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AI FOR ACCESSIBILITY IN EDUCATION: A SYSTEMATIC REVIEW OF EMPIRICAL RESEARCH ON EDUCATORS' ADOPTION FACTORS

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Abstract: *Artificial intelligence (AI) holds immense potential to enhance accessibility in education, especially for students with learning disabilities. AI-powered solutions can break down barriers and create more equitable learning environments by providing AI tools such as personalized learning experiences, real-time captioning, and assistive technologies. However, the successful integration of AI in education depends on educators' willingness to adopt these innovative technologies. This systematic literature review aims to synthesize the empirical research on the factors influencing educators' adoption of AI for accessibility in educational settings. A comprehensive search of databases was conducted between year 2018 to 2024 which involved Scopus, Science Direct, Emerald Insight, Web of Science, and IEEE Xplore. The findings showed that perceived usefulness and ease of use of AI tools, digital competence and attitudes of educators, and institutional support are the key factors. The review also uncovered barriers such as concerns over data privacy, algorithmic bias, and the need for teacher training. The results provide valuable insights for researchers, policymakers, and educational leaders seeking to harness the power of AI to create more accessible and inclusive learning experiences. Recommendations for future research and practical implications are discussed to guide the responsible integration of AI in support of Sustainable Development Goal 4 which is ensuring quality education for all.*

Keywords: *Accessibility, AI Adoption, Artificial Intelligence, Learning Disabilities, Systematic Literature Review*

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Introduction

Artificial intelligence (AI) has even brought a new age of change and innovation that provides users with all the tools and applications. AI is the ability of machines to adapt to new surroundings, solve problems, answer questions, and perform other functions that need a level of intelligence evidence in human beings (Chen et al., 2020). Likewise, the article of Rizvi et al. (2023), the author defines AI as a concept of self-improving automated computers generated to solve problems that were previously assigned to humans. According to Whitby B. (2003), AI is the study of intelligent behaviour in humans, animals, and machines with the aim of incorporating that behaviour into an artifact, like computers and computer-related technologies. It is credible to agree that AI is the combination of computers, computer-related technologies, machines, and information communication technology innovations and developments, enables computers to execute task that are similar to those of humans. In line with the adoption and use of new technologies in education, AI has also been an important use in the education sector.

Learning Disabilities (LD) is a category of special education that addresses learning challenges faced by person in their studies. Students with LD are usually unable to read, listen, speak and do calculations. However, different children with different LDs may have different difficulties. For instance, one child may struggle with spelling or fluency, while another child may struggle with mathematics. Some of them may have challenges with more than two skills which is reading, writing and calculation (Alqarni, 2018). According to the Department of Social Welfare of the government, learning disabilities are one of the qualifying categories of impairments for registering people who have disabilities in Malaysia. The registration enables those with disabilities to receive support and services provided by the government and government-linked agencies. From the article written by Dzalani and Shamsuddin (2014), it is about 38.7% of the registered persons with disabilities in Malaysia are those with learning disabilities. However, the accurate statistics of children with learning disabilities remain under-reported as there is still a lack of up-to-date prevalence data on children with learning disabilities (Abdullah et al., 2019.)

Previous research underscores the manifold advantages of AI in the education sector. AI can help students to enhance their critical and analytical abilities as by using ChatGPT, they can understand the text by posing personalised queries and offering comments on their responses. Another crucial aspect of ChatGPT is helping students explore languages, enabling them to modify sentences, practise correct pronunciation and terminologies, grasp sentence structure and give real-time interpretations (Gill et al., 2024). Furthermore, it also mentioned in SDG 4 which ensures inclusive and equitable quality education and promotes lifelong learning opportunities for all. By enhancing through AI-powered tools and solutions, educational institutions can ensure that all students include learning disabilities students have equal access to quality learning opportunities. AI can facilitate personalized and adaptive learning, break down language barriers, and provide assistive technologies for students (Halder & Saha, 2023)

This study embarks on a systematic literature review (SLR) elucidating the nexus between AI adoption and accessibility in education. Conducting the SLR with a focus on identifying factors influencing educators' adoption of AI for accessibility in education, the study seeks to illuminate the current state of research in this domain. The study is structured into five components: an introductory section, an elaboration on the methods employed, a presentation and critique of findings, an exploration of the topic's nuances, and culminating with conclusive insights and ideas.

