AI for Inclusive Learning: A Review of Adaptive Technologies for Disabled Students

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Abstract: This paper explores the intersection of artificial intelligence (AI) and inclusive education, focusing on how AI technologies support learning for students with disabilities. AI-driven tools, such as intelligent tutoring systems, speech-to-text applications, and text-to-speech readers, offer personalized, adaptive, and accessible learning experiences. These tools enhance academic engagement and foster independence for students with cognitive, sensory, or physical disabilities. A systematic literature review of recent studies (2020–September 2025) was conducted, analyzing research from the fields of education, health, and technology to identify trends, benefits, and challenges. The review reveals growing interdisciplinary interest; key results indicate that while AI enhances student engagement and independence, significant challenges remain. The paper concludes that AI, when developed responsibly and used collaboratively, has the potential to transform inclusive education, but requires supportive policies, ethical frameworks, and equitable access. The findings emphasize the central role of teachers in guiding AI implementation and interpreting its outputs. It is concluded that AI has vast potential to transform inclusive education, but realizing this requires supportive policies, robust ethical frameworks, and equitable access, ensuring teachers remain central to the learning process.

Keywords: Adaptive Technology; Artificial Intelligence; Inclusive Learning; Students

Introduction

The rapid advancement of Artificial Intelligence (AI) has transformed educational practices, creating new pathways toward inclusive and personalized learning. AI technologies such as machine learning, natural language processing, and adaptive interfaces are increasingly being integrated into educational platforms to address the diverse needs of learners (Holmes et al., 2021). While substantial research has explored AI's pedagogical potential, limited attention has been given to how these technologies specifically empower students with disabilities (Al-Azawei & Badii, 2024). It is highlight that AI contributes significantly to pedagogical innovation by automating feedback, supporting data-driven instruction, and enabling personalized learning trajectories. This trend signals the growing relevance of AI as a catalyst for transforming learning environments toward greater inclusivity and adaptability (Arini etal, 2024). This review fills that critical gap by synthesizing current developments in AI-based adaptive tools designed to enhance accessibility, participation, and learning outcomes for disabled students. The resent study shows that AI-supported digital platforms enhance student engagement through adaptive content delivery and automated evaluation processes, and also the effectiveness of AI-powered chatbots in facilitating real time communication and providing instant academic assistance. These findings suggest that AI-driven solutions can potentially benefit disabled learners who require continuous, tailored support an essential feature that traditional classroom settings may struggle to provide. (pairunan, 2022 & Engreini 2025).

The novelty of this research lies in its cross disciplinary and integrative framework that unifies

fragmented research across education, computer science, and assistive technology. Prior reviews have typically examined either a single disability type or one class of technology (e.g., screen readers or tutoring systems). In contrast, this paper maps the entire landscape of AI-driven adaptive solutions across multiple educational levels, learning contexts, and disability categories. By comparing innovations from cognitive, sensory, and physical domains, it identifies common design principles, gaps in inclusivity, and ethical challenges that have not yet been systematically analyzed within a unified conceptual model (Zawacki-Richter et al., 2019; Lin et al., 2022).

This research is particularly important in light of the global agenda for inclusive education, as outlined in the United Nations Sustainable Development Goal 4, which emphasizes equitable access to quality education for all learners (United Nations, 2015). Despite the proliferation of AI tools, critical questions remain regarding their accessibility, fairness, and ethical implications (Williamson & Eynon, 2020). Moreover, without a comprehensive understanding of how adaptive AI technologies function in real-world educational settings, efforts to promote inclusive learning may inadvertently reinforce existing inequalities (Holmes et al., 2022).

AI's capacity to transform student engagement is further evident in some studies, which demonstrates that AI tools can boost motivation through interactive learning interfaces and adaptive feedback mechanisms. The studies also notes that AI integration in physics instruction promotes conceptual understanding by simplifying complex content using intelligent visualization. Collectively, these results underscore how AI can accommodate diverse learning styles, including those of students with cognitive, sensory, or physical disabilities, by offering flexible, multimodal modes of instruction (karim 2020 & Arini 2022). Providing an evidence based synthesis of adaptive AI technologies make this study contributes to a more equitable and human centered approach to educational innovation. It aims to inform educators, policymakers, and developers on how AI can be harnessed not only to enhance learning efficiency but also to advance social inclusion and empowerment for students with disabilities.

This work is also novel in temporal scope, as it reviews empirical studies published between 2020 and 2024, a period marked by rapid digital transformation in education. During these years, AI adoption accelerated due to the expansion of online and hybrid learning environments, leading to a surge in the development of adaptive and assistive tools for inclusive education (Holmes et al., 2022; Al-Azawei & Badii, 2024). However, despite this momentum, a comprehensive synthesis connecting these developments to practical inclusivity outcomes has not yet been conducted.

