., 2025; Nasir et al., 2025; Rofidi et al., 2025; Yang et al., 2024). For instance, social robot-based interventions have been reported to significantly increase students' social responses, frequency of eye contact, joint attention, imitation skills, and social quotient scores after specific intervention periods (Kouroupa et al., 2022; Marino et al., 2020). This indicates that AI functions as a crucial early communication bridge before students master more complex human interactions.

The second domain focuses on the impact of AI on emotion management and the self-awareness of autistic students. Research shows that facial expression recognition systems and real-time emotional analytics enable students to identify, reflect upon, and match expressions with appropriate emotional states, thereby proactively supporting behavioral regulation (Adako et al., 2024; Haque et al., 2025; La Fauci De Leo et al., 2025; Li et al., 2024; Rofidi et al., 2025; Marino et al., 2020). These adaptive systems can detect emotional states or track student errors, enabling immediate interventions, such as adjusting task difficulty, providing personalized feedback, or utilizing responsive robot behaviors to support emotional understanding and mitigate distress (Clabaugh et al., 2019; Marino et al., 2020; Rofidi et al., 2025).

Subsequently, the third domain highlights the improvement of student focus retention and classroom engagement. Numerous studies demonstrate that the use of NAO social robots, adaptive learning applications, and data-driven platforms can capture students' interest, sustain attention to tasks, and maintain active engagement (Atturu et al., 2025; Clabaugh et al., 2019; Kouroupa et al., 2022; Marino et al., 2020; Rofidi et al., 2025; Yang et al., 2024). In this context, learning sessions that are automatically personalized according to the student's cognitive level and current performance are proven to enhance focus, sustained engagement, memory, and problem-solving capabilities by preventing cognitive overload (Anagnostopoulou et al., 2020; Atturu et al., 2025; Clabaugh et al., 2019; Wang, 2026).

In summary, the application of AI in personalized learning does not solely support academic aspects; rather, it facilitates the holistic development of autistic students across social and emotional domains. A summary of the impacts of AI technology usage, based on each analyzed journal article, is presented in Table 7.

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Table 7 Impact of AI technology usage on social communication, emotion management, focus retention, and engagement of autistic students

Impact on Students	**A1**	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**	**A11**	**A12**	**A13**	**A14**	**A15**	**A16**	**A17**	**A18**	**A19**	**A20**	**A21**	**A22**	**A23**	**A24**
Improvement in Communication & Social Interaction	/	/	/	/	/	/	/	/	/	-	/	/	-	/	/	/	-	/	/	/	/	/	/	/
Emotion Management & Awareness	-	-	/	-	-	-	/	/	/	-	/	-	-	-	/	-	-	/	/	-	/	-	-	-
Focus Retention & Engagement	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Improvement in Academic / Cognitive Skills	/	-	/	/	-	-	-	-	/	/	-	/	/	/	-	/	/	-	-	/	-	/	-	/
Reduction in Repetitive / Negative Behaviours	-	-	-	-	/	-	-	-	-	-	-	-	-	-	/	-	-	/	/	-	-	-	-	-

Objective 3: Implementation Challenges and Research Gaps in the Use of AI for Personalized Learning of Autistic Students

An analysis of the 24 selected articles indicates that although AI offers significant potential in personalizing the learning of autistic students, its field implementation remains constrained by technical challenges, human competency, and complex ethical issues. Furthermore, research gaps exist that compromise the reproducibility and generalizability of the findings.

Major challenges include teacher readiness and training, where educators frequently struggle with technical issues, system integration, and a lack of professional training to optimize AI usage in the classroom (Anwar et al., 2026; Daud et al., 2025; Devadas, 2025; Frolli et al., 2024; Gadzhimusieva et al., 2026; Wang, 2026). Technical constraints also persist, particularly regarding the accuracy of algorithms and computer vision models in recognizing atypical emotional expressions in real-time or identifying the optimal profiles of autistic students (Anagnostopoulou et al., 2020; Clabaugh et al., 2019; Kouroupa et al., 2022; La Fauci De Leo et al., 2025; Rofidi et al., 2025). Moreover, concerns regarding the risk of technology replacing human interaction and empathy have become critical issues that must be balanced to ensure teacher-student relationships are not compromised (Atturu et al., 2025; Devadas, 2025; Nair et al., 2025).

Additionally, ethical, privacy, and data security issues present significant constraints. Given that AI collects sensitive data—including the profiles, emotional expressions, and behaviors of autistic students—this elevates the risk of confidentiality breaches and algorithmic bias that could marginalize individual unique needs (Adako et al., 2024; Anagnostopoulou et al., 2020; Daud et al., 2025; Devadas, 2025; Li et al., 2024; Singh & Wadhwa, 2025). Furthermore, resource equity factors, such as hardware costs, maintenance, and the technological divide, limit the inclusive implementation of AI, particularly for students from lower socioeconomic backgrounds (Atturu et al., 2025; Clabaugh et al., 2019; Devadas, 2025; Singh & Wadhwa, 2025; Wang, 2026).