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Literature Review

Disabilities in the educational context refer a wide range of physical, cognitive, emotional, and developmental impairments that can substantially obstruct a student's ability to learn effectively. These can vary from physical limitations, such as mobility issues, to cognitive challenges like learning disabilities (LD), which hinder a student's capacity to process and acquire information through conventional methods (Kussin et al., 2023). Learning disabilities are notably marked by difficulties in core areas like reading, writing, speaking, listening, and mathematical calculations. Students with these challenges often face issues in integrating information across multiple cognitive domains, which, if left unaddressed, can lead to significant academic struggles (Dzalani & Shamsuddin, 2014). The identification and classification of learning disabilities, however, differ widely across countries, creating obstacles in providing standardized and effective educational support (Othman et al., 2022). In Malaysia, for example, the broad classification of learning disabilities poses difficulties in delivering precise interventions for those who need them most (Dzalani & Shamsuddin, 2014). A nuanced understanding of these diverse impairments is critical to fostering inclusive educational strategies that meet the individual needs of each student.

Artificial Intelligence (AI) presents transformative possibilities in education, offering tools that could vastly improve learning outcomes for students with disabilities. However, integrating AI into educational environments faces several challenges. A key issue is the limited awareness among educators about AI's capabilities and potential benefits (Sivalingam, 2024). Many are reluctant to embrace these technologies due to concerns about their complexity and the perceived difficulties of incorporating them into existing systems. Moreover, significant concerns about data privacy and ethical issues, especially the potential for algorithmic bias, further complicate AI adoption, as these biases might exacerbate existing inequalities in education (Gill et al., 2024). Institutional barriers, such as insufficient technological infrastructure and lack of professional development opportunities for educators, particularly in developing nations, further impede the widespread implementation of AI (Othman et al., 2022). These obstacles slow the adoption of AI technologies, limiting the potential for innovative, tailored educational interventions for students with learning disabilities.

The successful adoption of AI in educational settings is heavily influenced by several key factors. First, the perceived usefulness of AI tools is paramount which educators are more inclined to adopt AI if they believe it will enhance their teaching and improve student outcomes (Chen et al., 2020). Equally important is the ease of use of these tools; technologies that are user-friendly and seamlessly integrate into daily teaching practices are more likely to gain widespread acceptance (Rizvi et al., 2023). Educators' digital competence and their overall attitude toward technology also play crucial roles, with those possessing higher levels of digital literacy being more open to adopting new technologies, including AI (Kussin et al., 2023). Institutional support, such as access to necessary resources, comprehensive training, and a conducive policy environment—is essential for facilitating AI adoption (Othman et al., 2022). Without such support, even the most innovative AI tools may struggle to gain traction. Lastly, concerns surrounding data privacy and algorithmic bias remain significant barriers, underscoring the need for clear ethical guidelines and standards to ensure the responsible deployment of AI in education (Gill et al., 2024).

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Research Methodology

Research Question

1. At what stage is empirical research on educators' adoption on artificial intelligence use right now?
2. What are the factors that influence educators' adoption of AI-based solutions for students with learning disabilities in Malaysia education sector?

Searching Techniques and Data Sources

Expanding upon the previous stage, this research deliberately uses Scopus as its main database to find reputable journals. Furthermore, articles sourced from four other reputable platforms, namely IEEE Xplore, Science Direct, Emerald Insight, and Web of Science (WoS), were meticulously curated to enrich the depth and breadth of this research. This collection of internet databases is considered relevant and extensive, providing a wide range of information sources, in accordance with the particularities of the study's context. This study covers the most recent and pertinent academic research in the subject from 2019 to 2024.
Throughout this time, as many pertinent studies in a given field were conducted as feasible

1. The keywords in Scopus are TITLE-ABS-KEY ("artificial intelligence" OR "AI" OR "e-learning") AND ("learning disabilit*" OR "special education*" OR "inclusive education*") AND ("educator*" OR "teacher*") AND ("adopt*" OR "accept*").