Inclusive learning has increasingly become a central concern in modern educational systems, particularly as classrooms grow more diverse in terms of students' cognitive, physical, and socio-emotional needs. Recent studies emphasize that technology-enhanced learning environments can significantly support equitable access to education, especially when digital tools are designed to adapt to learners' individual characteristics. Hadi et al. (2023) highlight that integrating technology within instructional design improves students' conceptual understanding, demonstrating how interactive digital platforms can bridge learning gaps for heterogeneous student groups. Their findings provide an essential foundation for examining how more advanced technologies such as Artificial Intelligence (AI) can further expand inclusive learning opportunities.

Candra et al. (2022) and Hasibuan et al. (2020) note that when learners receive immediate and individualized feedback, their motivation and conceptual mastery significantly improve. AI systems, particularly those employing intelligent tutoring mechanisms, are capable of providing such real-time, tailored feedback—making them promising tools for supporting students with disabilities, who often require differentiated instructional responses.

In addition, Afriani et al. (2022) and Sari et al. (2021) emphasize the value of problem-solving–oriented digital tools in promoting critical thinking and independent learning. These studies strengthen the argument that AI technologies—through features such as adaptive scaffolding and predictive analytics—can help overcome challenges faced by students who struggle with traditional instructional formats.

The importance of this research stems from the global commitment to inclusive education articulated in United Nations Sustainable Development Goal 4 (SDG 4), which emphasizes equitable access to quality education for all learners (United Nations, 2015). Although AI promises to democratize education, its deployment often mirrors existing social and structural inequalities particularly for students with disabilities in low-resource contexts (Holmes et al., 2022). Moreover, increasing dependence on data-driven systems raises ethical and fairness concerns, including algorithmic bias, lack of transparency, and risks to data privacy (Williamson & Eynon, 2020). Without intentional design and governance, AI could unintentionally reinforce exclusion rather than promote inclusion.

Another compelling reason for this study's relevance is the central role of teachers in mediating AI's use in inclusive classrooms. While AI can provide adaptive feedback, content personalization, and accessibility enhancements, educators remain indispensable in interpreting AI outputs and aligning them with individual learning goals. Yet, many teachers

still lack sufficient training to integrate AI tools effectively into diverse classroom environments (Holmes et al., 2021). Understanding how AI reshapes teachers' roles is therefore crucial for supporting professional development and ensuring that human centered pedagogy remains at the heart of inclusive innovation.

Furthermore, the persistent digital divide continues to hinder the equitable implementation of AI in inclusive education. Students with disabilities in under-resourced or rural regions often face barriers related to cost, infrastructure, and access to adaptive technologies. Examining the global patterns of AI accessibility provides valuable insights for policymakers seeking to promote equitable digital inclusion.

From a technological perspective, AI has advanced significantly in assistive design through tools such as speech-to-text, text-to-speech, emotion recognition, and adaptive learning systems. However, many of these technologies remain developed for limited user groups and have not been extensively tested in authentic classroom settings (Lin et al., 2022). By analyzing both well-established and emerging systems, this study highlights key research and implementation gaps that must be addressed to realize AI's inclusive potential.

Gunawan et al. (2019) and Pratama & Sukardi (2020) provide evidence that immersive and interactive learning environments, including virtual simulations, enhance students' spatial reasoning and scientific literacy. These findings resonate strongly with emerging AI applications that generate dynamic, personalized simulations for learners with sensory, cognitive, or motor impairments. In summary, this research contributes a comprehensive and cross-disciplinary synthesis of adaptive AI technologies for inclusive education. Its novelty lies in combining *multi-disability coverage*, *integrative analysis*, and *ethical-policy contextualization* a synthesis not yet achieved in the literature up to 2024. The study is important because it (1) addresses a pressing knowledge gap by mapping how AI-driven adaptive technologies support diverse learners, and (2) provides actionable insights for educators, policymakers, and developers on how AI can be responsibly harnessed to enhance accessibility, fairness, and empowerment for students with disabilities. By emphasizing inclusivity as both a technological and ethical imperative, this research underscores the potential of AI to reshape education toward greater equity and human centered learning.

AI has the potential to transform inclusive education by providing adaptive learning experiences and assistive technologies for students with disabilities. However, overcoming challenges such as accessibility, teacher training, and ethical considerations is crucial for maximizing AI's impact. Future research should focus on developing AI solutions that are cost-effective, ethically sound, and universally accessible, ensuring that technology continues to break barriers rather than create new ones.

Method

To ensure that the research process adhered to the highest standards of methodological rigor and transparency, this systematic literature review was conducted in accordance with the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, which provide a structured and widely accepted framework for reporting systematic reviews and meta-analyses (Page et al., 2021).

Implementing the PRISMA framework helps improve transparency and consistency in reporting, while also ensuring that every phase of the review process from locating relevant studies to selecting those for inclusion is conducted in a structured and unbiased manner, thereby strengthening the credibility and dependability of the results. This methodological approach is particularly critical when synthesizing complex interdisciplinary topics such as the application of Artificial Intelligence (AI) in inclusive education for students with disabilities, where a diverse range of studies with varying designs, populations, and technologies must be carefully assessed and compared. As the field of AI-assisted learning technologies evolves rapidly, a systematic approach grounded in PRISMA principles allows for a coherent mapping of current developments, technological impacts, and research gaps. Moreover, by following this framework, the review aims to provide educators, technologists, and policymakers with robust, evidence-based insights that are both academically sound and practically relevant. The following subsections outline the detailed procedures followed in the search strategy, eligibility screening, data extraction, and quality assessment phases of the review.

