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RESEARCH ARTICLE

The Impact of Artificial Intelligence on Personalized Learning in Education: A Systematic Review

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ARTICLE INFO	ABSTRACT
	The growing application of Artificial Intelligence (AI) in positive education is changing education at a breath-taking speed as it allows for more adaptive and personalised experiences for learners. This paper explores issues related to the application of AI technologies in particular areas, such as adaptive learning systems, intelligent tutoring systems (ITS), analytics IT, automated assessment systems and special education. In addition, it provides more insight into the ethical issues connected to using such technology – issues such as privacy, the autonomy of teachers, and accessibility, among others. According to the PRISMA 2020 Checklist, 46 publications between 2018-2024 have been analysed. The research focuses on learning outcomes based on using artificial intelligence and its ethical implications, whether positive or negative. AI-enabled personalised adaptive-learning systems deliver educational materials according to the specific requirements of a learner, in contrast to ITS systems, which enhance the level of interaction by offering personalised feedback on the spot, which is particularly useful in engaging students with technical subjects. Predictive analytics identifies students who should be intervened with in good time. At the same time, in addition to improving the quality of learning, automated grading systems boost learners' efficiency by giving students instant feedback. It also encourages diversity in learning by catering for different types of learners. Still, some concerns, including algorithmic discrimination and privacy, remain a big issue. The importance of AI in transforming the education system through improving the flexibility and effectiveness of personalised education cannot be understated. Nevertheless, the impending questions of fairness and bias, as well as data security, need to be dealt with in the interest of helping all learners without discrimination.

INTRODUCTION

Technology plays a major role by using innumerable digital tools. Those tools help teachers enhance their teaching practices, technical skills and learning (Shah et al., 2024). Artificial intelligence is a very modern technology, which imitates human cognition using machines. More popularly called artificial intelligence, the process primarily concerns reasoning, problem-solving, learning, and adjustment. This enabled its use in different sectors, and education was not left behind. In educational

technology, for example, AI plays a major role in introducing new aspects that affect the delivery methods, and how one can reach out to all students as individuals. Education technology has enhanced the mobilisation of its resources through AI, which has improved management efficiency. This has made using adaptive learning systems for tailored education in schools possible, improving student retention and learning (Anuyahong et al., 2023; Su & Yang, 2023).

Personalised learning refers to an approach in education where different students are instructed differently based on their characteristics, preferences and pace of learning. Traditional education forms have had difficulties accommodating this learning because of logistical issues. Astonishingly, Big Data has transformed the practice of personalised learning where, thanks to the enormous amounts of data created, analysis helps map students 'learning journeys' (Hashim et al., 2022; Sajja et al., 2023). The power of AI is applied within education in that teachers can follow the learning curve of each of the students and are therefore able to provide appropriate and timely remarks that enhance the teaching/learning process (Nick, 2019). On top of that, employing AI within the scope of education facilitates recognizing students' learning abilities and difficulties in all the learning activities, which helps understand what level of learning and what area specifically needs input to enhance the learning process. Such AI-enhanced systems include intelligent tutoring systems (ITS), adaptive learning technologies, as well as learning analytics that aim to facilitate education for every student (Baidoo-Anu & Ansah, 2023). However, some issues remain unaddressed such as: privacy issues including the security of learner-related information; and implications of bias-advocating decision making in this field of education (Ray & Ray, 2024). Other issues that are apparent even in terms of education and its tools is Intelligent Tutoring Systems. Just like human tutors, these ITS systems are designed to help the end users with feedback and support. These systems use the AI algorithms technology to monitor how a student answers questions and in turn assess the level of comprehension and available avenues of enhancing it for better learning results. In other words, this acquisition of knowledge through technologies is most effective in areas such as Mathematics and Sciences where people tend to seek assistance (Holmes et al., 2019). However, the merits that come with the application of these advanced technologies raise data quality and morality concerns when naivety is employed in developing such systems (Biswas et al., 2016).

This research intends to explore the influence of artificial intelligence on educators' perception of personalized learning. By means of this systematic review the report will establish the place of adaptive learning devices, ITSs, predictive analytics, and automated assessment in the formation of personalized learning environment based on artificial intelligence. The study will also seek targeted whether application of artificial intelligence has the potential of enhancing attainment levels and outcomes in the education system contrary to some lazy opinions even though some of the concerns in its use will be resolved.

RQ 1: How the decision-making system in adaptive learning systems incorporating AI can be improved compared to the existing systems in the olden days?

RQ 2: How do they help increase the student motivation and performance in the given subjects in question, especially if these are complex ones?

