

Inclusive Adaptive Learning Environments and the Role of Artificial Intelligence: Insights from South African Classrooms

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Abstract

The emergence of educational digital technologies harnessing artificial intelligence (AI) and adaptive learning environments enables continuous monitoring of learner progress while providing tailored, personalized feedback and recommendations. These innovations make it easier for teachers and parents to identify specific areas where learners need improvement. Adaptive learning and AI tools are transforming education by moving beyond traditional teacher-centered approaches that limit learner autonomy and critical thinking. This article investigates the use of adaptive learning and AI to foster personalised learning in South Africa in resource constraint areas, with the focus to enhance learning experiences. In these platforms, large amounts of data can be analysed, adapt, and tailored to the content and delivery of educational materials to meet learner individual needs. A systematic literature review was conducted using data from Scopus and Web of Science, guided by the PRISMA framework. Literature published between 2020 and 2025 was included, as this period marks a significant rise in AI adoption within the education sector. Boolean operators (AND, OR, NOT) were applied to refine search results and identify peer-reviewed studies relevant to the research objectives. Findings reveal that adaptive learning and AI-based platforms effectively monitor learner performance, identify learning gaps, and provide targeted interventions. The reviewed studies further demonstrate that such tools improve learning outcomes, enhance learner engagement, and support teachers by automating administrative tasks and generating progress reports. Despite these benefits, the South African education sector continues to rely heavily on traditional pedagogical methods. Many educators express uncertainty about AI's role and raise ethical concerns regarding students' misuse of AI tools. The study concludes by emphasizing the urgent need for teacher training and institutional readiness to harness AI's full potential for inclusive education.

Keywords: Adaptive Learning; Artificial Intelligence (AI); Personalized Feedback; Learning Outcomes; Pedagogical Approaches

Introduction

The ubiquity of Artificial Intelligence (AI) in the contemporary era, alongside escalating geopolitical tensions, is profoundly reshaping the global landscape of the 21st century. These developments have far-reaching implications across economic, political, and social spheres,

intensifying global competition and redefining how nations position themselves (Gerlich, 2024). Education has not been immune to this transformation; it must adapt proactively to equip learners with the skills and competencies necessary to thrive in technology-driven environments. Digital technologies are revolutionizing education by shifting traditional teacher-centred methods, often characterized by passive knowledge transfer toward more engaging, student-centred pedagogies. The increasing prevalence of these tools has made information more accessible than ever through the internet and digital learning platforms. The proliferation of digital devices is evident in daily life, underscoring the need for educational platforms to embrace technological diversity as a means of fostering creativity and innovation. Educational institutions, therefore, have a responsibility to reflect and nurture the diverse talents of their communities. Almost all children today, one way or the other have a smart phone, tablet, or any digital device. The prevalence of these digital tools has democratized access to education and necessitated a shift towards a more inclusive, personalized and interactive learning experiences (Elsa & Miles, 2024). What matters to learners is the development of an inclusive classroom that acknowledges their experiences of belonging and learner diversity; embracing both similarities and differences; and how these factors influence their learning (Black-Hawkins et al., 2022). In education, the integration of adaptive learning and Artificial Intelligence (AI) has been shown to reshape pedagogical approaches in ways that promote inclusivity and enhance learner performance (Akavova, Temirkhanova, & Lorsanova, 2023). Inclusive classrooms enable learners to recognise themselves as capable and knowledgeable members of society, as well as valuable contributors to their social communities (Black-Hawkins, 2014).

Adaptive learning refers to the customization of educational content and experiences through technology to meet the unique needs of individual learners. In contrast, AI involves the use of computer-based systems capable of performing intelligent tasks with minimal human intervention. Adaptive learning environments are educational platforms that leverage AI to tailor learning experiences according to learners' needs, preferences, and abilities (Zhao, 2023). Such systems create personalized learning paths, enhance engagement, and improve learning outcomes (Tapalova & Zhiyenbayeva, 2022). By adjusting content delivery, pacing, and assessments, adaptive learning environment provide a more tailored and effective educational approach (Choi & McClenen, 2020). AI plays a bigger part to adaptive learning environments by providing the analysis of large dataset in identifying learner performance patterns and provide real-time adjustments (Wittal et al., 2022; Meylani, 2024). Together AI and data analytics helps adaptive learning environments to provide a tailored learning experiences that meet individual learning styles and paces (Zhao, 2023).

