Integrating Artificial Intelligence Tools in Teaching and Learning Comprehensive Review

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Abstract
The primary goal of the current study was to show the current state of the art of using artificial intelligence technologies and tools to support learning and teaching, improving learning outcomes. The study adopted a systematic literature review design to collect data that was analyzed thematically. Six themes, including improved feedback and assessments, learning and teaching, task administration, access to learning, academic writing and research, and personalized learning opportunities were identified from the review as positive benefits, and four themes, including ethical concerns, privacy and data security issues, technological limitations, and the risk of diminished creativity and critical thinking as negative benefits. When artificial intelligence tools and technologies are integrated into teaching and learning, the feedback and assessment mechanisms, teaching and learning processes, and task administration are greatly improved, leading to improved learning outcomes. Equally, integrating artificial intelligence tools and technologies into teaching and learning processes helps instructors meet the needs, interests, and preferences of learners, ultimately improving their learning outcomes. Institutions offering online courses can use artificial intelligence tools and technologies to recommend relevant courses to targeted students to meet their needs, interests, and preferences. Finally, artificial intelligence-driven solutions, including text generation, plagiarism detection, grammar checks, and artificial intelligence-driven data analysis help improve academic writing and research outcomes, and hence the learning outcomes. Future research should explore how the integration of AI in teaching and learning processes directly impacts the effectiveness of the learning institutions and learning outcomes. Furthermore, it should focus on how to maximize the positive benefits of artificial intelligence technologies and tools in teaching and learning processes to enhance learning outcomes.

Keywords
Artificial Intelligence, Tools, Technologies, Teaching, Learning

I. INTRODUCTION

Various innovative solutions linked to Artificial intelligence (AI) have enhanced teaching and learning and continue to redesign the educational environment. Some of the AI technologies including natural language processing (NLP), cognitive modeling, machine learning (ML), and data analytics have helped in the development of models with the capability to examine big data produced in the current educational setting to improve students learning experiences to meet their specific needs [1]. With intelligent educational systems (IES) running on AI models and algorithms, educators have obtained data-driven insights that help them match student needs and teaching styles to improve their educational outcomes [2]. Wadim Strielkowski et al. [3] pointed out that AI technologies have a significant impact on the transformation of conventional instructional methods resulting in a more personalized, engaged, and effective learning experience for all learners. Educational outcomes are significantly impacted by AI through the integration of various tools such as Grammarly, ChatGPT, and QuillBot among many others. Such tools allow learners to improve their sentence structuring, minimize plagiarism, and improve grammar, particularly for non-native English writers and speakers [4]. Moreover, language translation has been made possible owing to the development of AI-driven virtual assistants in educational settings [5].

Generally, AI technology evolution has led to the development of various course management systems, intelligent tutoring programs, and computerized grading systems. Such systems have greatly improved the effectiveness and quality of existing instructional practices [6]. Furthermore, student performance is monitored using AI programs so that personalized learning is provided to enhance it further [7]. However, regardless of the above benefits of AI tools in educational settings, various challenges have been experienced and these include increased ethical concerns, such as the high risk of replacing human decisions in educational matters, increased fragmented systems lacking consistent practices [8], privacy infringement, the high risk of weakened critical thinking among learners, and bias [9]. Overcoming such challenges requires a collaborative approach to ensuring accountable and fair use of AI tools and technologies in educational settings based on standardized frameworks and adhering to specific ethical standards in decision-making [10]. In this regard, effective use of AI can improve the learning outcomes and improve the skills of instructors if they adhere to provided ethical standards.

The current study adopts a systematic literature review (SLR) to show the current state of the art of using AI tools to support learning and teaching, thereby improving learning outcomes. The focus of the SLR was both the positive and negative benefits of AI tools and technologies to administrators, students, and instructors. Exploring the benefits of AI integration in teaching and learning could increase the desire to incorporate AI technologies in educational settings to improve learning outcomes.

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II. METHODOLOGY

A. Theoretical Framework

The theoretical framework was built on the Diffusion of Innovation theory (DIT), established by Everett Rogers in 1962 [11]. The model gives a guideline for people to understand how new ideas, products, or technologies are accepted in a social system. The theory highlights the adoption of new technology, the characteristics of an innovative idea, the media channels for relaying it, the opinions of potential users, and the larger social environment. Adoption normally takes the shape of bell curve distribution where initially the venture is undertaken by innovators and earlier adopters who are usually more open to new ideas and then early and the late majority, and finally the laggards who are more cautious or resistant to the change. Resistance may be due to people's refusal of new technologies, lack of knowledge, or disadvantages. Leadership support is the biggest factor for educational institutions in the expansion of these innovations. Innovative best practices can be shared among peers to turn the working environment into a learning community. More detailed knowledge of these factors equips educators and administrators with the necessary tools for the formation of specific strategies through which they can encourage new tool uptake among their respective groups of users [11]. The theory is essential in this study because it could point toward the benefits that increase AI adoption in teaching and learning and other reasons for its minimal adoption.