From a research perspective, prominent empirical gaps exist. The majority of studies remain conceptual, simulation-based, or reliant on teacher perceptions, rather than involving direct assessments of autistic students in actual inclusive classrooms (Adako et al., 2024; Anagnostopoulou et al., 2020; Frolli et al., 2024; La Fauci De Leo et al., 2025; Marino et al., 2020; Nair et al., 2025). A lack of longitudinal studies impairs the understanding of the long-term effectiveness, skill retention, and impact of AI interventions in real-world settings (Atturu et al., 2025; Gadzhimusieva et al., 2026; Kotsi et al., 2025; Kouroupa et al., 2022; Marino et al., 2020). Additionally, small sample sizes (Abu-Amara et al., 2024; Kouroupa et al., 2022; Marino et al., 2020; Yang et al., 2024), a broad focus that is still generalized to neurodevelopmental disorders (Barua et al., 2022; Pontillo & Oliva, 2025; Wang, 2026), and methodological inconsistencies complicate the establishment of standard guidelines that can be consistently applied and seamlessly integrated into educational learning management systems (Devadas, 2025; Kotsi et al., 2025; Kouroupa et al., 2022).

In conclusion, to ensure the sustainability and efficacy of AI in autism education, strategic focus must be directed toward improving AI literacy among teachers, establishing robust data protection, and conducting inclusive, long-term empirical research. This is essential to support the implementation of interventions that are effective, equitable, and capable of fulfilling the unique needs of autistic students. A summary of the implementation challenges and research gaps based on each analyzed journal article is presented in Table 8.

Table 8 Implementation challenges and research gaps in the use of AI for personalized learning of autistic students

Challenges and Gaps	**A1**	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**	**A11**	**A12**	**A13**	**A14**	**A15**	**A16**	**A17**	**A18**	**A19**	**A20**	**A21**	**A22**	**A23**	**A24**
Challenges																								
C1: Teacher Readiness, Training & Adaptation	-	-	-	-	-	-	-	-	/	-	-	-	-	-	-	-	/	/	/	/	-	-	-	-
C2: Ethical, Privacy & Data Security Issues	-	-	/	-	-	/	-	-	/	-	-	/	-	-	-	-	-	/	-	-	-	/	-	-
C3: Technical Constraints & Model Accuracy	/	-	-	-	-	/	/	-	-	/	/	-	-	-	/	-	-	-	-	-	-	/	-	-
C4: Access, Cost & Resource Equity	-	-	-	-	-	/	-	-	/	-	-	/	-	-	/	-	/	-	-	-	/	-	-	/
C5: Risk of Reduced Human Interaction	-	-	-	-	-	-	-	-	/	-	-	-	-	/	/	-	-	-	-	-	-	-	-	-
Gaps																								
G1: Lack of Empirical / Field Evidence	-	/	/	-	-	-	/	-	-	-	-	/	/	/	-	/	-	/	-	-	/	/	-	-
G2: Need for Longitudinal / Long-Term Studies	-	-	-	-	/	-	-	/	-	-	-	-	-	-	/	-	-	-	/	-	/	-	/	-
G3: Small Sample Size / Limited Testing	-	-	-	/	/	/	-	-	-	/	/	-	-	-	-	-	-	-	-	/	/	-	/	-
G4: Lack of Specific ASD Focus (General Population)	/	-	-	-	-	-	-	-	-	-	-	-	/	-	-	-	/	-	-	-	-	-	-	-
G5: Need for Standardization & Frameworks	-	-	-	-	-	-	-	/	/	-	-	-	-	-	-	-	-	-	-	-	-	-	/	-

DISCUSSION

AI Applications as an Adaptive Learning Ecosystem for Autistic Students

The SLR findings indicate that Artificial Intelligence (AI) applications in personalized learning for autistic students are no longer limited to the isolated use of technology; rather, they form an adaptive learning ecosystem. This ecosystem encompasses various instruments such as Intelligent Tutoring Systems (ITS), adaptive learning systems, social robots, emotion recognition, Computer Vision, mobile applications, natural language processing (NLP), virtual reality (VR), augmented reality (AR), learning analytics, and AI-based assistive technologies. The diversity of these instruments demonstrates that AI plays a role in supporting content adaptation, real-time feedback, student progress monitoring, and multimodal interactions that are highly responsive to individual learning profiles.

