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Transforming Traditional Education: A Review of Literature on the Impact of Artificial Intelligence on Classroom Learning Processes

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ABSTRACT

Integrating Artificial Intelligence (AI) in the education sector has changed the whole traditional learning process in class markedly. In this literature review, topical and argumentative methods are used to evaluate the influence of AI on classroom education, additionally, the glimmer and the gloom of the AI are also considered. In addition, the review also looked at different academic databases to cover a wide range of studies published between 2015 and 2024. In this time, not only the definition and scope of AI in education changed significantly, but also the area moved from the basic to the complex and personalized learning experiences. One of the main features of AI as the intelligent tutoring system, chatbot, or learning analytics that are the instruments has updated the learning in the classroom in such a way that it is more personal and interactive. By giving teachers more freedom to focus on individualizing teaching, upgrading the feedback system, and making the flipped classroom more available, these changes have positively influenced teachers' working methods. The impact of various AI-driven instructional methods on learners' academic results has been substantial as they have led to increased motivation, participation, and academic performance. On the other hand, teachers feel a different way as they are not fully prepared for AI integration and most of them are deficient in AI-related content and technological knowledge. Nevertheless, the AI technologies deployment for enhancing teaching and facilitating learning go hand in hand with challenges as ethical, data privacy, and implementation strategy issues have been raised. Besides that, a few more studies need to be undertaken on the topics of introducing the moral principles and standards, raising the teacher competence in AI, and the radical discovery utilizing AI for the better learning outcome. AI continuous evolution will undoubtedly have an impact on the education sector, and determining whether these effects are constructive or destructive will be one of the critical tasks of research during the transition. This in turn will create a need for continual research not only to monitor but also to guide the implementation of AI in education, which in turn will lead to the students' improved adaptability, inclusiveness, and effective learning capability.

Keywords: Artificial Intelligence, Classroom Learning, Personalized Learning, Intelligent Tutoring Systems, Student Engagement, Teacher Readiness

For a very long time education through the traditional method of teaching in the classroom has been the main way people learn. These classes are characterized by the direct interaction of teachers and students in a certain physical place. The model mainly revolves around teacher-led activities, students working in groups, and teachers being able to give immediate feedback. As a result, it not

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only provides a place for the transfer of knowledge but also the practice and acquisition of skills. Artificial Intelligence (AI) when applied to the education field, means the use of smart computer programs that are capable of accomplishing tasks that require human-like intelligence. AI in education can involve different aspects of technology and the use of various methods, such as machine learning algorithms, natural language processing, and adaptive learning systems, all of which are aimed at making the educational process more efficient and student-centered.

One of the first steps to finding out how AI technologies have penetrated the educations sectors is to review the related literature systematically. This report of research communicates the implementation successes, the difficulties faced, and the opportunities ahead. The extensive study is a tool for decision-making by educators, policy makers, and researchers, who may then decide whether or not to adopt and adapt AI technologies in the educational context.

The article aims to first and foremost thoroughly and critically weigh artificial intelligence impact on traditional classroom structure by argument's pros and cons. The main focus is on the topics where schools utilize AI that scarcely goes beyond the development of the educational intelligent tutoring systems and the creation of the automated grading tools, the effects of these changes on teaching methodologies, student engagement, and learning outcomes.

Besides current studies, this paper also refers to the real-life examples to accomplish the goal of the research, which is to depict the use of AI not as the only way for the future of education but rather a means of introducing it to the pedagogical methods taking into account the potential benefits and disadvantages of AI in education to form an equilibrium of ideas with respect to how to harness it to make a radical shift in traditional school frameworks.

Objectives of the Study

- To analyse the current state of AI integration in traditional classroom settings.
- To identify potential advantages and limitations of AI applications in classroom education.
- To explore the challenges faced in implementing AI technologies within traditional educational frameworks.
- To explore the implications of AI adoption on the roles of educators and students in the learning process.

Method of Review

The review has implemented a thorough search strategy through different academic databases to locate studies that are relevant. The major databases that were used include Google Scholar, JSTOR, and Scopus. Besides these, to ensure that no important research has been left behind, searches were also done in Researchgate, Academia.edu, and Web of Science. Studies are chosen based on the time of their publication which should be within the last ten years, that is from 2015 to 2024. This period was chosen to emphasize the latest and most relevant research while also providing sufficient historical context.