B. Research question

The current SLR aimed to address the research questions:

a. What potential benefits are linked to the integration of AI technologies in teaching and Learning processes?
b. What challenges are associated with AI technology integration in teaching and learning?

The research questions sought to examine the potential benefits and challenges of integrating AI technology into the teaching and learning context. The questions would facilitate an extensive exploration of AI integration in teaching and learning to offer practical recommendations for improving educational outcomes.

C. Search Strategy

Major databases including Google Scholar, ERIC, ScienceDirect, and JSTOR were used to collect relevant literature works to answer the review question. The databases were selected because they are worldwide data sources [12] that could help understand AI integration in teaching and learning globally before identifying a literature gap. Considering the primary purpose of the current study which focused on showing the current state of the art of using AI tools and technologies to support learning and teaching, thereby improving learning outcomes, keywords included positive and negative benefits of integrating AI tools and technologies in education settings, pros and cons of integrating AI in education settings, and advantages and disadvantages of integrating AI in educational environments. Moreover, the scope of relevant articles was narrowed based on the review questions and focused more on the positive/pros/advantages of integrating AI in learning and teaching processes. Such a search was aimed at identifying literature documenting information about how the integration of AI tools and technologies in teaching and learning positively impacts instructor and learner performance.

D. Inclusion and Exclusion Criteria

Specific criteria were utilized in selecting the identified scholarly articles for inclusion in the final review. According to Adiyono et al. [12], the inclusion/exclusion criteria are crucial in SLR because they help identify the most relevant scholarly articles to use in accomplishing the purpose of a study. Such articles had to be available in full text, published in English, peer-reviewed, and covered the benefits of AI in teaching and learning. On the contrary, books, presentations, conference articles, magazines, and non-peer-reviewed and scholarly articles without full text were excluded from the final review. Moreover, articles that did not highlight the benefits of AI integration in teaching and learning processes were excluded. Table (1) summarizes the inclusion/exclusion criteria.

TABLE 1. INCLUSION/EXCLUSION FOR SELECTING THE MOST RELEVANT ARTICLES

#	Inclusion	Exclusion
1	Peer-reviewed scholarly articles.	Non-peer-reviewed scholarly articles.
2	Availability of full-text versions.	Theses and dissertations.
3	Published in English.	Magazines, conference articles, newspapers, Books and book chapters, and presentations.
4	Covers the benefits of AI in teaching and learning.	Does not cover the benefits of AI in teaching and learning.

E. Article Screening

The screening process is vital because it helps identify the most relevant scholarly articles to include in the final review [13]. A total of 170 scholarly articles documenting the benefits of integrating AI tools and technologies into the teaching and learning processes were identified from the four databases that were searched. The detailed screening process is shown in the PRISMA flow chart diagram in Figure (1).

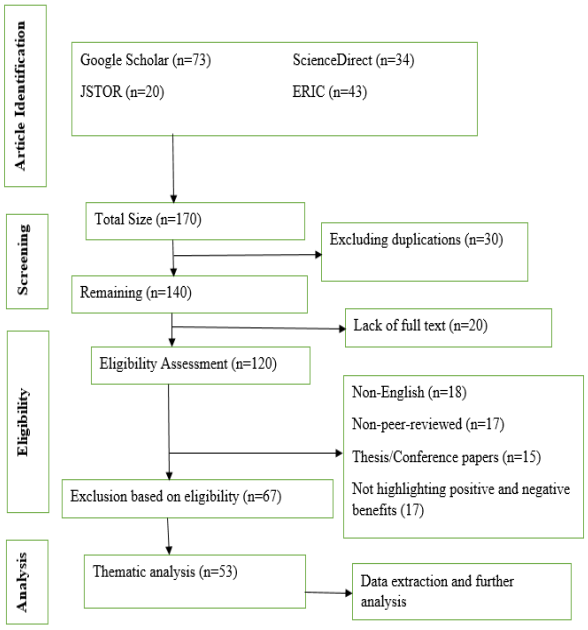

Fig. 1. The PRISMA Flow Chart Diagram

Each of the identified articles was screened based on the inclusion and exclusion criteria. The first step involved excluding duplicate articles (30 articles excluded). Secondly, full-text availability of the remaining scholarly articles was performed, and 20 articles were excluded for lacking full-text sources. Thirdly, the remaining articles were assessed to determine if they were published in English, were peer-reviewed and not theses, magazines, newspapers, or conference papers, and included the benefits of AI in teaching and learning, and 67 articles were excluded for failing to meet the eligibility criteria. Finally, 53 articles were included in the final review and data analysis.