2. The searches used for the WOS are TS=("artificial intelligence" OR "AI") AND TS=("learning disabilities" OR "special education" OR "inclusive education") AND TS=("educators" OR "teachers") AND TS=("adoption" OR "factors").

3. IEEE is ("artificial intelligence*" OR "ai") AND ("accessibilit*" OR "inclusive education*" OR "learning disabilit*") AND ("educator*" OR "teacher*") AND ("adoption*" OR "acceptance*").

4. Emerald Insight is ("artificial intelligence" OR "AI" OR "e-learning") AND ("learning disabilities" OR "special education" OR "inclusive education" OR "learning disorder") AND ("educators" OR "teachers") AND ("adoption" OR "acceptance").

5. Meanwhile, the keywords that are set for Science Direct and ACM databases are '("artificial intelligence adoption" OR "AI adoption") AND ("accessibility" OR "inclusive education" OR "learning disability") AND ("educators" OR "teachers")'.

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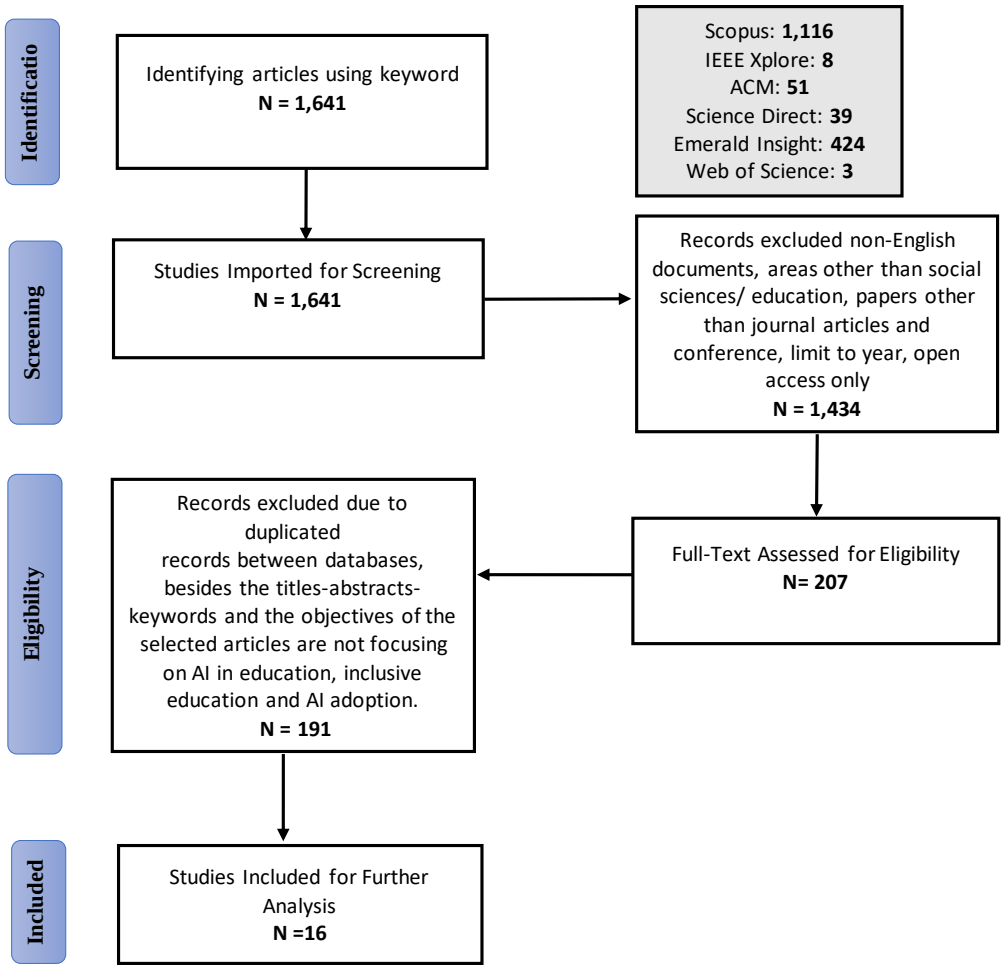

Figure 1: Processes of Selecting the Articles

Source: Adopted and Adapted from Yazid Albadarin (2023)

The development of inclusion and exclusion criteria

Leveraging the selected keywords resulted in an extensive array of journal articles during the preliminary search. The identification of a relevant article assumes paramount significance in discerning its appropriateness for subsequent in-depth analysis. Following the meticulous scrutiny of titles and abstracts, the process of article selection unfolded, meticulously applying predefined inclusion and exclusion criteria. The criteria guiding this study's selection process are meticulously delineated in Table 1.