In this context, the personalization of learning for autistic students cannot be achieved solely through the use of a single technological tool. Instead, it requires a combination of systems capable of identifying student needs, adapting activities, supporting communication, monitoring engagement, and assisting teachers in making pedagogical decisions. This aligns with Barua et al. (2022), Frolli et al. (2024), Kotsi et al. (2025), Devadas (2025), Singh and Wadhwa (2025), Gadzhimusieva et al. (2026), Anagnostopoulou et al. (2020), and Anwar et al. (2026), who emphasize that AI has the potential to strengthen learning that is more flexible, adaptive, and responsive to the diversity of autistic students.

Nevertheless, AI as an adaptive learning ecosystem still needs to be critically evaluated. The diversity of AI instruments does not necessarily prove robust pedagogical effectiveness because the level of technological maturity and the strength of empirical evidence still vary across studies. Some studies have involved empirical interventions or field evaluations, such as Abu-Amara et al. (2024), Clabaugh et al. (2019), Yang et al. (2024), Atturu et al. (2025), Wang (2026), Marino et al. (2020), and Gadzhimusieva et al. (2026), whereas other studies remain conceptual, simulations, literature reviews, or early prototypes, such as Adako et al. (2024), Anagnostopoulou et al. (2020), La Fauci De Leo et al. (2025), Haque et al. (2025), Pontillo and Oliva (2025), and Nasir et al. (2025). Therefore, AI should be understood as a potential pedagogical support ecosystem, but its effectiveness remains dependent on the suitability of the design to the autistic student's profile, integration with the teacher's role, and empirical validation.

AI in Personalized Learning for Autistic Students: Potential, Impact, and Limitations

The SLR findings indicate that the most consistent AI impacts are reported in the areas of focus, motivation, and early engagement of autistic students. AI technologies that are interactive, visual, structured, and provide immediate feedback are seen as suitable for some learning characteristics of autistic students who require routine, visual stimuli, and clear responses. Abu-Amara et al. (2024) and Marino et al. (2020) reported that the use of the NAO robot alongside adaptive applications can increase student attention, joint attention, enjoyment, and responses during therapy sessions. Similarly, Yang et al. (2024) demonstrated that robot-assisted classroom activities increased focus and engagement, and reduced repetitive behaviors among ASD students. Furthermore, Clabaugh et al. (2019) found that a fully autonomous Socially Assistive Robot (SAR) successfully maintained an average of 65% active engagement throughout a month-long in-home intervention. These findings are also supported by Nasir et al. (2025), who showed that the AI mobile application Play Home has the potential to improve attention, object recognition, and student participation through interactive modules.

However, early engagement should not be directly equated with meaningful learning. Students' interest in technology may be influenced by the novelty effect, animations, voices, robot movements, or game design, rather than solely by skill mastery. Thus, the evaluation of AI effectiveness must go beyond immediate responses during activities and consider knowledge transfer, skill generalization, and the application of skills in real social contexts. Kotsi et al. (2025) and Kouroupa et al. (2022) assert that AI intervention studies for ASD students still require long-term efficacy evidence, generalizability assessments, and methodological standardization. Nair et al. (2025) also point out that although educators view AI as useful, concerns regarding screen dependency, reduced human interaction, and teacher training needs must be addressed.

Regarding social communication, AI provides a more controlled, repetitive, and less threatening training environment. Technologies such as social robots, VR, NLP, interactive applications, and adaptive learning systems allow autistic students to practice understanding instructions, providing responses, recognizing social cues, and building confidence in safer situations. Adako et al. (2024) highlight the potential of VR and NLP in social skills training, emotional regulation, and self-directed learning, while Haque et al. (2025) show that data-driven personalization and NLP have the potential to support learning pathways and communication skills of ASD students. Additionally, Kouroupa et al. (2022) confirmed through meta-analysis that social robots significantly improve social functioning, joint attention, and imitation. However, the main challenge still lies in transferring skills from digital environments to actual human interactions, which are more spontaneous, complex, and influenced by emotional and cultural contexts.

In terms of emotion management, emotion recognition technology and Computer Vision demonstrate potential in helping teachers identify emotional states, facial expressions, and student engagement levels. La Fauci De Leo et al. (2025) developed an AI framework based on emotion-aware technology to support the emotional awareness and socio-emotional skills of ASD children. Furthermore, Rofidi et al. (2025) developed AISTY, which uses a Convolutional Neural Network (CNN) and Explainable AI to detect student emotions and engagement to adapt learning content. Marino et al. (2020) also noted significant improvements in emotional comprehension and emotional lexicon using a robot acting as a co-therapist. Nevertheless, systems based on facial expressions still have limitations because the emotions of autistic students do not always align with typical facial expressions or algorithms trained on neurotypical populations. Therefore, AI should be used as a supportive indicator, not an absolute determinant of a student's emotional state.

