J. Adv. Res. in Cloud Computing, Virtualization and Web Applications
Volume 7, Print Issue 1 - 2024, Pg. No. 29-35
Peer Reviewed Journal

Review Article

The Role of Artificial Intelligence in Personalized Education and Adaptive Learning

Neha Sharma

Assistant Professor, PCTE Group of Institutes, Baddowal.

I N F O

E-mail Id:
nehasharma@pcte.edu.in
Orchid Id:
https://orcid.org/0009-0009-5132-149X

How to cite this article:
Sharma N. The Role of Artificial Intelligence in Personalized Education and Adaptive Learning. *J Adv Res Cloud Comp Virtu Web Appl* 2024; 7(1): 29-35.

Date of Submission: 2024-03-27
Date of Acceptance: 2024-04-28

A B S T R A C T

AI is contributing today in education, making learning more engaging and enjoyable. Adaptive learning platforms use various elements to motivate students, providing them rewards, various challenges after adopting AI, and interactive experiences after using AI based technologies. AI helps in positive learning mindset but also very have some negative impacts after its adoption.

Personalized learning through AI can be beneficial for learners according to their needs and mental abilities. Whether a student requires additional support or facing advanced challenges, AI can adapt to these individual requirements, and this learning environment enhance their strength and motivate them to do much better.

AI is powering the development of adaptive learning platforms that helps in analysing student performance data to create personalized learning paths. These platforms use machine learning algorithms to understand how each student learns, adapting the difficulty level and content delivery in real-time. This ensures that students receive the right level of challenge and support.

But on the other hand, after adopting the application of artificial intelligence technology, the interaction between teachers and students may be reduced, affecting the teacher's ability to understand students' learning needs and provide effective personali8zed guidance. Secondly, it may pose challenges in building teacher-student relationships. AI technology might have a negative impact on student's language proficiency. we can say AI can't replace real language learning and efforts.

Teachers should guide students to think critically about AI technology, helping them understand the advantages and limitations.

Introduction

AI in education can provide students with personalized learning methods that are helpful to them for achieving their objectives, exploring their interests, and working on their past knowledge according to their life experiences. AI increases learning outcomes of students by altering the content and a better understanding according to individual's specific requirements. By adopting AI, students are given the right challenges and assistance.

AI based algorithms helps them to analyse data and improves their progress to provide personalized educational content that meets their individual needs, preferences, and learning styles.

These AI based algorithms can analyse student's learning patterns, empowers their strengths, and focus on their weaknesses as well as enabling teachers to taught those lessons that meet

individual needs according to their interest and requirement. This process will not only empower students to learn at their own pace according to their interests but also reduces the workload of teachers by automating the process of adapting instructional study materials.

Firstly we Discuss What is Personalized and Adaptive Learning

Personalized adaptive learning is a software platform approach that provides each student a unique and interesting learning experience by allowing them to progress along their course content based on their own interest, knowledge, skills and learning needs.

For example, platforms like Carnegie Learning and Dream Box utilize AI to offer customized math lessons based on a student's proficiency, ensuring they grasp concepts thoroughly before advancing.

What are the Various Stages of Personalized Learning

- Stage One is teacher-centered with learner voice and choice.
- Stage Two is learner-centered where teachers and learners co-design learning.
- Stage Three is when learners design and drive their own learning.

What are the Goals of Adaptive Learning

The goals of adaptive learning include enhancing student engagement and involvement, improving comprehension. It aims to provide personalized learning experiences that meets individual needs, thereby maximizing educational outcomes.

AI Applications and Benefits in Education

Personalized Learning

Not every student adapts to knowledge in the same way. Some grasp the content quickly, whereas some need time to understand and implement. The conventional learning system lacked the concept of customized learning for individual student. This is where AI in online education comes forward.

AI in the education sector ensures that educational software is personalized for every individual. AI based supporting technologies like ML in education, the system backs up how the student remembers various lessons easily and adapts to that process to minimize their burden in an interesting way.

This contribution of AI in education focuses on every individual's requirements through AI- embedded games that attracts students, customized programs, and other features promoting effective learning.

Task Automation

With AI in school and college education as well as in virtual classrooms, the technology takes up most value-added tasks with real examples. For improving teaching skills, AI provides facility in education like checking the homework, grade the tasks and tests, organize research papers, maintain reports, make presentations and notes, and manage other administrative tasks.