This review examines the predictive analytics of AI that aids in evaluating students' achievements and providing early measures, while time consuming activities such as grading are performed by machines that also give personalized responses. Also, the use of AI in special education focuses on learners in need of assistance, however this is also accompanied with issues such as ethical issues like respect to people's data, limitation to teachers, and inequality to access resources (Capuano & Caballé, 2020). These points indicate the changes AI has brought in most of the aspects of personal segregation, including the advantages and disadvantages which cannot be avoided for the tomorrow of learning within the four walls.

MATERIALS AND METHODS

This systematic review adheres to the PRISMA statement expanded in 2020 for Reporting Systematic Reviews and Meta-analyses. This approach is systematic in nature which assures that the identification process is easy to follow and can be performed several times in a comprehensive manner in search of literature on the influence of artificial intelligence in personalizing learning in an educational environment. The following are the four steps of the PRISMA criteria that are strictly followed.

Step 1 Identification: This phase is very important for carefully identifying the relevant studies for review. The authors of this research used many databases to search for the required studies. The identification part includes carefully selecting keywords and following accurate search techniques. The following part is the organisation of those studies.

Step 2 Screening: The second step is carefully screening all the studies that have been finally selected for the review. The authors scrutinised each title and abstract of the search strategy identified for appropriateness. The authors of this research evaluated all titles and abstracts to determine their eligibility status.

Step 3 Eligibility Criteria: The third step pertains to eligibility criteria, in which the authors of this research established preset inclusion and exclusion criteria which are relevant in the review scope and seek to ensure specificity in educational AI applications. The studies which did not comply with the criteria were unable to overcome the eligibility grounds. The last selection of studies will abide by eligibility criteria pertaining to study's objectives, language and peer-reviewed status, in keeping with the methodology of Brony et al. (2024).

Step 4 Inclusion Criteria: The fourth step is "Inclusion." In this final stage, studies that pass the eligibility criteria are included. At this stage, the data for the finalised studies and discussions are made. The flow diagram shows these four steps graphically.

Databases: An extensive search was undertaken to identify relevant research literature about the topic of interest (Dharejo et al., 2023). These databases have been chosen because they encompass a wide spectrum of educational and technological research:

Scopus: A multi-disciplinary database containing broader information on educational and technology research in general and social sciences.

PubMed: This is primarily life sciences oriented but includes references to healthcare-related material like Artificial intelligence involvement within medical education.

ERIC (Education Resources Information Center): The database captures educational-based studies while being specific, among other things, about AI applications for learning environments.

IEEE Xplore: IEEE Xplore is a major aggregator of technological research, so papers on AI algorithms and systems and their use in education can be found there.

Google Scholar: It is an alternative search engine that caters to all disciplines, allowing one to access various study findings without having to visit different sites separately

Search Strategy: In the search strategy, the authors employed a combination of keywords and Boolean operators to ensure comprehensive coverage of relevant literature. The following approach was used:

Keywords: Terms that reflect core concepts related to AI and personalised learning will be employed, including "Artificial Intelligence in personalised learning," "intelligent tutoring systems," "AI in adaptive learning," "automated feedback in education," "AI in education," and "machine learning in education."

Boolean Operators: Boolean operators (AND, OR, NOT) will be used to refine and expand search results. For example:

 - AND: "AI AND personalised learning" will ensure the results focus on studies that discuss both elements.

 - OR: "AI in adaptive learning OR intelligent tutoring systems" will expand the scope to include different types of AI systems used in education.

 - NOT: "AI NOT non-educational applications" will exclude studies irrelevant to the educational focus of this review.
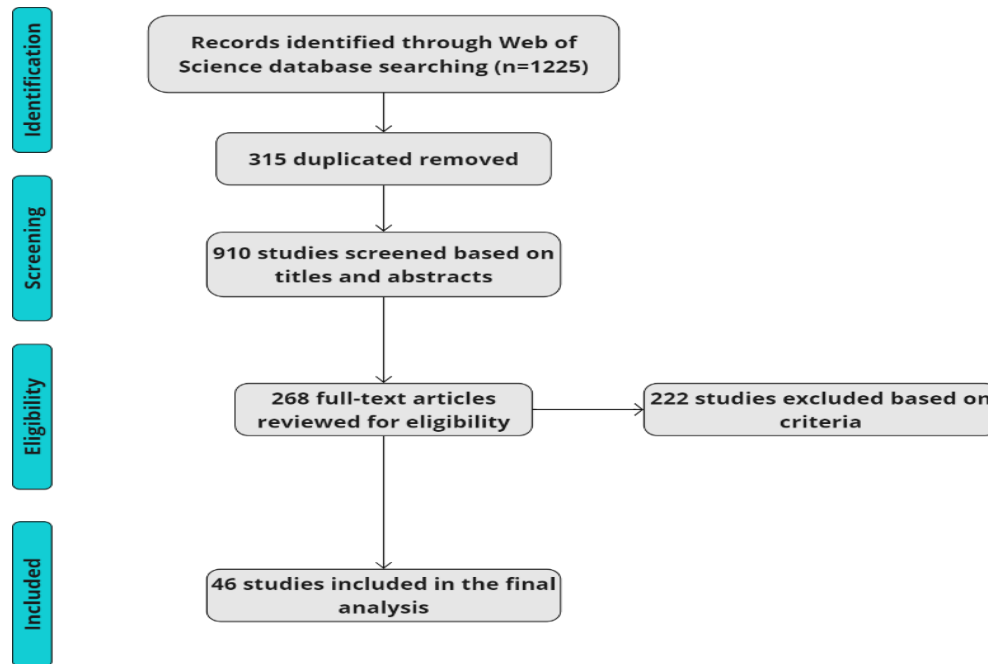
Figure 1: The search strategy for the inclusion of articles in our analysis