Many teachers in South Africa still practice one-size-fits-all approach where learners are taught one content at the same time and pace. This traditional approach perpetuates learning that does not promote critical thinking, a skill that is required in the 21st century. It does not cater individual learning styles and pace of different learners. Adaptive learning environments driven by AI can offset the traditional approach of teaching and learning and provide personalised learning for learners of diverse backgrounds (Tapalova & Zhiyenbayeva, 2022). It uses AI algorithms that identify the challenges learners face and tailor the content material relevant to learners' specific needs. Put it differently, AI in adaptive learning environment uses machine learning algorithms to analyze data, recognise patterns, and customise learning materials to meet learner needs. Natural Language Processing (NLP) enhances content engagement and understanding through interactive dialogue and real-time feedback, creating highly individualized learning experiences (Meylani, 2024). Gradually, traditional classroom setups are transitioning toward personalized learning

environments that address the unique needs of each learner. This article explores the adaptive learning environments and the role of AI in South African classrooms and their potential benefits thereof. Through the integration of AI, teachers can reshape instructional spaces by creating dynamic and interactive learning experiences that enhance learner engagement, improve academic performance, and foster lifelong learning (Meylani, 2024). However, teachers remain largely unprepared to navigate this evolving digital landscape, and there are no clear institutional guidelines on how AI should be integrated into classroom practice, leaving adoption to individual initiative. Teachers therefore have an obligation to understand adaptive learning environments and AI to design new, learner-centred educational pathways. While this review builds upon established discussions of adaptive learning and artificial intelligence in education, it extends current understanding by situating these innovations within the South African context an area often underrepresented in global AI-in-education discourse. By foregrounding issues of inclusivity, resource constraints, and teacher preparedness, this study offers a nuanced perspective on how adaptive learning environments can be localized to address inequities in the Global South. The paper therefore contributes a regional dimension that enriches the broader literature and highlights the contextual realities of integrating AI into developing education systems.

Purpose of the review

This study primarily focuses on adaptive learning environments and the role of Artificial Intelligence (AI) in South African classrooms, examining their potential benefits, emerging trends, and existing gaps. The objective is to provide future directions for integrating these systems in ways that transform and sustain effective teaching and learning practices (Khan et al., 2022).

Review of the Literature

The literature reflects the widespread integration of AI in education, with its application expanding significantly in recent years, particularly in countries where digital tools are ubiquitous. This study systematically reviews existing research on adaptive learning environments in classrooms, with a specific focus on identifying knowledge gaps within the South African context. Huang, Saleh, and Liu (2021) provided an overview of the growing presence of AI applications in education, including adaptive learning systems and virtual classrooms. Their study highlights the potential of AI to transform teaching and learning spaces by reshaping pedagogical strategies and practices in educational contexts (Sajja et al., 2024; Singh et al., 2025). AI plays a crucial role in developing adaptive learning environments by enabling data mining, intelligent tutoring systems, learning analytics, and real-time assessment core components of adaptive learning (Van Der Vorst & Jelacic, 2019). The reviewed literature reflects an integration of recent and authoritative sources published between 2020 and 2025, aligning with the most current developments in the field. However, it also engages with foundational studies that laid the groundwork for adaptive learning frameworks, thereby maintaining theoretical continuity. This balance between contemporary and classic works provides a robust and credible scholarly foundation that ensures both relevance and depth in the review. Adaptive learning environment endeavours to include various aspects of teaching, learning, and practice into the adaptive learning environment to promote learning (Van Der Vorst & Jelacic, 2019).

Adaptive Learning Environment

An adaptive learning environment employs digital learning tools that adjust instructional materials to meet learners' needs, optimize the learning process, and ultimately improve learner performance. The adaptive learning system typically consists of the following core components:

- 1. Expert model. This is a model that possesses all the information that will eventually have to be transferred to the student. This model is also aware of the degree of difficulty of the information, and the hierarchical structure between the concepts.*
- 2. Student model. This model keeps track of what information the learner has already learned and what skill level the learner has. In fact, it models the way a learner learns.*
- 3. Instruction model. This model is specialized in teaching methods. The model knows what the best way to give feedback to a specific student, and when to apply certain didactic strategies such as productive failure (first let the student try it himself before a correct answer is given). The model combines information from the expert model and the student model in order to determine the most suitable instructions (Van Der Vorst & Jelcic, 2019, pp. 5-6).*

The models work well when implemented in Bayesian statistics and with advanced deep learning techniques. A deep learning model learns by taking in the input and learns from it to produce output.