The initial phase involved a comprehensive and systematic search of academic literature through multiple well-regarded databases. The databases used in this stage included Scopus, Web of Science, ERIC (Education Resources Information Center), Elsevier ScienceDirect, and SpringerLink, all of which are known for hosting peer-reviewed and high-impact publications in the fields of education, technology, and science. To maintain the scholarly integrity of the review, non-peer-reviewed sources, such as blog posts, student theses, preprints, or editorial articles, were excluded from the final pool. Search strings were carefully constructed using Boolean operators and a combination of keywords related to "AI for inclusive learning", "adaptive technology disabled students", "AI in special education", "machine learning accessibility education", and "assistive technologies for disabilities in learning.

Following the automated excision of duplicate records and a rigorous primary screening phase wherein titles and abstracts were evaluated against pre-defined inclusion criteria to eliminate tangential, non-empirical, or out-of-scope studies the corpus was distilled to a focused subset of approximately 200 articles. These 200 candidates were subsequently retained for comprehensive full-text eligibility assessment to ensure they met the stringent quality standards required for this review

Table 1. Database and Research Query.

Database	Research Query
Scopus, Web of Science, ERIC (Education Resources Information Center), Elsevier ScienceDirect, IEEE Xplore, Google scholar.	("Artificial Intelligence" OR "AI") AND ("inclusive learning" OR "inclusive education") AND ("adaptive technology" OR "assistive technology") AND ("students with disabilities" OR "disabled learners" OR "special education")

Eligibility criteria

In the eligibility stage, the remaining articles were evaluated in-depth to determine their methodological rigor, empirical relevance, and substantive alignment with the objectives of the review. The full texts were examined to assess whether each study provided sufficient data, analysis, and discussion regarding the Adaptive Technologies for Disabled Students. Studies that merely referenced Adaptive technology for student without focusing on its implementation in inclusive learnings for disabled students contexts were excluded. Furthermore, studies were assessed for quality indicators such as the clarity of research questions, robustness of design (quantitative, qualitative, or mixed methods), sample size adequacy, and clarity of findings. This led to the exclusion of 27 articles, resulting in a refined set of works for final synthesis.

Table 2. Inclusion and exclusion criteria.

Criteria	Inclusion	Exclusion
Period	2020-2024	Published before 2020
Publication type	Original research, published in a peer-reviewed journal	Articles that are not peer-reviewed or original research
Focus of article	Assistive technology in inclusive learners for disabled student	Articles did not include assisted technology in field of inclusive learners.
Research method	Quantitative, qualitative, and mixed methods were included	Reviews of other articles

Study Selection Process

The process of identifying and selecting studies for this review is illustrated in Figure 1.
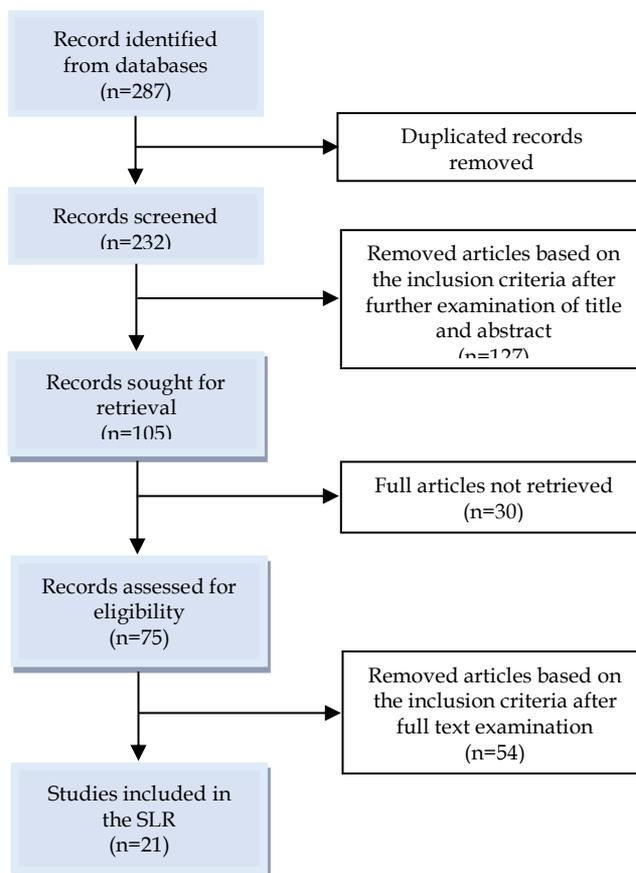

Figure 1. PRISMA flow diagram of the study selection process

Initially, 287 records were retrieved from academic databases. After excluding 55 duplicate entries, the dataset was reduced in size. After a first reading of titles and abstracts, duplicate articles were removed, resulting in the elimination of 127 items. This left 105 records, which were subjected to a manual screening to retrieval the full articles in result there are 30 articles not retrieved. Subsequently, 48 articles were removed based on the inclusion criteria after full text examination. These criteria focused specifically on identifying research that explored the application of artificial intelligence in facilitating inclusive and adaptive learning environments for students with disabilities. This rigorous approach ensured that only high-quality studies addressing the core themes of AI-driven personalization, accessibility enhancement, and assistive educational technologies were retained for full-text review and synthesis (Pagliara et al., 2024; Chalkiadakis et al., 2024).