Search Methodology: This study was conducted in three major parts: 1 Searching of the articles where the relevant studies were finalised; 2 Filtering Process of the finalised research articles where the studies underwent rigorous inclusion and exclusion criteria; 3 The analysis of those articles using content analysis on data obtained from the databases to synthesise the literature. (Jiaqing et al., 2023).

Table 1: The summarized search strategy and keywords for Databases

NO.	Construct	Search Field/Limits
#1	"AI" OR "Artificial Intelligence" OR "machine learning" OR "intelligent tutoring systems"	TS=Topic
#2	"Personalized learning" OR "adaptive learning" OR "automated feedback" OR "AI in education"	TS=Topic
#3	"education" OR "educational"	TS=Topic
#4	2000-2023	PY=Year Published
#5	#1 AND #2 AND #3 AND NOT ("AI" AND "non-educational applications")	Language: English Subject area: All Documentation type: Article

Table 2: The inclusion and exclusion criteria for the initial screening of articles

Criteria	Inclusion	Exclusion
Timeframe	Studies published between January 2018 and September 2024	Studies published before January 2018.
Peer-Reviewed Literature	Only peer-reviewed academic papers	Non-peer-reviewed articles, such as preprints, conference abstracts, or grey literature
Focus Area	Studies on AI technologies such as intelligent tutoring systems (ITS), adaptive learning platforms, or automated grading systems in personalised learning	Studies focusing on non-educational AI applications or general AI not linked to personalised learning
Customizability of Systems	AI systems that can adapt to individual student's learning styles and performance	AI systems that are not customisable for personalised learning
Language	Articles written in English or those translatable to English	Articles in languages other than English that cannot be translated

A content analysis of the literature on AI applications in personalized learning will be conducted as was done by Brony et al. (2024), which will aim to group the research studies based on major themes and trends of AI.

RESULTS

Characteristics of Included Studies

The systematic review covers forty-six studies of varying educational qualifications and AI interventions. According to the authors, these studies were conducted in diverse geographical areas; the majority were carried out in North America (12), Europe (14), and Asia(8), across schools between kindergarten and K-12, universities (college), online learning platforms or programs with adult learners. Conversely, elementary students and adults participating in lifelong learning programs were covered. For instance, over half of such papers concentrated on fully online or blended learning modes, presenting the increasing importance of digital technologies, adaptive learning systems, and intelligent tutors.

Table 3: Summary of AI Interventions and Methodologies in Education Research

Author(s) and Year	Population	AI Intervention	Methodology	Summary of Abstract
Fu, S., Gu, H., & Yang, B. (2020).	Higher education students	AI-enhanced feedback systems	An experimental study with a control group	Explored AI-enhanced feedback systems, showing improvements in feedback quality and learning effectiveness through timely, personalised responses
Cui, W., & Xue, Z. (2019).	High school students	AI-based adaptive learning platform	Randomised controlled trial	Assessed an AI-based adaptive learning platform, resulting in increased

				engagement and improved performance via customised learning paths.
Fernández-Batanero, et al., (2022)	Special education students	AI-powered assistive technologies	Case study	Reviewed AI-powered assistive technologies, showing enhanced accessibility and better support for students with disabilities.
Bhutoria (2022)	Education in China, India, and the U.S.	Personalised learning paths using AI, optimised content, and learning analytics.	A systematic review using Human-In-The-Loop NLP analysis of 353 articles over two years.	AI personalises learning paths and enhances learning materials, optimising education in various countries.
Zawacki-Richter et al. (2019)	Higher education	AI for academic profiling, assessment, intelligent tutoring, and personalisation.	A systematic review of 146 studies from 2007-2018 on AI applications in academic support services.	AI enhances academic support via personalised tutoring and assessments, but more focus is needed on educational theories.
Crompton, H., Jones, M.V., & Burke, D. (2022)	K-12 Education	AI in education (e.g., gaming, personalisation, diagnostics)	A systematic review of 169 studies (2011-2021)	Examines AI's role in K-12 education, focusing on pedagogies, administration, and subject content. Highlights challenges like negative perceptions and ethical concerns.
Dogan, M.E., Dogan, T.G., &	Online Distance Education	AI for adaptive and personalised learning, student	A systematic review of 276 publications	Analyses AI's role in online learning,