Table 1: Criteria of Inclusion and Exclusion

Criteria	Articles that are included	Articles that are excluded
Published period	Articled published between 2019-2024	Articles published out of the period
Document type	Conference paper proceedings or journal articles only	Lecture's notes/modules, bibliographies, full thesis, conference foreword, magazine articles, etc.
Availability of document	Available as full-text	No full-text available
Language	English written	Non-English manuscript
Field of Study	Education	Studies focus other than education

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The processes of article selection

The dual stages of selection culminated in the identification of 1,641 papers. This outcome transpired first through the meticulous utilization of keywords/strings from each database and subsequently, during the second phase, predicated on the discernment of adequacy within abstracts, keywords, and titles (refer to Figure 1). Employing the Mendeley application and judiciously scrutinizing abstracts, keywords, and titles facilitated the refinement of this total after the expulsion of document duplicates. Subsequently, the remaining 191 papers underwent a discerning selection process based on stringent inclusion and exclusion criteria, following the elimination of redundant and extraneous contributions. The subsequent phase involves a comprehensive scrutiny of the full texts, yielding 16 final documents, a process conscientiously conducted with due regard for quality control. A comprehensive tabulation of all the papers, organized according to the database employed, is diligently presented in Table 2.

Table 2: Results for the Article Selection Processes

No.	Publisher	Initial	Relevant Articles
1	Scopus	1,116	3
2	IEEE Explore	8	2
3	ACM	51	1
4	Science Direct	39	7
5	Emerald Insight	424	3
6	Web of Science	3	0
	Total	**1,641**	**16**

The assessment of quality

To ensure the validity of the articles included in this study, certain quality assessment criteria were applied to confirm their value. Quality assessment of the candidate papers followed the guidelines outlined in the study by Kitchenham et al. (2007). Consequently, we formulated the following questions to evaluate quality.

Modifications made to the questions as described below in compliance with the requirements of this SLR:

QA 01: Are all of the study questions answered?
QA 02: Does the publication clearly state the objectives or topic of the research?
QA 03: Is the AI technique and methodology used in this study fully defined?
QA 04: Are the limitations of this study were adequately addressed.

Empirical Results and Analysis

Empirical research status

This section unfolds the responses to RQ 01, elucidating the inquiries delineated in the preceding sub-chapter. Herein, the elucidation encompasses the diverse research methodologies deployed in papers submitted for publication across journals, conference proceedings, and other scholarly forums, coupled with a detailed examination of the underlying theoretical paradigms.

Journal and conference publication

This analysis mapped the articles depending on when and where they were published using the 16 papers that were submitted. Around 50% of publications (N = 8) were published in 2023, according to Figure 2.

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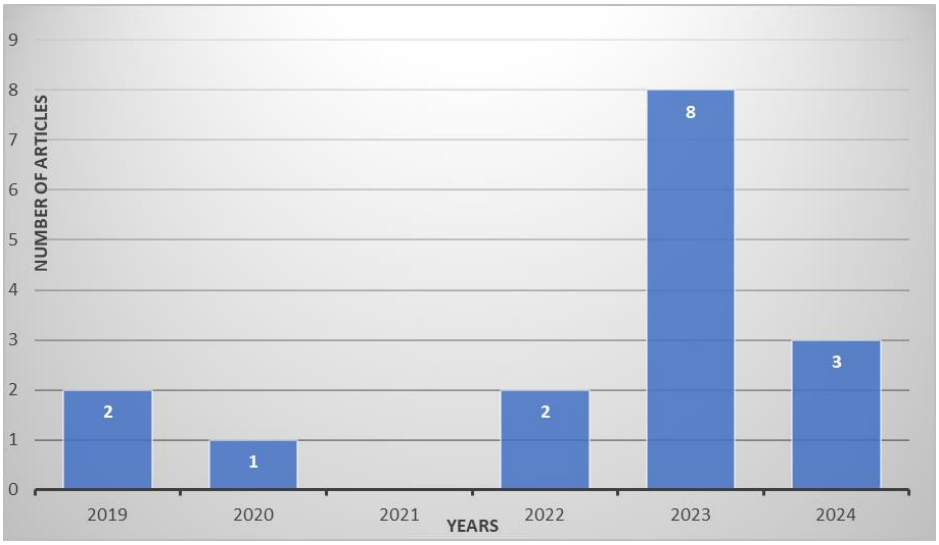