The adaptive learning environments powered by AI is continuing revolutionising and shaping the existing teacher centric approach (Singh et al., 2025). The system requires a different approach as it present instant feedback, adaptive knowledge tailored to specific needs. With AI at disposal to teachers, now they can create tailored educational needs that meet individual learner facilitating inclusive education that is effective, and captivating. Pedagogical approaches are being altered in the classroom because of AI power, and teachers are positioned more as directing and encouraging learners through AI-powered instructional settings (Singh, Singh & Ravesangar, 2025). According to Akavova, Temirkhanova, and Lorsanova (2023), adaptive learning offers the advantage of providing real-time feedback to learners. Unlike traditional teaching methods; where feedback is delayed and often loses its impact; adaptive systems address misconceptions immediately, enhancing learning effectiveness. In adaptive learning environment, AI algorithms analyse answers from the learners in real-time and instantly respond with correct answers with some guidance on how to arrive at the final solution to help them understand their mistakes. Instant feedback motivates learners and promotes self-directed learning as well as the development of critical thinking skills. It serves as a pedagogical method designed to meet diverse learner needs and abilities. Through machine learning and algorithms, it learns what challenges a learner face and adapt accordingly to tailor the content and some tasks that assist learner to progress with understanding and ultimately achieve his/her goals. In addition, if a student continues facing some challenges with the concept, the system provides more resources and support to help the student move on (Bull, 2018).

This adaptive learning environments approach ensures to keep student motivated and powered to continue attempt next problems, resulting in a more engaging and effective learning experience. Educators are provided with some insights on how their learners are progressing and providing the necessary support. AI algorithms generate detailed reports and analytics, reflecting some area where students are doing well and where they have challenges. These reports assist teachers with the information to identify learners that need some early interventions in their studies and offer the needed support. These platforms generate predictive analytics, which identify potential learning

gaps for each learner or the entire classroom and alter the content material to suite their pace and level of understanding (Akavova, Temirkhanova & Lorsanova, 2023). AI has revolutionised how teachers teach and how students learn. It can form a personalized learning plan according to the needs and learning situation of students. As alluded earlier, using AI in education allow students to create personalized learning plan which fits learner needs and situation (Dishon, 2017), provide immersive learning experience (Ip et al., 2019) and intelligent learning tracking to help students improve their learning ability and efficiency. AI can deeply evaluate students' daily and test performance based on big data and machine learning and provide personalized teaching guidance for students' difficult knowledge and difficulties (Bingham, Pane, Steiner, & Hamilton, 2018), shortening students' learning time (Quer, Muse, Nikzad, Topol, & Steinhubl, 2017) and improving learning efficiency (Kong et al., 2019).

Virtual Reality (VR) and Augmented Reality (AR)

The development of virtual reality (VR), augmented reality (AR) technologies have become another approach that promote teaching conducive to the learner needs (Huang, Saleh & Liu, 2021). Ubiquitous computing technology have made it possible to create virtual classrooms and virtual laboratories that help enhance learning (Encalada & Sequera, 2017). In virtual classroom, teachers can simulate teaching scenes that are challenge to explain, or hard to observe in real life, and be presented in a smart classroom to create a conducive and contextual learning environment. These technologies enhance mobilizing students' vision that makes abstract concepts more intuitive and visualized, stimulate and engage learners' interest in learning, and improve teaching effects (Huang, Saleh & Liu, 2021).

Intelligent Tutoring System (ITS)

Learners often require personalized attention, yet teachers face challenges with large classes and limited time. Tutoring offers tailored guidance and promotes effective learning. An Intelligent Tutoring System (ITS) serves as an excellent alternative to traditional tutoring. This software simulates a real tutor by presenting problems, offering support, correcting mistakes, and providing encouragement. ITS operates as an intelligent, computer-assisted instructional program and it customized environments for education works most when complemented with a teacher-centric methodology. Teachers play a crucial role in assisting children to learn, helping them navigate new AI-powered platforms, and encouraging creativity and critical thinking (Singh, Singh & Ravesangar, 2025).