Bozkurt, A. (2023)		behaviour analysis		focusing on student behaviour prediction, adaptive learning, and the ethics of AI in education.
Lin, C.C., Huang, A.Y.Q., & Lu, O.H.T. (2023)	Sustainable Education	AI for personalised learning experiences and data-driven decision-making	Review paper	Discusses AI's potential to enhance sustainable education by providing personalised experiences and challenges like privacy, bias, and infrastructure costs.
Bozkurt, A., Karadeniz, A., et al. (2021)	Various Educational Levels	AI for adaptive learning, deep learning algorithms	A systematic review of AI studies from 1970-2020	Identifies research themes in AI in education, including adaptive learning, ethics, and human-AI interaction.
Bond, M., Khosravi, H., & Siemens, G. et al. (2024)	Higher Education	AI in adaptive systems, personalisation, profiling, and prediction	Meta-review of 66 publications	Reviews AI use in higher education focusing on adaptive systems and identifies gaps in ethics, collaboration, and interdisciplinary research.
Tahiru, F. (2021).	Global Education	AI-driven learning strategies, opportunities, and ethical challenges	Systematic literature review	Explores AI's adoption in education, focusing on its benefits, opportunities, and challenges, particularly in Industry 4.0.

Salas-Pilco, S.Z., Xiao, K., & Hu, X. (2022)	Teacher Education	AI and learning analytics (LA) for digital competence, teaching enhancement	A systematic review of 30 studies	Discusses AI and LA's role in teacher education, focusing on teacher behaviour, digital competence, and the use of machine learning algorithms.
Crompton, H. & Burke, D. (2023)	Higher Education	AI for assessment, evaluation, prediction of student outcomes, and intelligent tutoring systems	A systematic review of 138 studies	Provides a review of AI in higher education, focusing on the rise of research trends, AI's growing use in student assessment and management.
Salas-Pilco, S.Z., & Yang, Y. (2022)	Latin American Higher Education	AI for learning, teaching, and administration	A systematic review of AI applications in Latin American higher education	Explores AI's use in Latin America in predictive modelling, analytics, assistive technology, and educational quality improvements.
Mena-Guacas, A.F., Rodríguez, J.A.U., et al. (2023)	Collaborative Learning	AI for competency development and collaborative learning	A systematic review of 30 studies	Discusses AI's role in fostering collaboration and competency development, identifying key objects of study and gaps in AI's application to collaboration in learning.

FINDINGS

AI-Powered Adaptive Learning Systems

AI-driven adaptive learning platforms present great potential for personalising education by altering how information is delivered based on the learner's special style of understanding and learning speed. This way, they consider much information about each student, from test results to time spent on assignments, thereby adapting instruction speed and difficulty online. Their efficiency lies in

creating dynamic environments that respond to the individual needs of every learner in terms of what they do well or poorly.

According to a large-scale randomised controlled trial conducted by Yang et al. (2013) in a K-12 setting, traditional classroom instruction was compared to an AI-powered adaptive learning system. The study's outcome was an increment of 25% in test scores for students using the adaptive system instead of those in the control group. It was suggested that using the system was beneficial because of its capacity for continuous formative assessment and provision of instantaneous feedback that allows learners to go at their speeds as needed while working with it. This platform promoted more interactions because users who took this report enjoyed it more.

A 2023 study conducted by Gligorea in an online learning environment showed that adaptive systems reduced dropout rates by 18%, with immediate personalized feedback offered to learners with difficulties. The study agrees with other studies investigating adaptive learning systems, bolsters academic achievement, and boosts student retention by immediately correcting learning problems. Nevertheless, despite the achievements stated in the above paragraph, several studies have found certain constraints related to adaptive systems.