Result and Discussion

A total of 21 studies, published between 2020 and 2024, were included in the final analysis. These studies explored a wide range of artificial intelligence applications in educational contexts tailored to learners with disabilities

Table 1. Data of 21 sttudies published between 2020 and 2024

Author and Year	Title	Advantages	Challenges	Recommendations	Date & Source
Agathi stathopoulou et all, 2024	The use of artificial intelligence in the education of students with learning disabilities	The study shows that AI can help students with learning disabilities by giving them tools and strategies that fit their needs.	The limited research on AI in education makes it difficult to develop effective tools and teaching methods for students with learning disabilities.	Explore different AI tools and methods that can be customized to fit student unique learning needs.	Global journal of engineering and technology advances
Gabriel julien et all, 2024	The Significance of artificial intelligence (AI) and inclusive education	Large Language Models (LLMs), can support fairer education. By providing multilingual support, adaptive materials, and instant feedback, these technologies help remove barriers to learning.	The integration of AI in teaching and learning are not detailed in the provided information, indicating a gap in the discussion of potential obstacles that educators may face when implementing AI technologies.	Investigating the long-term effects of AI integration in educational settings on student performance and motivation could provide valuable insights into the sustainability and effectiveness of AI as a support tool in teaching and learning.	Advances in educational marketing, administration, and leadership book series
Brotosaputro et all, 2024	AI-Powered assistive technologies for improved accessibility	1. The case studies presented in the research illustrate diverse applications, such as AI-driven speech recognition and emotion recognition systems, which provide substantial benefits to users.	1. The study acknowledges limitations such as a small sample size, which may affect the generalizability of the findings and the robustness of the conclusions drawn regarding the effectiveness of AI-powered assistive technologies. 2. Explore the long-term impacts and cost-effectiveness of AI-integrated solutions in enhancing accessibility for individuals with disabilities.	1. Future research should explore the long-term impacts of AI-powered assistive technologies on accessibility and investigating the cost-effectiveness of AI-integrated solutions compared to traditional assistive technologies is essential, as it will help determine the financial viability and potential for widespread adoption of these innovations in various settings.	International transactions on artificial intelligence
Chalkiadakis et all, 2024	Impact of artificial intelligence and virtual reality on educational inclusion a systematic review of technologies supporting students with disabilities	The integration of AI and VR is positioned as a strategy to foster genuinely inclusive learning environments, aligning with the goals of the convention on the rights of persons with disabilities (CRPD)	High cost of implementation, which can limit the ability of educational institutions to adopt AI and VR technologies for inclusive education and need for professional development support for educators to effectively integrate these technologies into their teaching practices.	Research should focus on addressing the significant challenges identified in the review, such as the high cost of implementation, technical barriers, and limited teacher readiness, to advocate for more equitable access to AI and VR tools in underserved educational settings.	Education sciences journal

Author and Year	Title	Advantages	Challenges	Recommendations	Date & Source
Alkan, 2024	The role of artificial intelligence in the education of students with special needs	AI supports teachers by helping them achieve learning goals more effectively and tools like expert systems also boost productivity in educational settings, making teaching and learning more efficient.	It emphasizes the importance of assessing the learning inclinations, strengths, and weaknesses of special needs students to ensure that the tailored learning content and resources provided by AI effectively.	Another area for future research may involve exploring the ethical considerations and potential challenges associated with the integration of AI in the education of special needs students.	International journal of technology in education and science
Pagliara et all, 2024	The integration of artificial intelligence in inclusive education: a scoping review	The scoping review addresses ethical considerations, ensuring responsible integration of AI in education, which is crucial for privacy, accessibility, and bias mitigation.	The review identifies gaps in existing research regarding the application of AI in supporting inclusive education, highlighting the need for further exploration and development of AI-driven practices	Ethical considerations surrounding the use of AI in education, such as privacy, accessibility, and bias, require further investigation to ensure responsible integration and to address potential challenges that may arise in diverse educational contexts.	Accessibility and inclusion in education: enabling digital technologies
Lin et all, 2024	An exploratory study on the efficacy and inclusivity of AI technologies in diverse learning environments	The study advocates for greater inclusivity and accessibility in education through the use of AI tools, while also emphasizing the need for strong ethical frameworks to ensure their responsible and fair implementation in learning environments.	There is a call for a shift in perception among educational stakeholders towards AI, emphasizing the need to de-stigmatize its use in education, which suggests that current attitudes may hinder the effective integration of AI technologies in learning environments.	Future research could explore the development of robust ethical frameworks to govern the use of AI in educational settings, ensuring that AI technologies are implemented in a manner that respects student privacy and promotes fairness among diverse student populations.	Sustainability (multidisciplinary digital publishing institute)
Tsouktakou et all, 2024	The use of artificial intelligence in the education of people with visual impairment	The article includes a case study of the "PeopleLens" system, which serves as an in-depth analysis of how AI can function as an assistive technology, demonstrating its potential benefits in the educational context for individuals with visual impairments.	challenge highlighted is equity, focusing on the disparities in access to AI technologies among different student populations, which can exacerbate existing inequalities in education and limit the benefits of AI for all learners.	Future research could focus on the development and enhancement of artificial intelligence applications specifically tailored for the unique educational needs of individuals with visual impairments, ensuring that these technologies are accessible and effective in various learning environments.	World journal of advanced engineering technology and sciences
Damyanov, 2024	Effective pedagogical strategies and	The paper concludes with practical	1. Many educators face difficulties in adapting their teaching methods	Future research could focus on the development and effectiveness of	International Journal of scientific