Stronger empirical evidence can be seen in longitudinal studies such as Atturu et al. (2025), which conducted a 12-month observation on 43 ASD children using the CognitiveBotics platform, reporting improvements in social age, social quotient, developmental age, as well as receptive and expressive language skills. Similarly, Clabaugh et al. (2019) demonstrated significant cognitive improvements in mathematical reasoning through a long-term personalized robot intervention. However, observational designs and small sample sizes still limit cause-and-effect conclusions, as the findings may also be influenced by continuous therapy, caregiver training, platform usage compliance, and the natural development of the students.

Overall, the impact of AI on autistic students can be summarized as positive but conditional. The strengths of AI are most evident in improvements in focus, motivation, and early engagement, whereas evidence regarding social communication, emotional regulation, skill generalization, and long-term effectiveness still requires broader empirical validation.

AI Implementation Challenges: Teacher Readiness, Data Ethics, Algorithmic Bias, and Access Gaps

The study findings indicate that the challenges of implementing AI in autism education are not only focused on technical aspects but also involve pedagogical dimensions, ethics, and educational support structures. Although AI has the potential to increase the engagement and personalization of learning for autistic students, its effectiveness remains reliant on teacher readiness, institutional support, technological capabilities, and clear data governance. Li et al. (2024) and Anagnostopoulou et al. (2020) found that while educators and parents view AI as a technology with the potential to support autistic student learning, its implementation is still limited by technical issues, training needs, and data privacy concerns.

Teacher readiness is a primary challenge because AI does not operate neutrally or automatically within a classroom context. AI systems can suggest activities, adapt content, monitor progress, or provide feedback, but pedagogical decisions still require the professional judgment of teachers. Gadzhimusieva et al. (2026) showed that teacher acceptance of SpectrumSphere was influenced by perceived usefulness, ease of use, and computer efficacy. This finding indicates that AI effectiveness depends not only on system design but also on teacher confidence levels, professional training, and institutional support. This aligns with Nair et al. (2025), Devadas (2025), Singh and Wadhwa (2025), Marino et al. (2020), and Anwar et al. (2026), who emphasize the importance of teacher training, infrastructure, and adaptive pedagogical models—particularly emphasizing that systems often still rely heavily on a human therapist-in-the-loop approach—when implementing AI for inclusive education.

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Besides pedagogical aspects, ethical issues and data privacy are also critical challenges. This is because AI in autism education frequently involves sensitive data such as faces, voices, emotional expressions, behaviors, attention levels, and student developmental records. Studies by La Fauci De Leo et al. (2025), Rofidi et al. (2025), and Anagnostopoulou et al. (2020), for example, demonstrate the use of emotion recognition, Computer Vision technologies, and behavioral data assessments to support the learning of autistic students. However, the use of such data demands strict ethical controls because unrepresentative training data can produce algorithmic bias, inaccurate interpretations, and the risk of discrimination against students with varying communication profiles or emotional expressions. Therefore, AI implementation must be accompanied by informed consent, data protection, access control, system transparency, and clear ethical guidelines.

In the local context, the issue of algorithmic bias becomes even more significant because most AI systems are developed based on specific data, languages, and cultural norms. This is corroborated by Kouroupa et al. (2022), who highlighted a significant lack of research from diverse cultural backgrounds beyond the United States and Europe in current AI and robotics interventions. If these systems are used without local adaptation, AI analysis results may be less accurate for autistic students in Malaysia, who have different language backgrounds, cultures, communication styles, and emotional expressions. Thus, personalized learning through AI should not only be understood as an adaptation to the individual but also as an adaptation to the social and cultural context of the student. In this regard, local studies such as Nasir et al. (2025) show the importance of developing AI applications that are closer to the needs of autism education in Malaysia, although broader field validation is still required to ensure their effectiveness and usability in actual contexts.

Finally, the technology access gap is a significant challenge in ensuring AI truly functions as an inclusive educational tool. Schools with adequate devices, stable internet access, technical support, and trained teachers are more capable of implementing AI compared to under-resourced schools. Wang (2026), Anwar et al. (2026), and Atturu et al. (2025) indicate that resource equity issues, hardware costs, teacher readiness, and technology usage remain challenges in special and inclusive education. Therefore, without adequate policies, training, and infrastructure, AI risks widening educational inequality, particularly between high-tech schools and those facing resource limitations.

Research Gaps

The findings of this SLR indicate that although research related to AI in autism education is growing, the available research evidence is still insufficient to form robust conclusions about the effectiveness of AI in personalizing learning for autistic students.