Figure 2: Total Articles Based on Published Period (2019-2024)

Moreover, there have been more publications other than published on year 2023. The publishers of the chosen journal or paper conference publications are listed in Table 3.

Table 3: The Name of the Journal or Conference Recapitulated

No.	Publisher	Journal Name	No. of Articles
1	Scopus	International Journal of Education and Development using Information and Communication Technology	1
		Australasian Journal of Educational Technology	2
2	ACM	Journal of Education and Information Technologies	1
3	Science Direct	Computers and Education: Artificial Intelligence	4
		Journal of Information Technology Education	1
		International Journal of Educational Technology in Higher Education	1
		Journal of Telematics and Informatics	1
4	Emerald Insight	Journal of Interactive Technology and Smart Education	2
		Journal of Research in Innovative Teaching & Learning	1
5	IEEE Xplore	International Conference on Artificial Intelligence and Data Sciences (AiDAS)	1
		Education and Information Technologies Journal	1
		Education Sciences Journal	

Methodology and context orientation

Within the framework of geographic and national classification, an analysis was conducted on the 16 selected articles, distinguishing between contributions from developed and developing nations. Remarkably, only two of the 16 scrutinized research endeavours originated from developed nations, specifically one study from the Germany and one study from Australia. The remaining corpus was drawn from various developing nations, including China (n = 2), Dubai (n = 1), Oman (n = 1), Saudi Arabia (n = 1), Malaysia (n = 1), South Africa (n = 1), India (n = 3), Turkey (n = 1), Sweden (n = 1), Ghana (n = 1), and United State (n = 1).

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This distribution underscores a notable focus on the dynamics within developing nations, which may reflect the growing recognition of the challenges and opportunities associated with the adoption of technology in education within these contexts. The emphasis on developing nations also highlights the critical role that technology can play in addressing educational disparities and improving learning outcomes for students with learning disabilities in these regions.

Methodologically, quantitative research emerged as the predominant approach, with 10 out of the 16 studies employing survey-based methodologies, predominantly through the use of questionnaires. This trend underscores a preference for empirical data collection and analysis in exploring the factors influencing technology adoption in education. In contrast, mixed-methods approaches were utilized in 4 out of 16 studies, offering a more comprehensive understanding by combining quantitative data with qualitative insights. Qualitative approaches alone were employed in 2 out of 16 studies, focusing on in-depth interviews and case studies to explore the nuanced experiences of educators and students with learning disabilities.

This methodological distribution reveals a prevailing preference for quantitative research techniques, which aligns with the broader trend in educational technology research. However, the inclusion of mixed-methods and qualitative studies adds depth to the analysis, enabling a more holistic understanding of the complex factors at play in the adoption and use of technology in educational settings.

Influenced factors

This section unveils the resolution to the second research question, as elucidated in Table 4, delineating the discerned factors. An argument about AI adoption in education can be grounded in several key factors that significantly shape educators' engagement and willingness to integrate AI tools in their teaching practices. Research suggests that perceived usefulness (PU) and ease of use (PEOU) are critical determinants, aligning with the Technology Acceptance Model (TAM). These factors influence educators' beliefs about whether AI will improve their teaching efficiency and whether the technology is straightforward enough to integrate seamlessly into daily activities. When AI is perceived as enhancing learning outcomes and requiring minimal effort to use, educators are more likely to adopt it (Ayanwale et al., 2022; Kelly et al., 2023) .