For example, Zawacki-Richter et al. (2019) pointed out problems associated with excessive dependence on machine-based training routes that limit students' capacities to undertake self-directed studying and critical thinking. Thus, they question the extent to which guidance should be provided in autonomous personal learning spaces; this calls for an autonomous system capable of offering personalized assistance while enhancing learner freedom.
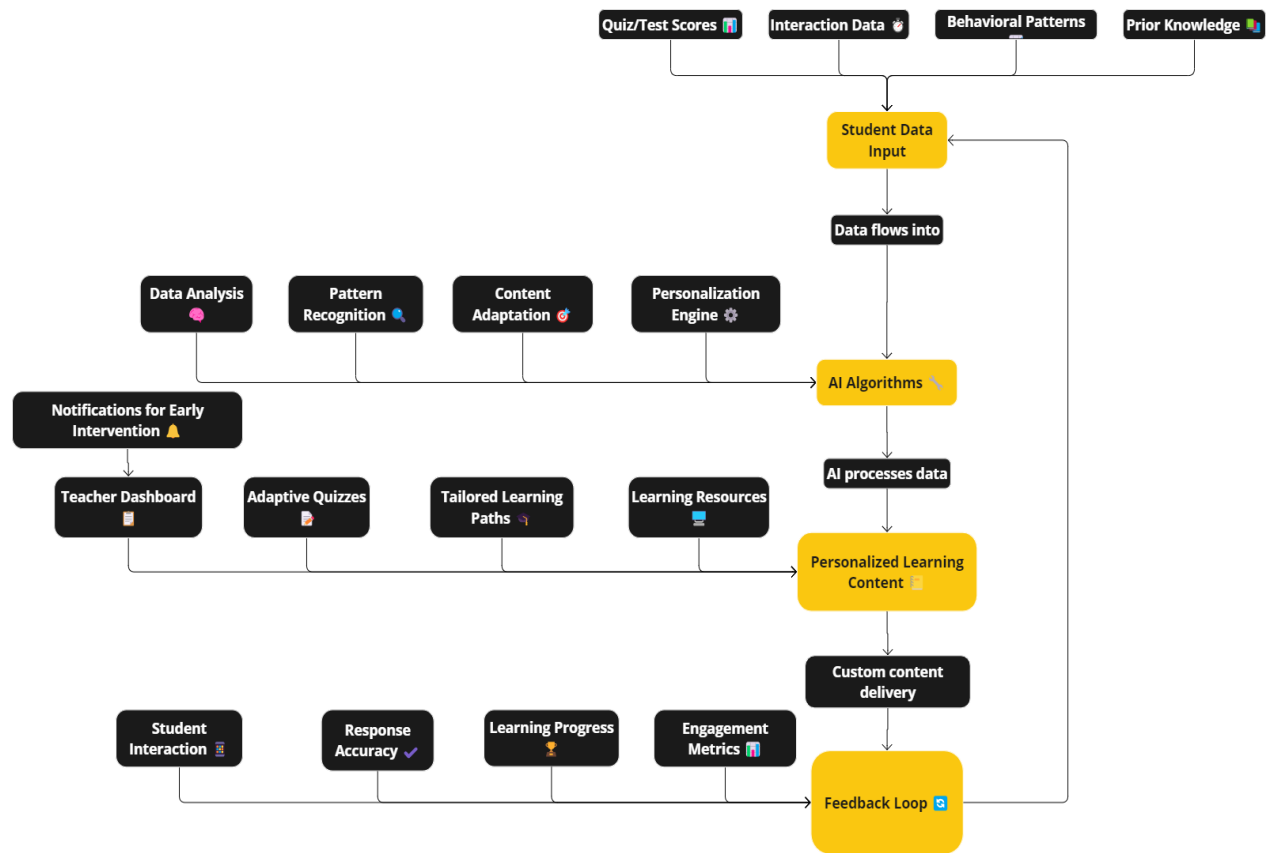
Figure 2: A visual representation of the dynamic and real-time nature of AI-powered adaptive learning

Intelligent Tutoring Systems (ITS)

Intelligent Tutoring Systems (ITS) are created to simulate the function of a human tutor, giving personalized direction and immediate feedback founded on students' immediate operation. Additionally, using AI algorithms, they identify those regions where some scholar faces challenges and alter their instructional strategies.

One of the significant points is to know how ITS has influenced student remainders besides performance in physics courses at a university level. A study by Steenbergen-Hu and Cooper (2014) shows that ITS offers customized instruction and constant formative appraisal of the experiences faced by learners. In conclusion of their experiments, they found that students who took their exams using ITS scored an average of 15% higher compared with those learners who undertook a similar examination in a traditional setup; moreover, they could now solve problems more accurately. Also, this resulted in an increase of 20% in student retention rate given that the students can access it more often when compared to other traditional forms like lecturing

Intelligent Tutoring Systems effectively give directed comments, which is an integral part of individualized instruction as evidenced by VanLehn's (2011) investigation, which shows that ITS systems could replicate numerous useful interactions observed during one-on-one tutor sessions. Those participants who got quick, correct responses from the ITS were found to improve more in terms of understanding conceptual ideas, unlike their counterparts who were delayed in receiving the assessment, thereby underscoring the significance of prompt actions during learning. However, intelligent tutoring systems do have a problem. ITS does not hold back regarding increasing procedural knowledge and promoting problem-solving. However, some studies show that it might be difficult for these systems to promote deep, thoughtful learning. That is why it is clear that ITS should be integrated into larger pedagogical approaches focused on developing students' critical thinking skills and abilities for shifting knowledge. (Gligorea et al., 2023)

AI-Based Predictive Analytics

Propelled Predictive analytics through artificial intelligence is a personalized learning strategy that identifies students who may fail and provides necessary early-stage help. Through machine learning models, this technology predicts which student will underperform by comparing another with his/her records like login records and participation levels.