Research methodology

The study employed a systematic review of literature relevant to adaptive learning and inclusivity in classroom contexts. A qualitative thematic synthesis was conducted to analyze existing research, guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (Figure 1) to ensure transparency and replicability. Boolean logic and keyword searches were employed to identify relevant studies published between 2020 and 2025. This approach enabled an in-depth examination of how adaptive learning environments function and how they are transforming educational practices.

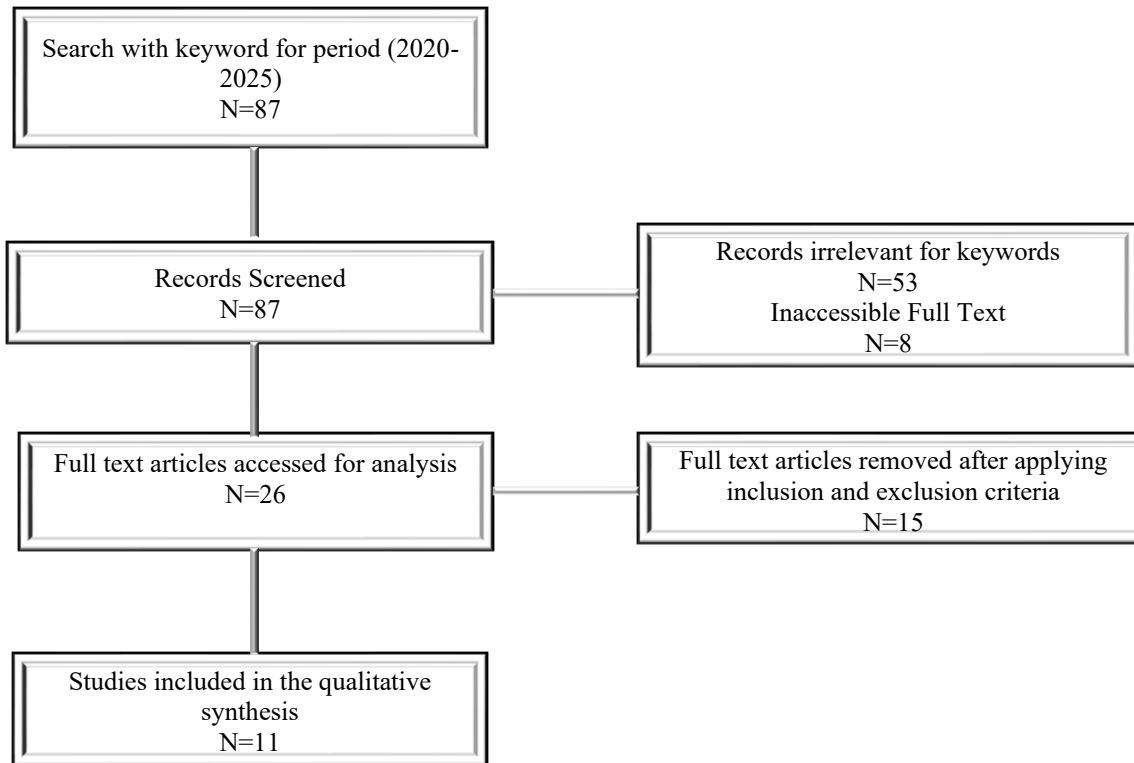


Figure 1: Processing of relevant literature review

Data collection

The literature search spanned multiple academic databases, including Scopus, Web of Science, and Google Scholar. Keywords such as “inclusivity,” “adaptive learning environments,” “artificial intelligence,” “classrooms,” and “South Africa” were used to refine the search. The search focused on peer-reviewed journal articles, conference proceedings, and reports published between 2020 and 2025. Studies without an AI component or lacking empirical evidence were excluded. The 2020–2025 period was selected because it represents a critical phase when AI-powered digital tools became increasingly prevalent in the education sector. Screening was conducted based on titles and abstracts to ensure both the relevance and methodological quality of the selected studies. Table 1 presents the authors, titles, and summarized findings of the reviewed studies. Data were extracted from Scopus and Web of Science databases. Of the 57 articles identified in Scopus, 11 met the inclusion criteria. From Web of Science, 30 articles were retrieved but subsequently excluded due to irrelevance to the study’s focus. To ensure reliability and minimize researcher bias, a two-stage screening process was applied. During the first stage, duplicate and irrelevant records were removed. In the second stage, full-text screening was performed by two independent reviewers, and discrepancies were resolved through discussion. This process enhanced the validity and trustworthiness of the systematic review.