Furthermore, social influence and institutional support are pivotal in AI adoption. Educators often follow the lead of peers or administrators who advocate for technological innovation. A supportive community culture can increase motivation to use AI, while skepticism or resistance can hinder its adoption. Additionally, institutional factors such as the availability of training programs, technical support, and resources can significantly boost confidence in using AI tools in educational settings (Cukurova et al., 2023).

Conversely, some factors seem to have a limited effect on AI adoption. For instance, gender and workload do not consistently influence educators' willingness to adopt AI tools on a broader scale. Although these aspects may affect individual experiences, they do not significantly drive AI adoption compared to primary factors like PU, PEOU, and institutional support (Wu et al., 2022; Zhang et al., 2023).Similarly, ethical concerns regarding data privacy, while important, may not act as direct barriers when robust policies address these issues (Cukurova et al., 2023).

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Table 4: Influenced factors

No.	Factors	References
1	Performance Expectancy	Kelly et al., (2022),
2	Social Influence	Şahin et al., (2022), Tiwari et al., (2024)
3	Anxiety	Şahin et al., (2022), Hidayat-ur-Rehman & Ibrahim, (2023), Buabeng-Andoh, (2019), Siyam, (2019), Schoenfeld (2020)
4	School Structure	Starks & Reich, (2023)
5	Effort Expectations	Hidayat-ur-Rehman & Ibrahim, (2023)
6	Motivation	Hidayat-ur-Rehman & Ibrahim (2023), Tiwari et al., (2024)
7	Usage Behaviour	Siyam (2019), Ayanwale et al., (2022), Hidayat-ur-Rehman & Ibrahim (2023), Algerafi et al., (2023),
8	Educators' Beliefs	Siyam (2019), Starks & Reich, (2023), Şahin et al., (2022),
9	Technological Readiness	Shant Priya et al., (2023),
10	Teacher Training	Starks & Reich, (2023), Schoenfeld (2020),
11	Attitude towards AI	Kelly et al., (2022), Ayanwale et al., (2022), Buabeng-Andoh (2019),
12	Institutional Support	Siyam (2019), Starks & Reich, (2022), Şahin et al., (2022), Al-Mughairi & Bhaskar (2024), Buabeng-Andoh (2019), Schoenfeld (2020), Shant Priya et al., (2023),
13	Perceived benefits	Kelly et al., (2022), Şahin et al., (2022), Ayanwale et al., (2022), Hidayat-ur-Rehman & Ibrahim (2023), Zhang et al., (2023), Yao & Wang, (2024), Algerafi et al., (2023), Tiwari et al., (2024)
14	Support from Colleagues	Starks & Reich, (2022),
15	Technology Compatibility	Schoenfeld (2020), Şahin et al. (2022)
16	Experience	Buabeng-Andoh (2019)
17	Time-saving	Siyam (2019)
18	Professional Development	Siyam (2019)
19	Reliability and Accuracy Concerns	Al-Mughairi & Bhaskar (2024)
20	Reduced Human Interaction	Kelly et al., (2022), Al-Mughairi & Bhaskar (2024)
21	Privacy and Data Security	Al-Mughairi & Bhaskar,(2024)
22	Digital Literacy	Yao & Wang, (2024)
23	Limited Access to Resources	Starks & Reich, (2023), Şahin et al., (2022), McGrath et al., (2023), Siyam (2019), Nazri et al. (2023)
24	Confidence level	Starks & Reich, (2023), Kelly et al., (2022), Ayanwale et al., (2022), Buabeng-Andoh (2019), Siyam (2019)
25	Gender	Buabeng-Andoh (2019)
26	Workload	Buabeng-Andoh (2019)

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27	Adaptability	Nazri et al. (2023)
28	Career Readiness	Nazri et al. (2023), Algerafi et al., (2023)
29	Knowledge	Schoenfeld (2020), McGrath et al., (2023)
30	Self-Efficacy	Şahin et al. (2022), Yao & Wang, (2024), Algerafi et al., (2023)
31	Perceived Enjoyment	Şahin et al. (2022), Zhang et al., (2023), Algerafi et al., (2023)
32	Innovative Behaviour	Hidayat-ur-Rehman & Ibrahim, (2023)
33	Perceived students' engagement	Hidayat-ur-Rehman & Ibrahim, (2023)
34	Financial Consideration	Shant Priya et al., (2023)