The review considered different types of research to have different perspectives and different ways of research. The categories of studies included were: empirical studies, theoretical papers, systematic reviews and meta-analyses, case studies, and mixed-methods studies. The criteria for inclusion were informed by the questions raised by the research, the strength of the methodology, and the publication in peer-reviewed journals or other reputable academic sources. Non-English studies were not considered in this review.

Review of Literature

Evolution of AI in Education

The changes played by AI in education over the last decade or so are quite stunning. Those first applications mainly talked about intelligent tutoring systems and natural language processing (Liang *et al.* 2021). Since 2015, there has been an explosive growth in the number of academic papers on AIEd, which is pretty much the main indication of the increasing concern and the devotion to this domain (Nasir *et al.* 2024). The use of the AI technology in the learning process has moved through several paradigm shifts, and presently, the learning environment is more individualized and students have more access to interaction. Data-driven

methods including machine learning, data mining, and advanced algorithms are currently employed in schools to achieve better learning outcomes (Liang *et al.* 2021). The appearance of GPT chat in late 2022 has changed not only the educational practice drastically but also, it has made it more complicated (Nasir *et al.* 2024).

It is also important to mention that the implementation of AI has been more eased in the higher education sector while the discussion about AI application in primary and secondary schools has been quite limited until recently (Su *et al.* 2023). Building AI literacy in young learners is the main point and the resources, as well as the methods of instruction, which would be suitable for their levels, are being introduced (Yim & Su, 2024). To conclude, the integration of AI technology in the education field is a gradual global recognition storyline of the huge AI potential to transform teaching and learning. On one hand, the use of AI has been expanded from intelligent tutoring systems to personalized learning platforms and virtual reality simulations which, in turn, restructure the educational landscape and thus, the future of education seems to be more adaptive, inclusive, and efficient (Farahani & Ghasmi, 2024).

AI Tools Used in Classroom Learning

AI tools have changed the way learning goes in classes a lot. They can give students learning experiences that are personalized and interactive. Intelligent Tutoring Systems (ITS) and cognitive tutors are examples of such systems that create interactive learning environments and eventually lead to better learning outcomes as they are based on individual student needs (Bilad *et al.* 2023; Lin *et al.* 2023). The facilities of these systems include feedback on the work done and the giving of instructions. They are able to identify and then address the learning gaps in students in real-time (Lin *et al.* 2023).

One of the most important factors for the development of new educational methods is the extensive use of chatbots. Especially, generative AI-driven chatbots like ChatGPT are transforming pedagogical activities by providing students and instructors with AVL-led interactive engagement opportunities (Ilieva *et al.* 2023). Besides, they can give On-demand assistance, self-directed learning, and motivation of students to study can be enhanced by these tools (Alshahrani, 2023). Moreover, AI-based devices such as lifeline chatbots, class dictating software, and voice command-enabled eBooks have facilitated the teaching and learning process to be really fast (Kumar *et al.* 2023).

Learning analytics powered by AI are a great help in instructional design, assessment, and delivery (Lin *et al.* 2023). These measures are a powerful means for assessing students' comprehensive quality and providing personalized learning recommendations (Damasevicius & Sidekerskiene, 2024). AI-powered automated assessment tools can work with the same goal of leading to better learning outcomes and overall student academic achievements (Abbas *et al.* 2023). Nevertheless, there are problems like ethical issues, privacy concerns, and the necessity for the proper implementation scenarios that still exist (Abbas *et al.* 2023; Tiwari, 2023). The primary promise of integrating AI tools into the school system is that it can greatly improve the quality and accessibility of education. However, it is extremely important that there is always ongoing research and that any such integration is done very carefully (Bilad *et al.* 2023; Kamalov *et al.* 2023).

Impact on Teaching Methods

One of the main ways AI has changed teaching is by enabling personalized learning, streamlined feedback, and easy flipped classrooms. AI-driven adaptive learning platforms study the student's academic data to prepare individual learning trajectories thereby content delivery is made at the student's own pace and level of comprehension (Onesi-Ozigagun *et al.* 2024). Such a tailored method escalates the student's involvement and school achievements. As for feedback, AI-driven personalized feedback systems (AI-PFS) are designed to give the most adequate and trustworthy feedback that is individual-oriented and is based on the student's collaborative processes and learning analytics (Xu *et al.* 2021). These technologies have reached a performance level of up to 95.32% with highly personalized and reasonable predictive features. The use of flipped classrooms with AI has delivered several positive effects on the learning results.