Table 1: Relevant Reviewed Articles

Author (s)	Title	Results
Waladi, C., Lamarti, M. S., & Khaldi, M. (2025).	AI-Driven Personalized Learning Pathways Customizing Education for Every Student. In Supporting Personalized Learning and Students' Skill Development With AI	AI -driven platforms create: <ul style="list-style-type: none"> • Learning pathways aligned with students' strengths, interests, and preferences. • Enhances engagement, motivation, and achievement. • Adjust content in real-time to match individual learning styles.
Quevedo Piratova, D. A., Sánchez Duarte, M. M., Chiappe, A., & Sáez Delgado, F. M. (2025).	Intelligent classrooms: How AI and IoT can reshape learning spaces	AI-driven teaching: <ul style="list-style-type: none"> • Cater for student needs. • Promotes inclusion. • enable adaptive learning environments, • Enhances personalised • Improves academic performance
Posavec, K. (Ed.). (2025)	Implementing personalized learning techniques with AI.	AI provides: <ul style="list-style-type: none"> • Personalized, efficient, and inclusive learning experiences. • Educators with skills to address challenges like large class sizes and diverse student needs by automating administrative tasks and tailoring content to individual learners. • Pedagogical strategies that enhance student engagement and improve overall outcomes. • Ways to integrate technology that redefine how knowledge is delivered and accessed, fostering more equitable and adaptive learning environments. • Educational practices that enhance the learning experience for both teachers and students.
Nuankaew, Nasa-Ngium, & Nuankaew (2025)	Artificial intelligence and educational data mining technologies for the 4th SDG quality education: A systematic review	AI tools: <ul style="list-style-type: none"> • Significantly contribute to equity in educational guidance and performance prediction • Offer culturally responsive learning environments. • Ensure equitable access to educational technologies. • Are essential for aligning AI applications with SDG 4 objectives, providing sustainable and inclusive educational outcomes globally.
Agrawal, K., Shahin, A. B., Kumar, S., Thamizharasan, S., & Babu, T. R. (2025, February).	AI-Driven Pedagogical Approaches in Science Classrooms: Enhancing Digital Literacy and Learning Outcome	AI driven approaches can: <ul style="list-style-type: none"> • Taylor instruction to individual paces and learning style that ensure personalised support for every student. • Offer additional assistance to learners facing challenges fostering equity and inclusivity in science education. • Assessment that provides teachers with valuable insights in student performance helping them to pinpoint the areas that

Author (s)	Title	Results
		requires improvement and targeted interventions. <ul style="list-style-type: none"> • Enables collaborative learning environment that allows the student to interact regardless of geographical constraints
Babu, Y., Agarwal, N., & Awadh, R. (2023, November).	Empowering Education with Artificial Intelligence: Advancing Instructional Settings and Personalization	AI-driven learning environments: <ul style="list-style-type: none"> • Provide adaptable and customised learning experiences. • Caters learning to suit individual. • Give prompt feedback, which encourages self-evaluation and progress
Singh, B., Singh, G., & Ravesangar, K. (2025)	Teacher-Focused Approach to Merging Intelligent Tutoring Systems with Adaptive Learning Environments in AI-Driven Classrooms: Empowering Educators	AI create: <ul style="list-style-type: none"> • Customised, effective, and captivating educational adventures for learners. • Use of a teacher-centric approach.
Queiros, R., Cruz, M., & Mascarenhas, D. (Eds.). (2024)	Integrating Artificial Intelligence in Education: Enhancing Teaching Practices for Future Learning: Enhancing Teaching Practices for Future Learning	Integrating AI into teaching practices: <ul style="list-style-type: none"> • Empowers educators to personalize learning experiences. • Enhances student engagement.
Taufikin, M. S. I., Azifah, N., Nikmah, F., & Kuanr, J. (2024, April)	The Impact of AI on Teacher Roles and Pedagogy in the 21st Century Classroom	AI caters: <ul style="list-style-type: none"> • Learners with diverse needs • Fosters for a personalized and adaptive learning environment. • Enrich the learning experience
Elshazly, E. (2025)	Promoting Accessibility and Personalizing Learning Experiences Through AI	AI: <ul style="list-style-type: none"> • Customize educational content, pacing, and teaching methods to meet individual student requirements. • Enhances engagement and minimizing disruptions. • Automated assessment tools deliver immediate feedback, enabling educators to concentrate on interactive teaching. • In Special Education offer personalized learning experiences that enhance cognitive and social skills for students with diverse needs.