This is why everyone rely on this advance technology to achieve daily goals. By automating everyday activities, AI makes the learning environment more knowledgeable and productive.

Smart Content Creation

AI and ML in education also help students and teachers create innovative content according to convenient preaching and learning. Here we are discussing a few examples of AI smart content creation:

Information Visualization

Where traditional teaching methods cannot offer visual elements, AI smart content creation stimulates the real-life experience of visualized web-based study environments. This technology helps with 2D and 3D visualization, where students can get important information differently.

Digital Lesson Generation

AI in education can also help our students to generate bit-size learning through low-storage study materials and other lessons in digital format. By this way, students and experts can get the entire study material without taking up much space in the system. Additionally, these materials are accessible from any device, so you don't have to worry

about remote learning. Educates millions of students by providing free study material and other interactive forms of learning with relevant content.

Adaptable Access

With complete access to information, it has become possible for millions of users to get the advantages of AI in education. A recent survey projects that more than 70% of education businesses rely on ML/AI based education app development supported by modern tools and features. Some other features like multilingual support help translate information into various languages, making it convenient for every native to teach and learn.

AI also plays a vital role in teaching visually or hearing-impaired audiences. AI-powered converter tools like Presentation Translator provide real-time subtitles for virtual lectures.

Determining Classroom Vulnerabilities

One of the powerful AI technology benefits in education is maintaining a positive impact on our environmental footprint with remote learning. However, many experts believe that AI will soon replace the human touch in learning. Now, this might be the case for other industries but not the education sector. AI and education go hand-in-hand, complementing manual and virtual teaching.

AI also supports the experts by improvising the teaching-learning process for individuals.

Closing the Skill Gap

Upskilling students is a valuable solution for businesses struggling with the technology gap. ML and AI-powered software and application development solutions deliver widely available and affordable opportunities for students to upskill.

This is not just limited to students or learners, upskilling and training the existing business workforce can boost morale and spark a company-wide commitment to improvement and innovation.

On top of that, the use of AI in the education sector impacts the L&D (Learning and Development) arena by analysing how people acquire skills. As soon as the system adapts to human ways of studying and learning, it automates the learning process accordingly.

Customized Data-Based Feedback

User feedback is a crucial ingredient when it comes to designing learning experiences, whether in a workplace or classroom. The fundamental difference between effective teaching and merely giving out content is that effective teaching includes giving continuous true feedback. It's essential that feedback comes from a trusted source, therefore, AI in education analyses and determines work reports after analysing every day's data.

A data-based feedback system helps with student satisfaction, removes the bias factor from learning and helps understand where the skills are lacking for improvements. This feedback is tailored according to every student and employee's performance recorded in the system.

24*7 Assistance with Conversational AI

These days Chatbots are an increasingly familiar example of how AI in education consumes data to inform and provide assistance accordingly. This technology benefits both business professionals and teachers for user engagement in customized learning.

Conversational AI in education delivers intelligent tutoring by closely observing the content consumption pattern and catering to their needs accordingly. People from worldwide are opting distance learning and corporate training courses where they don't have to take a break from their classes, family or job. AI chatbots can solve enrolment queries, deliver instant solutions, provide access to required study material, and assist them 24*7.

Secure and Decentralized Learning Systems

Today education industry is delivering rapid innovations with AI but is often held back by issues like data protection, alterable data accessibility, outdated certification processes, etc. Amidst all these challenges, AI based decentralized solutions can bring a positive technical revolution to the education sector.

For instance, Nova is a blockchain-based learning management system craft which resolves the authentication issues prevalent in the education market. This LMS is powered and backed up by AI and blockchain technology helping millions of teachers and students with data and information protection solutions.

AI in Examinations

AI software systems can be actively used in interviews and examinations to help detect suspicious behaviour and alert the supervisor. The AI programs keep track of each individual through microphones, web browsers, and web cameras and perform a keystroke analysis where any movement alerts the system.

An AI-based software and application solution can be beneficial in more ways than one can imagine. This is why enterprises and EdTech startups are attracted to AI technology solutions that successfully address the wide range of user's pain points. Therefore, if you are a part of the professional education sector, it's officially time to integrate AI solutions into your education business.

Discussion About Negative Impacts of AI in Education

Bias: One of the most significant concerns with the deployment of AI in education is the potential for bias in AI models. Algorithms are trained using data sets and if these data sets contain biased information, the AI system can inadvertently perpetuate and exacerbate these biases.