Author and Year	Title	Advantages	Challenges	Recommendations	Date & Source
	support mechanisms for enhancing the learning outcomes of students with special educational needs: a systematic approach	recommendations for educators and policymakers, aiming to foster inclusive, supportive, and effective educational environments for SEN students, ultimately striving to create a more equitable educational landscape where every student has the opportunity to thrive, regardless of their learning challenges.	due to limited training or insufficient resources 2. Schools often struggle with policy constraints and funding limitations, which restrict their ability to provide necessary support for special education needs students	professional development programs for educators, aimed at enhancing their skills in implementing differentiated instruction and individualized education plans (IEPs) for students with special educational needs (SEN).	research and management
Damyanov, 2024	Differentiation of educational content through artificial intelligence systems in inclusive education	A proposed framework is presented for the ethical and effective use of AI in inclusive educational settings, addressing both the benefits and challenges associated with current AI applications in education.	challenge highlighted is the necessity for educators to be adequately trained in utilizing AI tools to differentiate educational content, ensuring that they can effectively cater to the diverse needs of students while leveraging the potential benefits of AI in personalized learning.	Future research could focus on the development of more advanced AI applications that specifically address the unique learning needs of students in inclusive education settings, ensuring that these technologies are tailored to support diverse learning styles and challenges.	International journal of education
Iatraki et all, 2025	A review of artificial intelligence interventions for students with autism spectrum disorder	The study concludes that AI technology has significant potential in supporting students with Autism spectrum disorder (ASD) in their learning processes, highlighting its effectiveness in addressing academic, cognitive, and social challenges faced by these students.	Students with autism spectrum disorder (ASD) face significant challenges in social communication and interaction, as well as in managing stereotyped and repetitive behaviors, interests, and activities, which can hinder their academic and social development.	There is a need for standardization of methodologies in AI-based educational practices for students with ASD, which would help in creating consistent and reliable frameworks for evaluating the effectiveness of these interventions.	Disabilities journal
Rueda et all, 2025	Technological tools and inclusive pedagogy for students with disabilities in	The findings emphasize the role of Information and communication technologies in facilitating access to	challenge identified is the need for the elimination of digital and educational gaps, which requires the implementation of	Investigating the impact of various inclusive pedagogical methodologies and models on student retention and success	Revista de investigación educativa

Author and Year	Title	Advantages	Challenges	Recommendations	Date & Source
	higher education	education, potentially reducing dropout rates among students who struggle to adapt to digital resources.	appropriate technological tools and pedagogical components that support the teaching-learning process for students with disabilities.	rates among students with disabilities could provide insights into best practices for fostering an inclusive learning environment.	
Salazar et all, 2024	Artificial intelligence: a new reality to promote inclusion in higher education	The research explores the impact of these technologies on teacher training and access to digital resources, supporting the development of a more inclusive and equitable educational environment.	The paper identifies a challenge in the form of unequal access to technology and this disparity can limit the ability of students with special educational needs to fully benefit from the personalized learning opportunities.	Investigating the impact of teacher training programs on the effective use of AI in inclusive education could provide insights into how educators can leverage these technologies to enhance personalized learning experiences.	RGSA: Revista de gestão social e ambiental
Alvarado et all, 2023	Inclusive learning through immersive virtual reality and semantic embodied conversational agent: a case study in children with autism	A case study conducted on children with autism demonstrated that the system can serve as an effective assistive technology for teaching and learning in a more inclusive manner.	Teachers need to acquire the knowledge, skills, and support necessary to effectively implement inclusive practices, such as differentiated instruction and the use of assistive technology.	Investigating the scalability and adaptability of the immersive virtual reality system across different disabilities and educational settings could provide insights into its effectiveness.	Journal of computational science and technology
Toyokawa et all, 2023	Challenges and opportunities of AI in inclusive education: a case study of data-enhanced active reading in Japan	The study conducted a case study in Japan to explore how an AI-driven approach can support learners with diverse needs in inclusive education, focusing on the challenges and possibilities of implementing AI technology in the context of special needs education.	The research highlighted the challenges of obtaining consent from guardians for data collection, the lack of awareness about data-driven learning among some parents, and the importance of fostering data literacy and understanding among stakeholders for the successful implementation of AI-driven inclusive education practices.	There is a need to investigate the awareness and acceptance of data-driven learning among stakeholders, including parents and educators, to facilitate the integration of AI technologies in special needs education and to address concerns regarding data collection and its implications for learning support.	Smart learning environments
Karagianni et all, 2023	New technologies for inclusive learning for students with special educational needs	Teachers who create authentic, inclusive learning opportunities and adaptively integrate new technologies into their teaching greatly enhance the academic and life	1. The need for redesigning the educational process to align with the individualized needs of students 2. the role of teachers as facilitators and modulators of classroom settings	Future research could explore the effectiveness of specific tech tools and e-services in enhancing the accessibility and active participation of students with special educational needs in regular classroom	International journal of online engineering (ijoe)