The first gap can be observed in the strength of research designs. Some studies remain conceptual, simulations, prototype developments, initial usability evaluations, or perception studies, thereby limiting the generalizability of findings to actual classroom contexts. For example, Haque et al. (2025) used simulation data to evaluate the effectiveness of an AI platform, while Nasir et al. (2025) developed the Play Home application but still recommended real-world validation. Similarly, La Fauci De Leo et al. (2025) developed the EmoPal framework, which has the potential to support emotional awareness but still requires further testing regarding model accuracy and actual implementation. This indicates that a large portion of research is still in the early stages of technological development, rather than comprehensive pedagogical effectiveness evaluation.

The second gap is the lack of longitudinal studies and standardized methodologies. Although there are stronger studies such as Atturu et al. (2025), which evaluated the use of the CognitiveBotics platform over a 12-month period, the overall evidence in this field remains inconsistent regarding intervention duration, sample sizes, measurement instruments, and implementation contexts. Kotsi et al. (2025) and Kouroupa et al. (2022) clearly emphasize that AI research for ASD students still requires long-term evidence and methodological standardization to enable more systematic comparisons of findings across studies. Therefore, future research needs to evaluate not only immediate improvements in focus or engagement but also the consistency of AI's impact on social communication, emotional regulation, skill generalization, and the learning development of autistic students over a longer period.

The third gap relates to the limitations of study contexts and populations. Several studies reporting positive findings still involve therapy contexts, general special education, or special needs students more broadly, rather than exclusively autistic students. Wang (2026) and Anwar et al. (2026), for instance, evaluated AI-based personalized learning systems on special needs children and acknowledged that cultural contexts, technology costs, and teacher readiness could influence the usability of the findings. This situation highlights the need for more specific studies on autistic student subgroups based on support levels, communication profiles, sensory sensitivities, age, language, culture, and socioeconomic backgrounds. Without more detailed analysis, AI effectiveness risks being interpreted too generally and failing to reflect the true diversity of autistic students.

The fourth gap is the lack of research clearly linking AI functions with special education pedagogical theories. Many studies focus on the technology's capability to adapt content, monitor progress, recognize emotions, or provide feedback, but rarely explain how these functions align with autism intervention strategies and neurodiversity principles. Gadzhimusieva et al. (2026) assert that many technological interventions remain isolated, focused on specific skill domains, and poorly integrated with teacher workflows, longitudinal monitoring, and parent-teacher collaboration. Thus, future research must evaluate AI not merely as a technological tool but as part of a pedagogical ecosystem that supports teachers' professional decisions and the holistic development of students.

Finally, the voices of autistic students themselves are still underrepresented in existing studies. Most research evaluates AI effectiveness predominantly through system data, teacher, parent, or developer perceptions, whereas the experiences of autistic students regarding comfort, sensory stress, autonomy, motivation, and feelings of safety need to be prioritized. This gap is critical because technology that appears effective from a performance measurement standpoint may not necessarily be suitable from the perspective of the student's learning experience. Therefore, future research should integrate the perspectives of autistic students more directly to ensure AI development is truly inclusive, sensitive to neurodiversity, and aligned with their learning needs.

STUDY IMPLICATIONS

The findings of this study have significant implications for the use of AI in personalized learning for autistic students, particularly regarding pedagogical practices, as well as policy and the development of autism educational technology.

Implications for Special Education Pedagogical Practices

From a pedagogical standpoint, this study implies that AI is best implemented through a human-in-the-loop model, where teachers, therapists, and parents retain a central role in evaluating and adjusting the recommendations generated by AI systems. This model is crucial because AI should not function as a replacement for human interaction; rather, it should serve as a supportive tool that enhances professional judgment in planning interventions for autistic students. Atturu et al. (2025), for instance, showed that the CognitiveBotics AI platform yielded positive effects when used alongside continuous therapy, caregiver training, and home support. Similarly, studies involving social robots emphasize that active teacher supervision is still required to facilitate meaningful social exchanges (Marino et al., 2020). This indicates that AI effectiveness is more meaningful when the technology is integrated with human involvement, rather than used as a standalone intervention.

This implication also requires special education teachers to possess adequate AI literacy. AI systems can help teachers identify focus patterns, emotional responses, and student progress, but such data must be validated through teacher observation, student developmental records, and input from parents. Li et al. (2024) demonstrated that while AI is seen as having the potential to increase engagement and learning personalization, its implementation is still limited by technical issues, training needs, and data privacy concerns. Therefore, the pedagogical implications of this study emphasize not just the use of AI, but the necessity of building teachers' capacity to use AI critically, ethically, and contextually based on the students' actual needs.