A few studies have found a small but significant effect in favor of flipped classrooms on learning

(Hedges' g = 0.35) and pass rates (odds ratio = 1.55) (Låg & Sæle, 2019). Furthermore, the use of adaptive technology in flipped classrooms has yielded significant effects, with a major Cohen's d = 0.34 for open-ended-response performance (Clark & Kaw, 2019). In addition, AI-powered tools are automating scoring, creating engaging lessons, and providing instant feedback that teachers are becoming more facilitators of learning and developers of skills (Onesi-Ozigagun *et al.* 2024). This transition in teaching methods is elevating the education system to another level of learning by both enhancing students' learning experiences and streamlining administrative processes.

Impact on Students' Learning Outcomes

Educational methodologies have a major and complex effect on students' learning outcomes. A study by Abdulrahman et al., 2023, found that motivation, engagement, and self-efficacy to be the most important factors of academic achievement. Both intrinsic and extrinsic motivations are linked to self-efficacy and satisfaction with academic performance, whereas learning engagement has a positive effect on a student's GPA (Abdulrahman *et al.* 2023).

The implementation of Flipped Mobile-Based Microlearning (FMM) has received positive recognition in terms of factors such as accessibility, engagement, knowledge retention, and overall learning experience compared to the regular method, which has been a bit stagnant (Al-Zahrani, 2024). Likewise, the use of AI-based adaptive learning platforms has been identified as a major factor in Chinese students' performance and engagement through the positive correlation they have with these areas (Luo, 2023). Peer relationships are a very powerful factor that should not be underestimated, as they have an indirect effect on academic achievement through learning motivation and engagement (Shao *et al.* 2024). Active learning strategies have been confirmed as a means of improving STEM students' performance by the research studies (Aji & Khan, 2019).

Initially, the use of social and emotional learning (SEL) strategies in higher education has been linked with the increase of student engagement, motivation, and academic achievement (Elmi, 2020). Load reduction instruction (LRI) has been associated with positive changes in motivation, engagement, and achievement in mathematics (Evans & Martin, 2023). Teacher support is the most influential factor behind academic achievement in the online learning environment, and academic self-efficacy and student engagement mediate this relationship (Huang & Wang, 2023).

Teachers' Perception and Readiness

Different perceptions characterize teachers' and their readiness for AI integration in education. Some educators reveal an openness and a positive attitude towards the usage of AI in education, however, there exists a significant gap in the content and technological knowledge related to AI among K-12 teachers (Yue *et al.* 2024). Faculty members in the higher education sector are averagely prepared to get AI integrated into their pedagogy, with their readiness being influenced by factors such as perceived benefits, attitudes, and behavioral intentions (Alnasib, 2023). One of the interesting pieces of information is that teachers' behavioral intention to teaching AI is influenced by factors like AI relevance, attitude towards the use of AI, and confidence, whereas AI anxiety and readiness do not have a direct link with this intention (Jatileni *et al.* 2023).

The factors that influence AI pre-service science teachers to be engaged in AI inquiry-based teaching include AI literacy, subjective norms, and perceived usefulness (Ramnarain *et al.* 2024). Nevertheless, a large number of educators are without a systematic understanding of AI's potential in education and have only a few in practice when it comes to the application of AI tools (Sysoyev, 2023). The COVID-19 pandemic has exposed the digital competence need of teachers, thus, emphasizing the importance of professional development in this area (Hathaway *et al.* 2023). Basically, a certain acceptance of the use of AI has been identified, nevertheless, the disparities in knowledge and skills still exist. The right measures and well-rounded professional development initiatives are absolutely necessary in order to rise teachers' AI skills and make them willing to carry it out effectively in educational institutions (Alnasib, 2023; Woodruff *et al.* 2023; Yue *et al.* 2024).