For instance, an AI-based grading system might be trained using a dataset that reflects the unconscious biases of the teachers who originally graded the assignments. This could lead to an unfair disadvantage for certain groups of students. Similarly, AI platforms recommending courses or career paths could be biased towards certain demographic groups if the training data reflects societal prejudices and stereotypes. This introduces an element of inequality into the teaching and learning process, which is fundamentally against the egalitarian ethos of education.

Therefore, it's crucial to ensure that the data used to train AI systems in education is representative and neutral to avoid perpetuating existing biases.

Data Privacy & Security: Another significant issue is the potential infringement on data privacy and security associated with AI tools in education. These tools often require access to students' personal data to function effectively. However, if not properly safeguarded, this data could be vulnerable to breaches, leading to unauthorized access and potential misuse. This is a particularly pressing concern given the sensitive nature of educational records, which often include performance metrics, personal identifiers, and other confidential information. Strict data protection measures need to be implemented to maintain the privacy and security of student's information while using AI-based educational tools.

Reduced Human Interaction: The introduction of AI in the classroom might inadvertently minimize human interaction, which is a crucial part of the learning process. This reduction in face-to-face communication can negatively affect the development of social skills in students.

Furthermore, the absence of human touch could make it challenging for students to grasp complex concepts, as AI lacks the ability to comprehend and respond empathetically to students' emotional and cultural nuances. Thus, while AI can efficiently automate various aspects of education, the importance of human teachers and their irreplaceable role in fostering emotional intelligence and critical thinking in students should not be undermined.

Unemployment: In few cases, the implementation of AI in the education sector may lead Job Displacement. Automation of administrative tasks, online tutoring, grading assignments, and even developing personalized study plans could potentially reduce the need for human roles in these areas. This could result in job losses for some, particularly those whose tasks can be wholly automated by AI technologies.

Technology Overdependence : The increasing reliance on AI in education can lead to technology overdependence, which may have several unintended consequences. For instance, students may become overly reliant on AI tutoring systems to solve problems or complete tasks, reducing their ability or motivation to think critically and independently. Critical thinking is a crucial skill that students need to develop, as it equips them to analyse information objectively, make reasoned judgements, and solve

problems effectively. However, if students are always provided with ready answers by AI systems, they may not feel the need to engage in this kind of deep, analytical thinking.

Increased Costs: The implementation of AI in education is accompanied by significant costs. These expenses encompass the procurement of AI software, hardware, and the necessary infrastructure, as well as ongoing maintenance, updates, and potential repairs. Additionally, there are costs associated with training educators to use these new tools effectively. For institutions with limited budgets, these expenses may be prohibitive, thereby exacerbating existing inequities in access to quality education.

Ethical Issues: AI's deployment in education also raises significant ethical concerns. These include issues around transparency and accountability. For instance, it might be unclear why an AI has made a specific recommendation or how it arrived at a particular assessment result. This lack of transparency can make it challenging to hold the system accountable. In addition, the impersonal nature of AI interaction could lead to alienation, impacting the inclusive learning environment.

Technical Difficulties: AI-based systems, like all technology, can suffer from technical difficulties and glitches. These can disrupt the educational process, causing students to lose valuable learning time. More seriously, if an AI system crashes during a crucial assessment, it could negatively impact students' grades. Hence, dependence on AI in education necessitates robust technical support systems and contingency plans.

Lack of Personalized Feedback: While AI systems can generate automated feedback based on predefined algorithms, they lack the nuance and context sensitivity of human feedback. Teachers, through their interactions and understanding of individual students, can provide personalized feedback that caters to a student's unique learning style, personality, motivations, and struggles. Such feedback aids in the overall cognitive and emotional development of the student. However, AI systems, devoid

of emotional intelligence, might fail to deliver this level of personalization. Thus, while AI can be an efficient tool for providing immediate, objective feedback, it may not fully replace the value of human feedback in enhancing student learning and development.

Accessibility Concerns : AI-driven solutions might not be universally accessible. Differently abled learners, particularly those with visual or auditory impairments, may confront barriers when utilizing AI technologies. Similarly, students residing in rural areas or developing countries can face connectivity issues, ensuring AI tools remain beyond their reach. Therefore, the availability of AI advancements to all learners, regardless of their physical abilities or geographical locations, poses a significant challenge.