Implications for Policy, Ethics, and Educational Technology Development

From the perspective of policy and technology development, the findings of this study imply that the implementation of AI in autism education must be supported by a clear, evidence-based implementation framework that is sensitive to actual educational contexts. Although studies like Atturu et al. (2025) show the potential of AI platforms as a support for autistic student interventions through a 12-month longitudinal evaluation, the overall evidence in this field is not yet sufficient to support widespread implementation without further validation. Kotsi et al. (2025) also assert that AI research for ASD students still has gaps regarding long-term efficacy and methodological standardization. Thus, educational policies should not adopt AI merely as a technological innovation; instead, they must mandate assessments of AI application suitability in real classroom contexts.

Furthermore, this study highlights the need for stricter data governance. The use of AI in autism education often involves sensitive data such as faces, voices, emotional expressions, behaviors, engagement levels, and student developmental profiles. Studies by La Fauci De Leo et al. (2025), Rofidi et al. (2025), and Anagnostopoulou et al. (2020), for example, illustrate the use of emotion recognition and Computer Vision to support emotional awareness and adaptive learning for autistic students. However, the use of such data requires serious ethical consideration because the accuracy of AI systems still relies heavily on data quality, sample diversity, and usage contexts. Consequently, risks such as algorithmic bias, emotional misinterpretation, privacy violations, and technological discrimination must be managed through informed consent, data security, system transparency, access controls, and developer accountability.

Overall, the implications of this study show that AI has the potential to strengthen personalized learning for autistic students, but this potential can only be realized when the technology is implemented ethically, is evidence-based, and is guided by human expertise. Therefore, AI policies and development in special education must emphasize a balance between technological innovation, student protection, equity of access to advanced resources (Marino et al., 2020), and inclusive pedagogical values.

RECOMMENDATIONS

Based on the findings of this study, future research is recommended to focus on two main areas: strengthening empirical evidence and developing a more ethical, human-centric AI implementation model.

Recommendations for Future Research

Future research should employ more robust research designs, particularly longitudinal studies, experiments, or quasi-experiments involving larger and more diverse samples of autistic students. This recommendation is vital because a portion of existing studies remains conceptual, small-scale, perception-based, or conducted over short durations. Although Atturu et al. (2025) demonstrated the positive effects of an AI platform through a 12-month study, Kotsi et al. (2025) stressed that evidence related to long-term effectiveness and AI methodological standardization for ASD students is still insufficient. Therefore, future studies need to evaluate not only the immediate effects of AI on focus and engagement but also its effects on social communication, emotional regulation, skill generalization, and learning development in actual inclusive classroom settings (Marino et al., 2020).

Additionally, future research needs to utilize more standardized and meaningful measurements. Assessing AI effectiveness should not rely solely on the increased interest of ASD students while using technology; it must encompass behavioral changes, social interactions, and skill continuity after the intervention ends. Studies should also examine factors such as student functioning levels, language, culture, teacher support, and socioeconomic backgrounds to determine which AI technologies are most appropriate for different subgroups of autistic students.

Recommendations for AI Development and Implementation

Regarding development and implementation, future research should evaluate AI through a human-in-the-loop model, where teachers, therapists, and parents remain involved in interpreting data and adjusting the interventions proposed by AI systems. Li et al. (2024) indicated that AI implementation is still influenced by user training, technical issues, and data privacy concerns. Therefore, future studies should not only evaluate the application's effectiveness on students but also examine how teachers and parents use AI data to make more accurate and ethical pedagogical decisions.

Furthermore, AI development needs to shift from standalone applications toward more integrated learning ecosystems. Gadzhimusieva et al. (2026) pointed out that technological interventions for autistic students still face issues of fragmentation, limited longitudinal monitoring, and weak connections to teachers' daily practices or existing Learning Management Systems (LMS). Accordingly, future research should explore AI systems that combine progress monitoring, parent-teacher communication, learning analytics, and real-time content adaptation. Simultaneously, ethical aspects such as informed consent, data security, algorithmic bias, system transparency, and access equity (Marino et al., 2020) must be established as core components in research designs, rather than merely discussed as secondary issues.

In addition, future research must also be expanded within the local context, specifically in Malaysia, to ensure that the effectiveness of AI in autism education can be evaluated based on the realities of local language, culture, infrastructure, and student learning profiles. Local studies are crucial to reduce the risk of algorithmic bias that may occur when AI systems are trained using data that does not represent the diversity of autistic students in terms of emotional expressions, communication styles, language backgrounds, and cultural norms. Consequently, AI development must involve diverse local data as well as the participation of teachers, parents, therapists, and autistic students in the design and evaluation processes. This approach will not only improve system accuracy but also ensure that the developed AI technologies are more inclusive, culturally sensitive, and suitable for the special education context in Malaysia.