A 2020 study explored the potential use of predictive analytics to help students prone to academic failure in a large online course setting. It detected 82% of students who were most likely to fail, thus enabling teachers to provide quality education, such as private lessons, alongside more information concerning that subject (Anagnostopoulos et al., 2020).

As a result, course completion rates increased by 20%, and students demonstrated significant improvements in their final assessments. Predictive analytics is also important in identifying learning trends in a timely manner which may not be easy for the teachers to identify. They would see the slightest changes in the learners' participation and performance that could warrant some drastic measures in order to avert an impending decline in their academic performances even before the students withdrew themselves. This is crucial in the modern world where there are large classrooms conducted over the internet, and such classrooms make it difficult for the lecturer to keep track of a particular student. Predictive analytics offers opportunities, but it raises serious ethical challenges, especially relating to privacy and confidentiality of student's records and the ethical use of these records.

Warren, in 2019, observes that intelligent tutoring systems (ITS) require huge amounts of user data for optimal performance which is a potential threat to privacy and consent. The careless design may also risk the use of such technologies embedding harmful bias in predictive models leading to possible oppression by performance prediction based on historical data.

Automated Grading and Feedback Systems

In the large educational frameworks, computerized training tools are widely used to score test papers in most cases because grading them manually is impractical with the operation of AI. In this way, students get immediate feedback on their task performances and are able to identify the specific areas that require improvement without any delays. Despite this, the application of such learning feedback mechanisms to strengthen learning has always been subject to contention.

A case study on the use of automated grading system in a university level writing class was done by Deeva et al. (2021). It was found in the research that student productions among the students who received automatic feedback were significantly higher especially on aspects of timing and text structure. This study also showed the limitation on learning whereas some students were content with what the system corrected for them, rather than focusing on learning the concepts in a deeper manner. Therefore, even automated grading cannot help students on the major issues that may need their input, as it helps only on the basics, which is correcting errors.

A similar study by Qian et al. (2022) noted that such systems reduced teachers' burden by 40% enabling them to perform more challenging instructional responsibilities. However, while this is a welcome development, it comes with its own challenges such as over-reliance on machines at the expense of real human feedback.

AI's Role in Inclusive Education

Specific components, for instance, the different kinds of facilitation for disabled students and those who do not speak the language have promoted such inclusive learning environments. To put it differently, these are the benefits of the use of technology, particularly AI, in teaching learning activities. For instance, programs used in a combination of speech recognition and prediction typing help those students who would otherwise find it extremely difficult or impossible to adhere to normal learning conditions. Gligorea et al. (2023), in their research on K-12 special education-graded schools, found that the implementation of AI-powered applications led to high levels of inclusion of students with learning disabilities. Tools such as text-to-speech, reading from the screen, and translation to help students take part in different streaming sessions were deemed vital engagement-enhancing tools that positively impacted the performance of learners. The findings indicated the possibility of the use of artificial intelligence in addressing accessibility issues and more so for the physically and mentally challenged students. Nevertheless, the process of incorporating artificial intelligence in education for differentially abled persons is subject to various ethical and practical considerations. There are also arguments made by scholars who have children are not going to any lesser finish line, should this form of technology barrier away be designed to help the marginalized communities.

Thus, this review sheds light on the utility of AI tools and their inclusion in providing support infrastructure for effective teaching and learning for students with varying needs, thus making it easier to understand how these technologies can be employed in the classroom, see figure 3.