Challenges and Limitations

The use of AI in education raises a multitude of challenges that are of technical, ethical, and pedagogical nature. Various ethical issues that arise include the privacy of data, bias in algorithms, and student autonomy being infringed upon (Williams, 2024). Collecting and analyzing large amounts of student data not only poses privacy issues but also the possibility of unauthorized access or misuse of such data (Eden *et al.* 2024; Jiang, 2023). Algorithmic bias can reinforce the inequalities in society that have been there and can also be the cause that certain communities that are the least advantaged in the society become affected more unreasonably than others (Delgado *et al.* 2022; Sanchez *et al.* 2024). From a pedagogical perspective, it is necessary to find a balance between the use of technology and the traditional methods of teaching as well as setting the educational goals accordingly (Jiang, 2023). Students' academic self-efficacy and their critical thinking skills may be negatively influenced if they will heavily rely on AI tools (Williams, 2024).

The digital gap and unbalanced distribution of technology resources are factors that affect the fair implementation of this technology (Jiang, 2023; Sanchez *et al.* 2024). In terms of the technology itself, the issues surrounding data security, the establishment of strong privacy regulations, and the production of helpful interfaces for both educators and students are some of the challenges that are yet to be solved (Jiang, 2023). The "black box" characteristic of AI algorithms refers to the situation when secrets or details are hard to find or understand which in this particular case can make difficult the transparency and accountability in the processes of decision-making (Sanchez *et al.* 2024).

Ethically, the issue of informed consent is very difficult due to the digital transformation and this difficulty is present even when we are dealing with children or different groups of people (Facca *et al.* 2020; Gallagher *et al.* 2009; Marshall, 2006). To effectively handle such issues as these we must thoroughly investigate them over and over, which means research must be continuous, there must be a constant dialogue among stakeholders, and authorities need to give clear directions regarding the use of AI in the educational sector (Eden *et al.* 2024; Jiang, 2023).

Analysis of the Review

Summary of Key Findings

Artificial intelligence (AI) integration in education has evolved significantly over time as technology has transitioned from simple applications to sophisticated, personalized learning experiences. AI tools have transformed formal education, opening up personalized and captivating experiences through the use of intelligent tutoring systems, chatbots, and learning analytics. In addition, the deployment of AI in education has resulted in the transformation of teaching methodologies as it facilitates personalized instruction, expedites the provision of feedback, and supports the management of flipped classrooms. Various AI-based pedagogical approaches have been successful in raising the level of students' learning, thus their motivation, engagement, and academic performance, among other things, have improved.

Patterns and Contradictions

The use of AI in education sounds like a good idea, but those who argue in favor of it contradict themselves when they say that it would bring many benefits and teachers are not ready to implement it in an effective way. In general, teachers are positive towards AI, however, there are still considerable deficits in their understanding and proficiency. The influence of AI on educational achievements is mostly favorable, though difficulties in raising ethics, dealing with privacy and implementing fairly still exist.

CONCLUSION

The literature review on the impact of Artificial Intelligence (AI) on classroom learning processes indicates major changes in the way education has been traditionally delivered. The AI technology has progressed from simple to complex ones that provide a highly personalized learning experience, and the number of publications that address AI in education has been growing rapidly since 2015. In general, AI tools such as intelligent tutoring systems, chatbots, and learning analytics have contributed significantly to student engagement, motivation, and academic performance.

Artificial intelligence has changed education by providing new ways of giving feedback and introducing such methods as flipped classrooms.

These methods have shown great potential in raising educational outcomes, where there is a strong positive relationship between student performance and the use of AI-powered adaptive learning platforms. Nevertheless, there are obstacles to the use of AI in education. They include ethical issues, data privacy, and the requirement for suitable implementation strategies.

Teachers' perception of AI and their preparedness for the incorporation of AI in their work differ. The majority of them do not have a solid AI background and are not sufficiently technologically skilled to incorporate AI into their work. They are, on average, willing to accept the idea of AI, but at the same time, there are still considerable knowledge and skill deficiencies that require taking certain measures and providing professional development programs specifically designed for educators.

Continued inquiry in the field of AI and education is essential in overcoming difficulties and making use of the benefits of AI integration. The next generation of research works should be devoted to creating ethical guidelines, building teachers' competencies in the use of AI and discovering new ways to use AI to enhance learning outcomes. As AI keeps on revolutionizing education, research will serve as a guardian to its ethical and effective application and, therefore, will help in creating a learning environment that is more adaptive, inclusive, and efficient for the students.

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