The Important Role of Teachers

Despite the rise of AI in education, the role of teachers remains paramount. Teachers are often the primary source of inspiration and guidance for students, fostering a love for learning, and nurturing their academic growth and emotional development. They bring a human touch to the classroom, understanding the unique learning styles, motivations, and challenges of individual students. They can intuitively adjust classroom dynamics, create a nurturing and inclusive learning environment, and provide personalized and emotionally responsive feedback. This level of emotional intelligence and personalization is something that AI lacks. However, AI

can complement the role of Teachers, transforming them from mere knowledge providers into facilitators of learning. With AI handling administrative tasks like grading and scheduling, teachers can dedicate more time to individualized instruction and mentoring. They can focus on enhancing students' critical thinking skills, fostering creativity, and nurturing emotional intelligence. Thus, AI liberates teachers to do what they do best: inspire, guide, and care for students.

Teachers can also collaborate with AI to create personalized learning experiences for students. AI can analyse a wealth of data to identify students' learning patterns, strengths, and areas for improvement. Teachers can use these insights to tailor their instruction and provide targeted support to each student. This combination of AI's analytical capabilities and teacher's understanding of students can significantly enhance the quality of education.

Final Thoughts: In conclusion, while AI is transforming education, it does not replace the need for human teachers. Instead, it provides an opportunity for a synergistic relationship between teachers and AI. In this collaborative model, teachers leverage AI's capabilities to enhance their teaching effectiveness, while AI benefits from teachers' expertise and emotional intelligence to provide a more personalized and human-centred learning experience. This balanced integration and collaboration between teachers and AI can maximize the benefits of technology while preserving the irreplaceable human elements of teaching.

Discussion on Topic: Artificial intelligence offers a cutting-edge approach to enhance student engagement across all educational levels. Through interactive learning methods beyond traditional institutions, AI can dynamically alter course content, provide instant feedback, and gauge student involvement.

AI enriches teaching methodologies by providing students with unique educational experience. Students can access resources beyond the classroom and receive real-time feedback through AI interactions, unlocking new possibilities for learning and growth.

To make learning more fascinating and engaging, AI technology offers immersive and interactive learning experiences like virtual reality and augmented reality. In a safe and regulated atmosphere, students can participate in simulations and real-world situations, which can help them better learn and remember subjects.

For instance, children studying biology could explore the inside of a cell or witness the process of photosynthesis in a virtual lab, providing a more engaging and memorable learning experience.

For instance, students can study a new language at their own pace and without the help of an instructor using AI-powered language learning apps.

Negative Impact of AI on the Education Industry

Job Displacement : One of the biggest concerns about AI's involvement in education is the potential job displacement of teachers and educators. AI-powered tools can replace important tasks teachers perform, such as grading and providing feedback. This could impact the demand for teachers, resulting in job losses.

Emotional Intelligence Limitations: The lack of emotional intelligence plays a crucial role in learning and studying for many individuals. While AI technology has its merits, it should only partially replace teachers, as they offer more just than information. AI is still in its early stages of development regarding human interaction and personal connections, making it essential to maintain the invaluable role of human educators in the learning process.

Bias and Inequality: Biased AI algorithms may lead to inequality and discrimination. For instance, AI-driven admissions process might bias against particular student groups based on their socioeconomic situation or family background. Similarly, grading algorithms based on AI might be prejudiced against particular types of responses or writing styles.

Privacy and Security: AI-powered learning systems gather a wide range of student information, including their behaviour, learning progress, and personal data. Cyberattacks and data breaches could endanger student's security and privacy if this data is exposed. Unauthorized access to AI systems causes serious security issues impacting student's lives.

Dependence on Technology: The use of AI-powered learning tools requires access to modern technology, smartphones, Internet and the including computers. This could lead to a greater dependence on technology, potentially resulting in a decrease in problem solving skills and critical thinking.

Maintenance Challenges: Regarding AI in education, there are several drawbacks related to maintenance. It is crucial for authorities to closely monitor AI system, as they operate based on a finite body of knowledge and can have unintended consequences if pushed beyond their capabilities. Different AI machines may also have incompatible languages, leading to coordination issues and rendering them non-functional at critical times. Despite these challenges, we have explored the extensive advantages of AI in education and its potential for transforming the educational landscape.

Implications of AI on the Education Industry

The effects of AI on education are complex, with implications dependent on its creation, application, and management.

How to balance it out

Need for Regulation : Regulation of AI research and application in education is necessary to guarantee its moral and responsible application. Regulations should cover topics like privacy, prejudice, and security and make sure that all students may use AI- powered learning tools. But on the other hand, there should be control over student's use of AI.