Author and Year	Title	Advantages	Challenges	Recommendations	Date & Source
		skills of students with special educational needs.		settings, focusing on measurable outcomes.	
Standen et all, 2020	An evaluation of an adaptive learning system based on multimodal affect recognition for learners with intellectual disabilities	AI tools can improve social interaction and support learning by boosting student engagement and help teachers deliver personalized instruction.	1. Time-consuming to provide differentiated instructions for students. 2. Shortages of appropriate learning resources in schools.	1. Develop cloud-based AI tools for personalized education. 2. Address data safety and privacy concerns in AI applications.	British journal of educational technology
Salas-pilco et all, 2022	Artificial intelligence and new technologies in inclusive education for minority students: a systematic review	1. AI and new technologies encourage student interest in STEM/STEAM fields. 2. These technologies facilitate personalization of learning experiences and help identify at-risk students.	1. Technological challenges and dataset limitations. 2. Low satisfaction using technology and cultural differences.	1. Explore other minority groups in inclusive education. 2. Investigate teachers' practices and perspectives in inclusive education.	Sustainability (Multidisciplinary digital publishing institute)
El morr et all, 2024	Exploring the intersection of AI and inclusive design for people with disabilities	The paper highlights how artificial intelligence can be leveraged to create more accessible, personalized, and adaptive solutions that empower individuals with disabilities.	1. Limited research and lack of user involvement. 2. Potential data bias and reporting deficiencies.	1. User-centered design and inclusive participation 2. AI bias mitigation and diverse population considerations	Studies in health technology and informatics
Evans et all, 2024	Bridging the gap: diversity initiatives in AI education	1. The paper promotes the integration of AI knowledge across various subjects, fostering a comprehensive understanding of AI among students. 2. By bridging the digital divide, the paper aims to ensure equal access to technology and hands-on AI experiences for students from disadvantaged backgrounds, promoting digital	1. Limited opportunities for marginalized groups such as racial and ethnic minorities, women, individuals with disabilities, and those from economically disadvantaged backgrounds in AI education. 2. The digital gap, where students from underprivileged backgrounds face obstacles in accessing crucial technologies and resources necessary for AI education, widening the gap in AI literacy and opportunities.	1. Investigating the long-term impact of incorporating AI education into K-8 curricula on students' career choices and academic achievements. 2. Exploring the effectiveness of different teaching methodologies in promoting diversity and inclusivity in AI education, particularly for underrepresented groups such as racial and ethnic minorities, women, individuals with disabilities, and those from economically disadvantaged backgrounds.	Proceedings of the AAAI symposium series

Author and Year	Title	Advantages	Challenges	Recommendations	Date & Source
		literacy and competency.			
Bhakiyasri, 2024	AI enable personalized assistive tools to enhance education of disabled persons and its legal fallacies	The paper mentioned collaboration between educators, technologists, and policymakers is emphasized to ensure effective design and deployment, maximizing the benefits of these innovations.	The proprietary nature of data collection and usage practices of AI tools makes it difficult to fully assess how third parties manage and handle data, which can hinder transparency and accountability in the use of these technologies in education.	Future research should focus on the ethical implications of AI in education, particularly in reducing algorithmic bias and ensuring data privacy. This includes creating inclusive AI systems that are culturally and socially aware of the diverse needs of disabled individuals.	International journal for multidisciplinary research (IJFMR)