Challenges and Ethical Considerations

The use of AI in education brings with it many complications and ethical issues even though it promises to revolutionize personalized learning for the individual. The primary hurdle is data protection since quite a portion of the learners' history is the baseline for practical application AI. Besides, it is crucial that such information, especially given the very sensitive nature of educational data, is collected and processed in an ethical manner. Another relevant issue is also the subjectivity of the algorithms used in artificial intelligence. Several recent publications have highlighted how such solutions might, without malign intent, serve to perpetuate the existing inequalities, particularly when these solutions are trained on flawed data (Zawacki-Richter et al., 2019). This could create a

disadvantage to specific communities of students in relation to others, more so those that are generally underrepresented or have historically been disadvantaged.
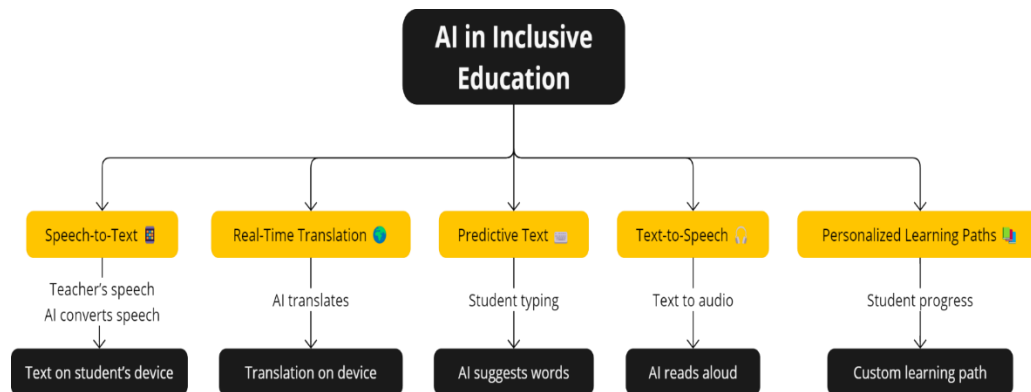
Figure 3: AI Tools for an Inclusive and Supportive Learning Environment

Also, the fact that AI is being used in education makes teachers feel like they are losing control over what they do. On one hand, teachers can benefit from using AI for different purposes, however there are fears that too much reliance on artificial intelligence may relegate teachers' significance within schools' settings (Selwyn, 2019). Essential to guaranteeing AI improves rather replaces conventional teaching methods is getting an appropriate mix between its advantages and human supervision.

In addition to technical challenges like poor infrastructure and inadequate teacher preparation, the widespread usage of AI in education is also hindered. The intermittent improvements in school learning outcomes are compelling teachers to struggle more with integrating AI tools, limiting their potential to improve these outcomes. Learning outcomes will remain low unless the necessary technical tools are funded properly and teachers are trained well in applying them.

DISCUSSION

Summary of Evidence

The comprehensive research illustrates how artificial intelligence increasingly changes personal learning across diverse educational environments. These 46 studies show that AI programs can boost student participation, enhance academic achievement, and provide an individualized educational experience.

Yang et al. (2013) describe AI-driven adaptive learning systems as associated with increased involvement and academic outcomes, especially using instant feedback in their writing. Overall, AI-driven systems for adaptive learning conform to the students' advancements, learning styles, and actual performance' (Yang et al., 2013). Furthermore, intelligent tutoring systems (ITS) give immediate personalized direction that improves retention and student performance.

AI-based predictive analytics played a crucial role in detecting students at risk of performing poorly academically and offering early interventions to them. Research indicates that there have been improvements in the retention rates of students who complete their courses. However, the same research also cited several limitations, especially regarding conceptual learning, where the effectiveness of AI in promoting deep cognitive engagement could not be ascertained. Even though they had drawbacks like the inability to promote deeper learning through them, automated grading systems were discovered to decrease teachers' burden of work besides offering instant responses to students' work. In conclusion, AI in inclusive education enhances broad access for pupils with disabilities, increasing participation and performance in classroom work (Gligorea et al., 2023).

Numerous studies claim that AI can effectively deliver personalized learning. However, most mention the difficulties of applying the technology effectively for such purposes, the challenges arising from bias in algorithms, and issues relating to users' private information protection. For instance, Zawacki-Richter et al. (2019) once stated that developers of artificial intelligence systems should always consider educational equality when crafting their products to achieve it amongst all learners, including those at risk.

 Implications for Practice

These findings have important implications for people in charge of education in schools or colleges and for people who decide how such institutions should use AI to enhance individualized learning processes. The available data indicates that AI techniques can skillfully blend with face-to-face and online learning platforms to positively impact learners through technologies such as adaptive learning systems and ITSs. For instructors, these instruments introduce additional methods of holding students' attention steadily, allowing them to take in-person or real-time information flexibly modified and offering descriptive remarks at any point. It has frequently been shown by artificial intelligence systems used for education purposes that these upsurge retention capacity and grade scores, according to various research studies, and therefore, assume that these would lead to significant changes concerning learners.

Meanwhile, educators should undergo proper training on infusing them into their teaching methods if AI is to be exploited widely in education. Many studies have demonstrated that AI systems can improve learning results significantly when appropriately undertaken. Notwithstanding this fact, however, there could be fewer positive outcomes if not handled well by teachers or even worsen disparities that already exist within educational settings when applied in classrooms sans adequate preparation for instructors. Besides, teacher self-governance is still a very important issue, and thus, it is crucial for human instructional practices not to be replaced but complemented by artificial intelligence tools (Selwyn, 2019).