Overall, these research recommendations assert that AI research in autism education must transition from merely proving technological potential to conducting more critical evaluations of effectiveness, safety, contextual appropriateness, and sustainability within special education.

CONCLUSION

The education of autistic students requires a flexible and personalized teaching approach due to the diverse needs of each student, particularly concerning social communication, emotion management, and focus retention. Within a classroom context, teachers frequently face challenges in adapting instruction individually due to time constraints, curriculum demands, and complex classroom management. Consequently, this systematic literature review was conducted to evaluate the potential of AI as a supportive instrument in personalizing the learning of autistic students.

Based on a comprehensive analysis of 24 articles meeting the study criteria, it was found that AI technologies—such as social robots, Intelligent Tutoring Systems (ITS), and emotion recognition applications—have delivered positive impacts on the learning of autistic students. These technologies not only enhance focus and engagement but also support emotion management and students' confidence in providing communicative responses. The distinct advantage of AI lies in its adaptive nature, wherein systems can evaluate a student's progress and emotional state in real-time, adjusting the pace and content of instruction according to individual needs.

However, this study also emphasizes that the implementation of AI in special education faces significant technical, ethical, and pedagogical challenges. Teachers still require professional training and institutional support to operate systems effectively, while data privacy issues, algorithmic bias risks, and the imperative to maintain human-centric interaction remain critical concerns. Furthermore, longitudinal empirical evidence from actual inclusive classrooms remains limited, necessitating further research to assess long-term effectiveness, skill generalization, and holistic student development.

Therefore, robust intervention strategies and synergy among various stakeholders are urgently required. The implications for special education practices suggest that AI should be understood as a pedagogical support tool—a "human-in-the-loop" collaborator—rather than a teacher replacement, that strengthens human intervention in autism education. Integration among teachers, technology developers, and policymakers is necessary to build an educational ecosystem that is safe, ethical, inclusive, and resilient. Through the strategic combination of AI innovation and educator expertise, educational gaps can be minimized, student learning experiences personalized, and neurodiversity principles respected, ultimately making special education more meaningful, equitable, and inclusive in the future.

REFERENCES

1. Abu-Amara, F., Mohammad, H., & Bensefia, A. (2024). Robot-based therapy for improving academic skills of children with autism. *International Journal of Information Technology (Singapore)*, 16(6), 3371–3380. https://doi.org/10.1007/s41870-024-01883-1
2. Adako, O. P., Adeusi, O. C., & Alaba, P. A. (2024). Revolutionizing autism education: Harnessing AI for tailored skill development in social, emotional, and independent learning domains. *Journal of Computational and Cognitive Engineering*, 3(4), 348–359. https://doi.org/10.47852/bonviewJCCE42023414
3. Anagnostopoulou, P., Alexandropoulou, V., Lorentzou, G., Lykothanasi, A., Ntaountaki, P., & Drigas, A. (2020). Artificial Intelligence in Autism Assessment. *International Journal of Emerging Technologies in Learning*, 15(06). https://online-journals.org/index.php/i-jet/article/view/11231/6727
4. Anwar, M., Karsidi, R., Sunardi, & Widyastono, H. (2026). The effects of universal design for learning and AI-AT on the engagement and academic outcomes of students with disabilities. *International Journal of Learning, Teaching and Educational Research*, 25(3), 557–581. https://doi.org/10.26803/ijlter.25.3.24
5. Atturu, H., Naraganti, S., & Rao, B. R. (2025). Effectiveness of artificial intelligence-based platform in administering therapies for children with autism spectrum disorder: 12-month observational study. *JMIR Neurotechnology*, 4, Article e70589. https://doi.org/10.2196/70589
6. Barua, P. D., Vicnesh, J., Gururajan, R., Oh, S. L., Palmer, E., Azizan, M. M., Kadri, N. A., & Acharya, U. R. (2022). Artificial intelligence enabled personalised assistive tools to enhance education of children with neurodevelopmental disorders: A review. *International Journal of Environmental Research and Public Health*, 19(3), 1192. https://doi.org/10.3390/ijerph19031192
7. Clabaugh, C., et al. (2019). Long-Term Personalization of an In-Home Socially Assistive Robot for Children With Autism Spectrum Disorders. *Frontiers in Robotics and AI*. https://www.frontiersin.org/journals/robotics-and-ai/articles/10.3389/frobt.2019.00110/full
8. Clarke, V., & Braun, V. (2013). Teaching thematic analysis: Overcoming challenges and developing strategies for effective learning. *The Psychologist*, 26(2), 77–101.
9. Daud, N., Ghazali, J. M., & Ahmad, S. N. (2025). A review of AI-driven approaches in autism education. *Malaysian Journal of Information and Communication Technology*, 10(2), 167–186. https://doi.org/10.53840/myjict10-2-232
10. Devadas, R. S. (2025). AI augmented education for children with special needs: A scholarly perspective. *World Journal of Advanced Engineering Technology and Sciences*, 15(3), 2000–2008. https://doi.org/10.30574/wjaets.2025.15.3.1125
11. Frolli, A., Cavallaro, A., La Penna, I., Sica, S. L., & Bloisi, D. (2024). Artificial intelligence and autism spectrum disorders: A new perspective on learning. *Proceedings of the Digital Innovations for Learning and Neurodevelopmental Disorders*.
12. Gadzhimusieva, D., Meliá, S., Lledó, G. L., & Nasabeh, S. S. (2026). Development and pilot evaluation of an AI-driven learning management system for personalized education for autistic students. *Education and Information Technologies*. https://doi.org/10.1007/s10639-025-13888-9
13. Haque, S., Islam, M. S., Islam, M. I., Islam, M. S., Khan, R., Tarafder, M. T. R., & Mohammad, N. (2025). Enhancing adaptive learning, communication, and therapeutic accessibility through the integration of artificial intelligence and data-driven personalization in digital health platforms for students with autism spectrum disorder. *Journal of Posthumanism*, 5(8), 737–756. https://doi.org/10.63332/joph.v5i8.3255
14. Kotsi, S., Handrinou, S., Iatraki, G., & Soulis, S. G. (2025). A review of artificial intelligence interventions for students with autism spectrum disorder. *Disabilities*, 5(1), 7. https://doi.org/10.3390/disabilities5010007