Study Characteristics

The review encompasses a diverse collection of recent research, primarily published between 2020 and 2025, indicating a rapidly evolving field. The included studies cover a wide range of educational contexts, extending from K-8 and special needs education to higher education settings. The literature addresses various specific disabilities, including Autism Spectrum Disorder, visual impairments, and learning disabilities, ensuring a broad perspective on inclusivity. The sources vary significantly, ranging from academic journals to conference proceedings and book series, which reflects a strong multidisciplinary interest in the role of artificial intelligence within inclusive education.
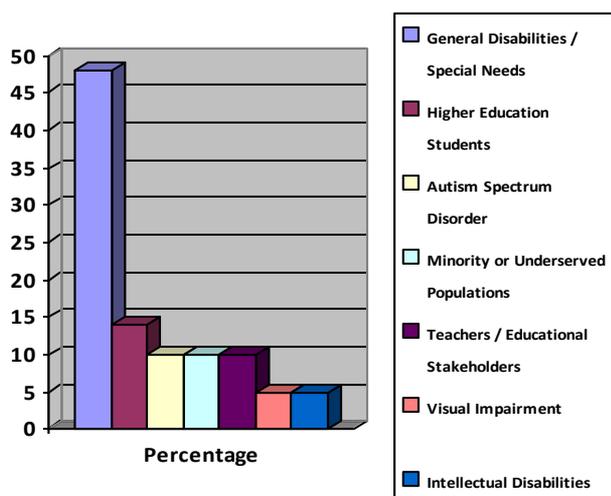

Figure 2. The distribution of the study characteristics.

Most of the reviewed studies appeared in journals related to health and technology, though a number were also published in education and engineering outlets. This distribution highlights the interdisciplinary nature of AI in inclusive learning, where technological development, pedagogical innovation, and student well-being intersect. The emphasis on health and technology suggests that many AI applications are being designed with a strong focus on assistive features such as speech-to-text tools, adaptive learning platforms, and intelligent tutoring systems aimed at reducing barriers for students with physical, sensory, or cognitive disabilities. At the same time, the inclusion of education-focused publications indicates that researchers are also considering pedagogical strategies and learning outcomes, emphasizing not just access but meaningful participation and progress in educational settings.

Emerging Themes and Challenges

Across the reviewed studies, several key themes emerged regarding the use of AI in inclusive learning environments for students with disabilities. One prominent theme is the emphasis on personalization and adaptability. Many AI-driven educational tools leverage machine learning algorithms to tailor content delivery, pacing, and feedback based on individual student profiles. This adaptability is especially critical for students with disabilities, who often require customized learning experiences that traditional methods cannot provide. AI tools such as intelligent tutoring systems, emotion-recognition software, and voice-controlled interfaces were commonly explored for their potential to support both academic learning and socio-emotional development.However, the studies also highlighted notable challenges that limit the broader adoption and effectiveness of AI in inclusive education.

A recurring issue highlighted is the lack of user centered design, where technologies are developed without meaningful input from students with disabilities, educators, or support professionals. This can result in tools that are technically sophisticated but misaligned with real classroom needs or accessibility standards. Furthermore, ethical concerns such as data privacy, algorithmic bias, and equitable access were flagged in several studies, underscoring the importance of responsible AI development. Another gap identified is the limited availability of large, diverse datasets

involving students with disabilities, which hampers the ability of AI systems to generalize across different types of learners and contexts. These findings suggest that while AI holds considerable promise for advancing inclusive learning, its successful integration depends on collaborative design processes, inclusive policy frameworks, and a commitment to addressing systemic inequities in both technology and education.
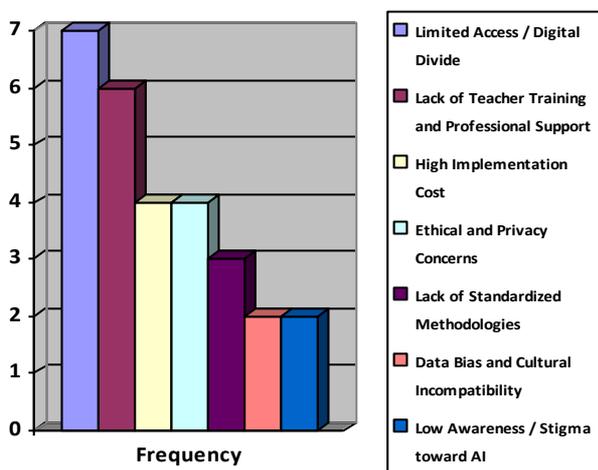

Figure 3. The distribution of key challenges identified.

Pedagogical Implications and the Role of Educators

The integration of AI into inclusive education not only transforms the learning experience for students with disabilities but also redefines the role of educators. The data emphasizes a fundamental shift in the educator's role from a sole provider of content to a facilitator and modulator of technology-enhanced environments. AI tools are viewed as supportive assets that boost productivity and help achieve learning goals, rather than replacements for human instruction. However, a critical implication identified in the review is the urgent need for professional development. Multiple studies indicate that educators often struggle due to limited training and insufficient resources. For AI to be effective as an assistive technology, teachers must explicitly acquire the knowledge and skills necessary to implement inclusive practices and differentiated instruction effectively.

Moreover, the adoption of AI technologies in classrooms introduces new professional development needs. Teachers must be equipped not only with digital literacy but also with an understanding of how to critically assess AI tools for accessibility, inclusiveness, and ethical use. The studies reviewed indicate that when educators are actively involved in the selection and implementation of AI tools, the outcomes for students with disabilities tend to be more positive. This includes aligning AI functionality with Individualized Education Plans (IEPs) and integrating it seamlessly with existing teaching strategies.