III. RESULTS

3.1. Positive Benefits of AI

TABLE 2. POSITIVE BENEFITS OF AI TECHNOLOGIES AND TOOLS IN TEACHING AND LEARNING PROCESSES

1	Improved Feedback And Assessment
2	Effective Learning And Teaching
3	Improved Task Administration
4	Personalized Learning
5	Improved Access To Learning
6	Enhanced Academic Writing And Research

A. Improved Feedback and Assessment

Various previous research studies have explored how AI integration in teaching and learning processes improves assessment and feedback. AI technologies help instructors evaluate assignments and tasks given to their learners through an automated grading system [14 and 15]. Such systems help instructors assess the knowledge of their students, provide them with real-time feedback, and design learning methods to meet their varying needs. Besides the automated scoring system, AI integration in teaching and learning has also allowed instructors to use adaptive learning systems in the collection of student data and its analysis. Such capability allows them to offer students real-time feedback based on individual progress reports, thereby improving their learning efficiency [16, 17, and 18]. Equally, AI technologies have led to the development of adaptive testing systems integrated into teaching and learning processes to evaluate the proficiency levels of learners using algorithms and design test experiences aimed at meeting the specific needs of students. Such systems have been found to help instructors adjust the difficulty and content of testing questions in real-time based on the responses of learners, thereby improving their proficiency [19, 20, 21, 22]. Finally, AI is integrated into teaching and learning to examine the preferences, interests, and performance of learners aimed at designing the classroom practice to offer the best learning experience that meets their needs and wants [23]. By highlighting the weaknesses and strengths of various students, AI technologies help instructors to offer feedback on practice questions and student learning activities and recommend learning materials to allow learners to enjoy a personalized approach to meet their needs [24]. From the above research studies, AI integration in teaching and learning processes has been indicated as an avenue for improving the feedback mechanisms and evaluation of student progress, improving overall educational outcomes.

B. Effective Learning and Teaching

The integration of AI technologies and tools into teaching and learning processes has opened new opportunities for improving the processes because of their ability to stimulate innovation and creativity. Instructors can now adopt new methods and systems to trigger innovative teaching that is effective for each learner, which eventually leads to improved learning outcomes [25, 26, 27, and 28]. AI technologies can improve the effectiveness of teaching and learning associated with knowledge dissemination, sharing, and development while upholding human capabilities, independence, and agency [29]. The use of generative AI in the educational processes can improve the learning experience for all learners by offering unique responses to varying prompts [30]. With text-to-text AI generators, students can brainstorm and offer constructive

feedback through different platforms including ChatGPT [31]. Meanwhile, AI generators focused on text-to-image content such as Stable Diffusion and DALL-E have become valuable in imparting artistic and technical skills to learners in the field of art and design [32]. Furthermore, generative AI technologies have often supported image research-related activities, allowing scholars to gather, synthesize, and analyze insights from large data. In this regard, they have made the analysis of big data a reality, improving the overall writing efficiency among learners [33, 34, and 35]. As such, the integration of AI in teaching and learning has been found to greatly improve the two processes, enhancing overall educational outcomes.

C. *Improved Task Administration*

Integration of AI into teaching and learning processes has greatly improved the administration of tasks within the classroom environment. Some of those tasks include the organization of assignment schedules and grading [36]. With the integration of AI tools, instructors are able to efficiently manage assignment timelines, thereby reducing administrative burdens. The AI-powered grading system allows teachers to assess assignments in real time and more accurately to provide timely feedback [37]. Moreover, instructors use AI technologies to streamline the task administration process to save time [38] and bridge gaps that may seem confusing to students [39]. For instance, AI technology and other related tools can help combine different types of questions, including multiple or single-choice questions in one platform. Such efforts increase the clarity of assignments and save instructors' time, which could have been wasted in designing different types of questions independently.