Data analysis

A standardized data extraction form was used to collect key information, including study details, research objectives, methodologies, findings, implications, and reported challenges. The research questions and literature review informed the initial coding framework, ensuring dependability and alignment with the study objectives. Themes were generated inductively, refined through iterative comparison, and represented visually using thematic maps to illustrate interrelationships among findings. Synthesizing findings from individual studies enabled the researchers to integrate diverse insights into a coherent and meaningful narrative.

Analysis of Findings

This study examined inclusivity within Adaptive Learning Environments (ALEs) and the role of AI in education, drawing from studies published between 2020 and 2025. The literature repository contains 12 papers which are analyzed and summarized. The review focused on identifying the potential benefits and trends of AI-driven tools and examining how they facilitate inclusive education. When tabulating the results, the researchers identified recurring attributes reported across studies, focusing on the following key areas:

1. AI in adaptive learning
2. Adaptive Learning Environment (ALE)
3. Potential Benefits

AI in Adaptive learning

Machine Learning (ML) algorithms serve as the core engine behind AI-driven adaptive learning systems. ML plays a pivotal role in analyzing data and identifying patterns that enable customization of educational content to meet individual learner needs. Coupled with ML is Natural Language Processing (NLP) that provides engagement and real-time interactive interactions. In other words, its role is to facilitate communication among learners and the learning platforms (Tapalova & Zhiyenbayeva, 2022). This real-time feedback and interactive engagement, help learner to understand the concept and application of the matter learnt in real-life situation. Thus, AI-driven learning environments such as personalisation and tailoring data, offer strong personalised educational experiences. These algorithms dynamically learn about the learners' needs, preferences, and performance levels and adjust accordingly to improve learning outcomes effectively (Zhao, 2023). AI promises to be the driving force of change as it tailors the educational content to meet the needs and demands of learner (Tapalova & Zhiyenbayeva, 2022). AI-driven personalization provides learning environments with content to adapt, determine the pace learners needs, and tailor assessments that match each learner's learning style and pace. Ultimately, this enhances learner engagement, promotes deeper interaction with content, and fosters more effective and meaningful learning experiences.

Adaptive Learning Environment (ALE)

The adoption and use of ALE in education have revolutionized pedagogical approaches and offered innovative pathways that tailor the learning materials and pace and preferred learning styles of the learner. They use AI algorithms to learn about the learner needs and customise assessments with real-time feedback to ensure continuous support of the learner. The personalised learning pathways enhance the performance of learner, despite their academic differences, thereby facilitating inclusive education (Rukadikar & Khandelwal, 2023), catering learners coming from different socioeconomic backgrounds. By customising the content materials, the ALE provides the learner with the opportunity to interact with the content materials at their own pace and learning preferences. In addition, due the interactive nature of the content, it provides learners with the eagerness to continue learning, thereby improving the learning outcomes (Raj & Renumol, 2022). Real-time adaptive assessments help learners by ensuring continuous evaluation and personalised support provision leading to improved learning outcomes. Employing ALE in personalised learning marks a paradigm changes in the educational setting, helping these institutions to succeed in an ever-changing, knowledge-driven world. However, there is limited evidence that these tools are harnessed in South African education space to foster new pedagogical practices in the

classroom. Teachers still rely too much on traditional methods of pedagogical approaches due to limited knowledge of integrating Ais in ALE.

Benefits of ALE using AI

The fact that ALE provides interactivity to the materials, it has become a valuable tool that has changed teaching ways that facilitates engagement, motivation, and provision of personalised pathways. The assessments are interactive in nature, propelling the learner to enjoy with the activity, making learner to continue increasing participation in the study. This practice does not stop here; it prepares the learner for further challenging task such as examinations and projects that require use of abstract thinking when solving problems. As learners continue practising using the ALE driven by AI, their retention rates improve, increasing satisfaction and engagement with the learning materials (Tapalova & Zhiyenbayeva, 2022; Raj & Renumol, 2022). The results are presented consistently across the identified themes of AI integration, adaptive learning environments, and associated benefits. Each sub-theme was derived from multiple converging sources, ensuring interpretive consistency. Cross-validation among studies minimized bias and strengthened the coherence of findings, thereby supporting the reliability of interpretations made in the subsequent discussion.