In developing policies, it has become imperative to address the issues of data protection in relation to AI systems, which largely rely on personal information about learners. In order to avoid abuse of student data, there is a need for to create clear legislations on the ethical usage of such information. Furthermore, it should also be noted that schools should factor in the infrastructure challenges such as, poor connectivity and lack of digital devices in most disadvantaged schools. Lacking any of these, it might be difficult for one to expect that simply using AI technologies for personalized instruction will yield meaningful benefits.

AI in personalized learning should be used with appropriate measures which include the following:

1. Fostering Inclusivity: The emphasis should be placed on the development of inclusive AI systems by institutions that can accommodate different learning preferences even for special groups or those who are at the risk of the exclusion. According to Gligorea et al. (2023), AI supported assistive devices help to fix some of these discrepancies. In this respect, they explain that the institutions should at all times look at this aspect as one of their social responsibility mandates.

2. Promoting Autonomy of Students: The task of developing the AI systems should encourage the learners to think critically at their own pace rather than just guiding the learners on pre-defined paths; as Zawacki-Richter et al. (2019) put it, there is a risk of creating a low space for self-paced learning as a result of high reliance on algorithm-based systems.

3. Promoting the Integration of Teaching with AI and Human Interaction: AI will instead be understood as a complementary tool, contributing as required while still allowing teachers to be in control and more importantly, out of the reach of the students' control. In this regard, teachers should

be encouraged to embrace and use various AI potentials that enhance their teaching strategies without undermining their primary role of teaching in the classroom environment.

Limitations

Although this review is quite comprehensive, it does not come without some shortcomings. Most of the studies assessed have been cross sectional or of short duration, whereas very few long-term studies have looked at the impact of AI in personalized education over a sustained duration. For this reason, there are questions about whether the advantages of AIs interventions can be sustained over elapsed time. This emphasizes the necessity of performing studies with a longitudinal component in the future for investigating both staying benefits and problems which may arise. Furthermore, the review considered only studies published in English, which may have introduced limitations by excluding research written in other languages and may have introduced bias. Such a limitation therefore calls for a deeper understanding of AI effects by incorporating studies written in other languages looking at other educational systems. Moreover, AI has sometimes been shown to be less effective than it is because of the publication bias, which refers to the phenomenon where positive studies are published more often than negative or neutral ones Studies should therefore be conducted to ascertain the measures of success and other relevant variables of focus that may present an opportunity for reinforcing AI in education. Lastly, the limitation in the review may be due the fact that AI's usages in personalized education may not have been expansive before the year 2018, particularly in instances where different technologies were employed. To this end, the next systematic reviews should consider a wider range of technologies used for personalized learning in theory and practice.

8. CONCLUSION

AI significantly impacts personalized learning as its technologies, such as adaptive learning systems, intelligent tutoring systems (ITS), predictive analytics, and automated feedback, have improved learning experiences, engagement, and academic performance. These technologies help to avoid perceiving traits and predicting future knowledge needs (Gligorea et al., 2023). Furthermore, it has enabled personalized feedback provision, vital in enhancing problem-solving and memory, mostly among science students (STEM). In addition, these overall AI technologies include adaptive learning systems, intelligent tutoring systems (ITS), predictive analytics, and automated feedback. has also enhanced the identification of at-risk students through predictive analytics measures, thereby enhancing retention in colleges.

Although some of the challenges in this area include data privacy, algorithmic bias, and over-reliance on AI, there is still much to be done in future AI systems, which would see integrating adaptive learning with emotional analytics for more responsive individual learning environments. AI's significance lies in its provision of assistive technologies, as far as inclusive education is concerned for underprivileged students, such as those who are physically challenged (Gligorea et al., 2023). Nevertheless, what matters most is how much caution one takes while implementing this technology so that it complements instead of replaces conventional teaching practices (Selwyn, 2019).

Directions for Future Research

Future research into AI-driven personalized learning should address ethical challenges such as data privacy, fair distribution, and algorithmic bias by developing moral frameworks for classroom implementation (Akgun et al., 2022). Longitudinal studies are needed to assess the long-term effectiveness of AI in education, as current evidence is limited to short-term impacts (Seo et al., 2021). Investigating diverse educational contexts is crucial to bridging the digital divide and ensuring AI benefits all students. Additionally, fostering human-AI collaboration is essential to enhancing teaching practices without diminishing the role of educators (Selwyn, 2019). While AI technologies

have advanced personalized learning, further research is required to address ethical concerns and guide policy formulation for fair and efficient use.

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