D. *Personalized Learning*

Previous research has also indicated that the integration of AI into teaching and learning processes facilitates personalized learning. Teachers can use intelligent educational systems to offer personalized learning materials and instructions based on the identified student needs, interests, and preferences [15, 40, 41, 42, 43, 44, 45, and 46]. The system allows instructors to adapt their content to the performance and skills of students, establishing a unique learning journey for both instructors and learners. Personalization of learning materials and skills is vital because it helps minimize boredom among learners, boosting their motivation and engagement with relevant content [21, 47, and 48], leading to improved educational outcomes.

E. *Enhanced Academic Writing and Research*

Various AI tools and technologies have been integrated into academic writing and research. EndNote and Mendeley have been adopted to offer efficient and effective literature management and organization during academic research projects. Other technologies such as ChatGPT and Grammarly have allowed students to enhance the quality of their research using AI-driven functionalities such as text-generation, plagiarism detection, and grammar checks. Other AI technologies such as Copyscape and Turnitin allow learners to detect plagiarism on their research projects because they extensively search the internet for similar information. When it comes to data analysis, MAXDA, NVIVO, ATLAS.ti, RapidMiner amalgamat AI, and many others have been developed to assist in achieving the primary aim of analysis [49]. Generally, the adoption of AI technologies in teaching and learning has improved collaboration, data processing, and hypothesis generation when doing scientific research projects [50]. With an increasing volume of data, scholars can successfully apply AI technologies and tools such as (ChatGPT) to learn and predict trends associated with given topics under study. Since AI technologies and tools can be leveraged to examine large datasets, learners can gain insights into the data to make unique and relevant predictions. Overall, AI technologies and tools have improved the research capabilities of learners, thereby improving their educational outcomes.

F. *Improved Access to Learning*

AI technologies can facilitate access to learning that instructors may be seriously seeking to offer. AI technology helps instructors around the world to offer online courses to all students successfully [42, 51]. The online learning platforms are leveraging AI technology to recommend courses that meet the needs, interests, and preferences of targeted learners. Such technology uses keywords utilized by learners to search for courses online to make appropriate recommendations [25]. Various free and easily accessible online courses have been designed to guarantee immediate enrollment and they support engaging, well-organized, and interactive content. Some of the notable platforms including Google AI, Coursera, MOOCs, Khan Academy, and Udacity among others may be using intelligent tutoring and adaptive learning robots to offer learning services [52]. The AI-generated courses offer personalized learning experiences, allowing users to receive progress notifications, offer learning material recommendations, and track test scores [53]. With AI-driven solutions, learning institutions seeking to offer global programs can tailor their courses based on profiles of targeted students to meet their needs and expectations [51, 54].

3.2. Negative Aspects of AI

TABLE 3. NEGATIVE ASPECTS OF AI TECHNOLOGIES AND TOOLS IN TEACHING AND LEARNING PROCESSES

1	Ethical Issues
2	Data Privacy
3	Technological Limitation
6	Loss of Creativity

a. Ethical Issues

Bias in AI systems is an ethical issue experienced during their development. Bias can come from training the models using past discriminations and social injustices or even disproportionate samplings of data sources- official documents, social media, and public datasets built on human judgment. Both Harry and Sayudin [56] also state that educational institutions must also be more proactive in the removal of AI system biases so that they can help improve learning outcomes. However, generative AI is also associated with ethical concerns such as plagiarism and other forms of academic integrity issues [57]. Kumar et al. [58] analyzed the responses of students in writing their academic papers with the help of AI tools and found that the output was original and relevant, however, the output was lacking proper citation and personal reflection which are signs of increased plagiarism and poor academic integrity.

b. Data Security and Privacy

Security and privacy of data are the most critical issues when applying AI technologies in the educational environment. They require information that is often sensitive- on the students' profiles, their learning achievements, and their behavior; hence, they are at risk of data attacks and unauthorized access [59, 60]. The information collected should be handled in such a way that it does not violate the rights of students and erode their trust in schools. Further problems are caused by data protection policies such as the General Data Protection Regulation (GDPR) or the Family Educational Rights and Privacy Act (FERPA) in that they present strict guidelines on the processing and storage of students' data [61]. Therefore, strong cybersecurity controls, effective data governance policies, and an emphasis on transparency are needed to address such concerns. In doing so, the risks are minimized while using AI to improve learning outcomes.

c. Technological Limitation

Another issue with AI tools in higher learning is access to appropriate technology since students do not have equal access to stable internet or newer hardware facilities. Most of them are only able to access poor network connections and use devices not working properly [62]. All these constraints suppress student's active utilization of digital learning and e-learning materials, thereby diminishing outcomes [63, 64]. As such, institutions should make the right infrastructural investments to ensure all students can afford AI technologies to support their learning activities.