15. Kouroupa, A., Laws, K. R., Irvine, K., Mengoni, S. E., Baird, A., & Sharma, S. (2022). The use of social robots with children and young people on the autism spectrum: A systematic review and meta-analysis. *PLOS ONE*, 17(6), e0269800. https://doi.org/10.1371/journal.pone.0269800
16. La Fauci De Leo, A., Bagheri Zadeh, P., Voderhobli, K., & Akbari, A. S. (2025). A new AI framework to support social-emotional skills and emotion awareness in children with autism spectrum disorder. *Computers*, 14(7), 292. https://doi.org/10.3390/computers14070292
17. Li, G., Zarei, M. A., Alibakhshi, G., & Labbaf, A. (2024). Teachers and educators' experiences and perceptions of artificial-powered interventions for autism groups. *BMC Psychology*, 12, 199. https://doi.org/10.1186/s40359-024-01664-2
18. Marino, F., et al. (2020). Outcomes of a Robot-Assisted Social-Emotional Understanding Intervention for Young Children with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders*. https://www.researchgate.net/publication/331634698_Outcomes_of_a_Robot-Assisted_Social-Emotional_Understanding_Intervention_for_Young_Children_with_Autism_Spectrum_Disorders
19. Nair, A. B., Madhuvanthi, M., & Sathyamurthi, K. (2025). Effectiveness of AI-based learning tools for autistic children: A study on special educators in Chennai. *GAP Bodhi Taru: A Global Journal of Humanities*, 8, 83–89.
20. Nasir, H. M., Brahin, N. M. A., Zainuddin, S., Isa, I. S. M., Azhar, M. A., Syazwani, N., & Jamal, N. (2025). AI-powered mobile application 'Play Home' for autism education. *International Journal of Research and Innovation in Social Science*, 9(IIIS), 6618–6626.
21. Pontillo, A. L., & Oliva, P. (2025). Artificial intelligence, universal design for learning, and adaptive learning for students with specific learning disorders: A possible synergy? *Giornale Italiano di Educazione alla Salute, Sport e Didattica Inclusiva*, 9(2). https://doi.org/10.32043/gsd.v9i2.1302
22. Rofidi, M. R. Z., Asmai, S. A., Fauadi, M. H. F. M., Masdzarif, N. D. I., & Jaya, A. S. M. (2025). AISTY: An explainable AI-driven vision-based adaptive learning system for children with autism spectrum disorder. *International Journal of Research and Innovation in Social Science*, 9(10), 4777–4783.
23. Singh, S., & Wadhwa, P. (2025). Artificial intelligence for implementing universal design for learning in inclusive education. *International Journal of Social Impact*, 10(4), 58–68. https://doi.org/10.25215/2455/1004706
24. Wang, J. (2026). The impact of artificial intelligence-based personalized learning systems on the cognitive ability enhancement of children with special needs. *International Journal of Cognitive Informatics and Natural Intelligence*, 20(1). https://doi.org/10.4018/IJCINI.397824
25. Yang, Q., Lu, H., Liang, D., Gong, S., & Feng, H. (2024). Surprising performances of students with autism in classroom with NAO robot. *arXiv*. http://arxiv.org/abs/2407.12014