Collaboration between AI and Teachers: AI should be used to support teachers instead of replacing them in the classroom. For individualized instruction and feedback, teachers should collaborate with AI-powered learning technologies. Smart classes should be installed, and students should be familiarized with them.

Investment in Infrastructure: A considerable investment in infrastructure, such as internet, smartphones, and computers are required to ensure all students can access AI-powered learning tools. It is important to direct this investment towards disadvantaged students to avoid leaving them behind in the digital divide.

Lifelong Learning: AI-driven learning systems can encourage lifelong learning by enhancing accessibility and personalization of instruction. However, to stay up with the quickly changing technological scene, both educators and students need to upgrade their knowledge and skills consistently.

Ethical and Social Implications: Guidance of the ethical and societal implications of AI development and implementation in education is necessary. It includes tackling issues like privacy, security and bias ensuring that AI-powered learning tools encourage inclusivity and diversity.

AI Trends in Education: According to the research, the following are the major trends in AI in education:

- The use of chatbots and virtual assistants is growing in educational institutions.
- The popularity of platforms for personalized learning and adaptive learning is increasing.
- Grading and assessment using AI is becoming more popular.
- Gamification and simulation are being used more and more in education.

Conclusion

At the end we can conclude that by providing personalized, accessible, and effective learning experiences, AI has the potential to revolutionize the education sector. However, technology developers, policymakers, and educators must work together to ensure that AI-driven learning tools are used ethically and responsibly. In conclusion, all stakeholders in education need to recognize these issues and strive to implement ethical and responsible AI practices. Ultimately, striking a balance between the benefits AI can provide and the ethical concerns it raises will be essential for successfully integrating AI in education.

References

- Siemens, G. (2004). Connectivism: A learning theory for the digital age. International Journal of Instructional Technology and Distance Learning, 2(1), 3-10.
- Siemens, G., & Long, P. (2011). Penetrating the fog: Analytics in learning and education. EDUCAUSE Review, 46(5), 30-41.
- Sweller, J., Ayres, P., & Kalyuga, S. (2011). Cognitive load theory. Springer.
- Klopfer, E., Squire, K., & Jenkins, H. (2008). Environmental detectives-the development of an augmented reality platform for environmental simulations. EducationalTechnology Research and Development, 56(2), 203-228.
- Bandura, A. (1989). Social cognitive theory. In R. Vasta (Ed.), Annals of child development, Six theories of child development (Vol. 6, pp. 1-60). JAI Press.
- Deci, E. L., & Ryan, R. M. (1985). Intrinsic motivation and self- determination in human behavior. Plenum.
- Freina, L., & Ott, M. (2015). A literature review on immersive virtual reality in education: State of the art and perspectives. In The International Scientific Conference eLearning and Software for Education (eLSE), Bucharest, Romania (Vol. 1, pp. 133- 141).

- Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The difference betweenemergency remote teaching and online learning. Educause Review, 27.
- Kaufman, A. (2019). How holograms are transforming learning. EdTech Magazine. Retrieved from https://edtechmagazine.com/k12/article/2019/06/how-holograms-are- transforming-learning
- Vanitha, V.; Krishnan, P.; Elakkiya, R. Collaborative optimization algorithm for learning path construction in E-learning. Comput. Electr. Eng. 2019, 77, 325–338.
- Dong, J.; Mohd Rum, S.N.; Kasmiran, K.A.; Mohd Aris, T.N.; Mohamed, R. Artificial Intelligence in adaptive and Intelligent Educational System: A Review. Future Internet 2022, 14, 245.
- Tapalova, O.; Zhiyenbayeva, N. Artificial Intelligence in education: AIED for personalised learning pathways. Electron. J. E-Learn. 2022, 20, 639–653.
- Adorni, G.; Koceva, F. Educational Concept Maps for Personalized Learning Path Generation. In AI*IA 2016 Advances in Artificial Intelligence; AI*IA 2016 Lecture Notes in Computer Science; Adorni, G., Cagnoni, S., Gori, M., Maratea, M., Eds.; Springer: Cham, Switzerland, 2016; Volume 10037.
- Birjali, M.; Beni-Hssane, A.; Erritali, M. A novel adaptive e-learning model based on Big Data by using competence-based knowledge and social learner activities. Appl. Soft Comput. 2018, 69, 14–32.