d. Loss of Creativity and Critical Thinking

While using AI in education, students' creative and analytical thinking power is eroded. AI has been found to help students develop relevant content. However, there should be a limit to the automation of tasks since ideas created cannot reflect the writing style, uniqueness, and depth of thoughts the human mind can achieve [65]. The issue is often common in disciplines such as humanities, relying on learners' critical and creative thinking to understand and write about complex concepts. Teachers should therefore embrace appropriate pedagogical methods to ensure students' creativity and critical thinking power are optimized. By over-relying on AI tools, creative and critical thinking skills are suppressed, thereby limiting students' intellectual and personal growth [66, 67]. In balancing this, both teachers and students should leverage the strengths of AI without undermining creative and critical thinking skills.

IV. CONCLUSION

The primary goal of the current SLR was to show the current state of the art of using AI tools to support learning and teaching, improving learning results. From the reviewed studies, various themes associated with the topic of study were identified. AI integration improves feedback and assessments, learning and teaching, and task administration, leading to enhanced learning outcomes. When AI technologies are integrated into teaching and learning, the feedback and assessment mechanisms are greatly improved. Instructors with the capability to offer real-time feedback associated with the strengths and weaknesses of students after analyzing their performance and progress could point out areas to improve further. As such, students leveraging instructor feedback may enhance their subsequent performances. The review has also indicated that AI integration in education improves teaching and learning processes. Instructors can use innovative AI solutions to improve their conventional teaching methods aimed at meeting the needs, interests, and preferences of their learners. Similarly, the review revealed that integrating AI into teaching and learning processes improves task administration. While automation of repetitive learning assignments and tasks reduces boredom, it enhances the motivation of learners to get engaged with the educational content and eventually improves their learning outcomes.

Equally, the review has indicated that integrating AI into teaching and learning processes offers personalized learning opportunities, improves access to learning, and enhances academic writing and research. When instructors integrate AI technologies and tools into teaching and learning processes, the needs, interests, and preferences of learners are identified or predicted and used in designing instructional programs and recommending learning materials. While such efforts reflect improved instructor performance, they ultimately help learners to improve their learning outcomes. Institutions offering online courses can leverage AI technology to recommend relevant courses that meet the needs, interests, and preferences of targeted learners. AI technology employs keywords used by learners to search for courses online to make appropriate suggestions. Finally, various AI-driven solutions (text generation, plagiarism detection, and grammar checks) can be used to enhance academic writing, while AI technologies for data analysis can improve the data analysis processes, improving overall research outcomes during the learning cycle.

Despite the above advantages, there are several challenges experienced when using AI in the education environment. These include but are not limited to privacy and data security issues, technological limitations, and weakened creativity and critical thinking. Regarding privacy, fears involve incompetent handling of students' personal information and non-compliance with legislation. On the side of unequal access to stable Internet and hardware, more focus is directed to increased inequality in education. Finally, overdependence on these AI systems gives very little room for innovation and critical thinking in subjects that depend on them as their foundation. These challenges must be addressed if AI is to enhance learning outcomes.

V. RECOMMENDATIONS

Recommendations for Practice Improvement

Improving learning outcomes requires institutions to enhance AI integration in education by addressing ethical, data privacy, technological limitations, and weakened creativity and critical thinking issues. Institutions should implement strategies to ensure unbiased data is used in training systems during development because this makes them unbiased in their service delivery. Equally, institutions should be compliant with data protection regulations protecting minors internationally and at the local level. On the other hand, there is a need to invest adequately in technological infrastructure that will ensure all students have access to AI tools affordably during their learning process. Creativity and critical thinking should be promoted even when using AI tools in the learning process by choosing AI-driven activities that require students to be innovative. Training programs for both educators and students on the effective and ethical use of AI should be provided, along with continuous monitoring to address privacy and security concerns. These efforts will help them maximize AI's benefits while minimizing its drawbacks, thereby improving overall learning outcomes.

Recommendations for Future Research

The current research was inclined toward understanding how AI technologies impact teaching and learning processes to improve learning outcomes. Future research should focus more on exploring how the integration of AI in teaching and learning processes directly impacts learning outcomes and the effectiveness of the learning institutions. Moreover, future research should focus on developing practical policy recommendations to equip instructors with appropriate skills to improve learning outcomes using AI technologies and tools. Finally, future research should focus on how to optimize the positive impact of integrating AI technologies and tools in teaching and learning processes to improve learning outcomes.

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