Discussion

The integration of Artificial Intelligence (AI) into Adaptive Learning Environments (ALEs) underscores the transformative potential of digital technologies in reshaping pedagogy. Such integration also reshapes how knowledge is constructed and how learner identities and relationships evolve within digital learning contexts. The reviewed literature collectively reveals that integrating AI into ALEs can transform teaching and learning by promoting inclusivity, personalization, and deeper learner understanding at individualized paces. Table 1 highlights AI-driven platforms that provide creation of personalised learning pathways and these can be customised to meet the learner needs (Waladi et al., 2025), while also fostering engagement, motivation and possibly improving learning outcomes. The reviewed studies highlight AI's catalytic role in fostering inclusivity by addressing the needs of diverse learners including those in resource-constrained classrooms and providing equitable access to quality learning opportunities (Nuankaew et al., 2025; Quevedo Piratova et al., 2025). In addition, AI-powered adaptive learning tools provide real-time feedback during assessments, allowing learners to identify and correct misconceptions instantly. These systems offer prompts and predictive analytics that help teachers identify struggling learners and implement timely interventions (Agrawal et al., 2025; Babu et al., 2023). The dual role of AI was highlighted both as a tool that supports teachers by automating administrative tasks (Posavec, 2025) and as a system that empowers them with data-driven insights to refine pedagogical strategies (Queiros et al., 2024). In inclusive education, AI is noted as demonstrating the ability to tailor the content materials, and thereby increasing learner cognitive domain (Elshazly, 2025) and learning is paced according to the understanding of the learner. The findings bear significant implications for educational policy and teacher professional development. Policymakers in South Africa should prioritize the inclusion of adaptive learning and AI literacy within the national curriculum frameworks and teacher training policies. Institutional policies need to support access to digital infrastructure and equitable resource allocation, especially in under-resourced schools. Furthermore, teacher education programs should incorporate AI ethics, data literacy, and digital pedagogies to ensure sustainable adoption. At the practical level, schools can use adaptive learning analytics to inform differentiated instruction, track learner progress, and

design targeted interventions for at-risk students. Despite these advantages, a significant gap remains in exploring sustainable strategies for preparing South African teachers to adopt and integrate AI-driven innovations effectively. Many educators continue to rely on traditional pedagogical methods, while those familiar with AI often express concern that students may misuse these tools for instance, outsourcing assignments raising ethical considerations. Addressing these challenges requires comprehensive teacher training and clear ethical guidelines for AI use in education. AI-powered adaptive learning environments are driving a paradigm shift toward equitable, learner-centred education. However, the long-term sustainability of AI-powered adaptive learning integration depends largely on teacher preparedness particularly in South Africa to adopt, adapt, and effectively implement these systems within their pedagogical practice. Investments in inclusive digital infrastructure and the alignment of educational policies are essential to ensure the successful adoption of AI-powered systems in pedagogical practice.

Conclusion

This study contributes to existing scholarship by examining how Artificial Intelligence (AI)-powered Adaptive Learning Environments (ALEs) can enhance inclusive education practices. Evidence shows that AI-powered tools have potential to improve learner engagement, provide real-time feedback, and learning continues seamlessly. The effective integration of these AI-powered tools hinges on critical challenges such as limited teacher preparedness and social dimensions of learning. To meet the SDG4, which emphasises on inclusive and equitable quality education that promote lifelong learning opportunities for all, alignment of these innovations with the goal is essential. The success of realising the benefits of fruits in the classroom requires a deliberate balance between technological innovation and pedagogical responsibility.’ This may position adaptive learning as a catalyst for achieving equitable and future-ready education in South Africa and beyond. The argument presented throughout this paper aligns coherently from conceptual framing to practical implications. Each section intentionally builds toward the central thesis that adaptive learning powered by AI offers a viable pathway toward inclusive and equitable education. The logical flow between evidence, analysis, and synthesis strengthens the persuasiveness of the findings and underscores the study’s contribution to both academic and practical discourses in educational technology.

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