Discussion

This study meticulously scrutinized 16 articles aligned with the objectives articulated in the preceding section, effectively addressing the two research questions posited earlier. This paper reviews synthesized findings from various empirical studies to identify key barriers and enablers to the integration of AI technologies in special education settings. The analysis highlighted several critical factors that shape the successful implementation of AI, including teachers' perceived usefulness of AI, access to adequate resources, and the availability of comprehensive training programs.

One of the most prominent findings across the reviewed studies was the significant role that teachers' perceptions play in the adoption of AI. Teachers who view AI as beneficial and effective in enhancing learning outcomes for students with learning disabilities are more likely to integrate these technologies into their classrooms. However, this positive perception is often contingent on their familiarity with and knowledge of AI tools. Studies have consistently shown that when teachers possess a higher level of understanding and training in AI, they are more likely to perceive its usefulness and, consequently, adopt it in their teaching practices.

Despite the potential benefits, several barriers to AI adoption were identified. A recurring theme in the literature was the lack of adequate training for educators. Many teachers reported feeling unprepared to use AI tools effectively due to insufficient training opportunities, which, in turn, hindered their confidence in implementing these technologies in the classroom. This finding aligns with previous research that emphasizes the necessity of targeted professional development to equip teachers with the skills needed to integrate AI into inclusive education settings. Additionally, limited access to AI resources and inadequate administrative support were frequently cited as significant obstacles. In some cases, teachers noted that even when AI tools were available, the lack of ongoing technical support and resource management prevented their effective use.

Conversely, factors that facilitate AI adoption were also identified. Supportive school policies, access to resources, and positive attitudes toward technology use among educators were key factors that promoted the successful integration of AI. Particularly, the presence of a robust support system—comprising both technical resources and administrative backing—was crucial in helping teachers overcome the initial barriers to AI adoption. Furthermore, studies highlighted the importance of collaboration among educators, where sharing experiences and strategies related to AI use contributed to a more supportive environment for technology integration.

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These findings are consistent with existing literature that underscores the importance of teacher training and resource availability in technology adoption. However, this study also revealed new insights specific to the context of inclusive education. For instance, the unique needs of students with learning disabilities necessitate a more tailored approach to AI integration, one that goes beyond general technology adoption strategies. This highlights a gap in current research, suggesting the need for more focused studies on AI's impact in special education contexts.

The implications of these findings are far-reaching. For educators and policymakers, there is a clear need to invest in comprehensive professional development programs that not only enhance teachers' technical skills but also address their attitudes towards AI. Additionally, ensuring equitable access to AI resources across schools, particularly in underfunded areas, is essential to prevent disparities in educational outcomes for students with learning disabilities. Policymakers should consider revising existing policies or introducing new ones that specifically support the adoption of AI in special education, with a focus on providing continuous support to educators.

Conclusion and Recommendations

This study delves into the strategic application of systematic literature review (SLR) to understand the educators' adoption of AI. The analysis is meticulously focused on identifying the key factors that influence the successful implementation of AI technologies in educational settings. Through a comprehensive review of relevant empirical studies, this investigation highlights the crucial role of teacher perceptions, resource accessibility, and professional development in facilitating AI adoption, while also identifying the significant barriers that persist in this domain.

Despite the valuable insights gained, certain gaps persist in this investigation. The study does not fully explore the complexities of the identified factors, indicating the need for more detailed examination. In particular, the roles of these factors as potential enablers or barriers to AI adoption are not classified or thoroughly analyzed. As a result, future research should focus on a more nuanced exploration of these elements, categorizing them as antecedents, mediators, or outcomes in the context of AI integration in inclusive education. Additionally, examining the impact of AI on student outcomes, especially from the students' perspectives, represents a promising direction for future studies, offering deeper insights into AI's effectiveness in meeting diverse learning needs.

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