Overall, the successful deployment of AI in inclusive learning environments hinges on empowering educators with the knowledge, tools, and support systems needed to facilitate equitable learning experiences. This underscores the need for cross-disciplinary collaboration between AI developers, educators, disability specialists, and policy makers to ensure that AI serves as a meaningful aid in advancing inclusive education goals.

Policy Implications and Future Research Directions

The findings of this review suggest that while AI offers powerful tools to enhance inclusive learning for students with disabilities, its implementation must be guided by thoughtful policy and sustained research. One major policy implication is the need for national and institutional frameworks that prioritize accessibility and inclusivity in the procurement, development, and evaluation of educational AI technologies. Current policies often lag behind technological innovation, leading to fragmented adoption and inconsistent support across schools and regions. Clear guidelines are needed to ensure that AI tools used in classrooms meet accessibility standards, respect student data privacy, and are ethically aligned with inclusive education goals.

Additionally, investment in infrastructure and teacher training must be emphasized in policy initiatives. Without adequate support, even the most advanced AI solutions risk being underutilized or misapplied. Policies should also promote interdisciplinary collaboration between educators, technologists, disability advocates, and researchers to ensure that the development of AI for inclusive learning is informed by real-world needs and lived experiences.

From a research perspective, there is a critical need for longitudinal and large-scale studies that assess the long-term impact of AI interventions on learning outcomes, social inclusion, and psychological well-being of students with disabilities. Many of the reviewed studies are small-scale or exploratory, limiting generalization. Future research should also focus on underrepresented disability groups and low-resource educational settings to ensure that AI-driven inclusive education does not exacerbate existing inequalities.

Conclusion

This review synthesized empirical and theoretical studies published between 2020 and 2024 to evaluate how AI technologies support inclusive learning for students with disabilities. Overall, AI tools (e.g., intelligent tutoring systems, adaptive content delivery, speech-to-text, and emotion-aware systems) show clear potential to personalize instruction, increase accessibility, and support learner independence.

However, gains are contingent on intentional design, pedagogical alignment, and equitable implementation.

Based on the evidence, the paper draws four concise conclusions and actionable recommendations:

1. Design & Evaluation: AI must follow inclusive, user-centered design and pre-deployment accessibility audits (including representative testing across disability types). Developers should publish transparency reports on datasets and performance across user groups.
2. Teacher Capacity: Educators are pivotal for meaningful AI integration. Institutions should mandate AI literacy and pedagogical training modules—covering interpretation of AI outputs, accessibility features, and risk mitigation—as part of professional development.
3. Ethics & Governance: Policymakers and institutions must adopt clear, enforceable guidelines addressing data privacy, algorithmic fairness, consent, and accountability (e.g., routine bias testing and data minimization). Procurement should require demonstrable fairness and privacy safeguards.
4. Research Priorities: Future research must broaden participant diversity (including underrepresented disability groups and low-resource settings), employ longitudinal and large-scale studies, and evaluate real-world learning outcomes and equity impacts.

When AI is developed responsibly, evaluated rigorously, and embedded within supportive pedagogical and policy frameworks, it can be a powerful enabler of inclusive education. Conversely, without these safeguards, AI risks perpetuating existing inequalities so action must be immediate, specific, and collaborative. Moreover, this review identifies several gaps and concerns that warrant attention. Ethical considerations such as data security, algorithmic bias, and the risk of over-reliance on automated systems must be addressed through robust governance, inclusive policymaking, and transparent system design. Many existing studies are still limited in scale and scope, with a need for more diverse participant representation and longitudinal approaches to better understand the sustained impacts of AI interventions. Importantly, low-resource contexts and marginalized disability groups are still underrepresented in current research, risking a digital divide that could deepen existing inequalities.

Looking forward, the successful integration of AI in inclusive education will require a coordinated effort across stakeholders researchers, educators, technologists, disability advocates, and policymakers. Policies should incentivize inclusive AI innovation, provide clear guidelines for ethical implementation, and ensure equitable access to technological resources. Future research must continue to explore not only what AI can do, but also how and under what conditions it can be most effectively and ethically deployed to support all learners.

In sum, AI holds substantial promise as a catalyst for inclusive education. When designed with empathy, deployed responsibly, and supported by inclusive pedagogical practices and strong policy foundations, AI can help dismantle barriers to learning and contribute to a more just and accessible educational future for students with disabilities.

Author Contributions

Conceptualization, E.L.B and W.A.B; methodology, E.L.B., W.A.B., D.R.; formal analysis, E.L.B. and W.B.; investigation, E.L.B., W.A.B. and D.R.; resources, E.L.B., W.A.B. and D.R.; writing—preparation of original draft, E.L.B.; writing—reviewing and editing, W.A.B.; visualization, D.R; supervision, W.A.B.; All authors have read and approved the published version of the manuscript.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper. All authors have read and approved the final manuscript and agree with its submission.

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