

Role of Artificial Intelligence in Modern Education

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Abstract

Artificial intelligence (AI) has the potential to revolutionize the way we learn and teach, making it more personalized, engaging, and efficient. AI in education refers to the use of artificial intelligence technologies, such as machine learning and natural language processing, to enhance the learning experience. It involves the use of algorithms that analyze data, identify patterns, and make predictions, enabling educators to personalize learning for each student. Artificial intelligence (AI) in education (AIED) has evolved into a substantial body of literature with diverse perspectives. In this review paper, we seek insights into three critical points:

- (1) The primary categories of AI applications explored in the education field.
- (2) The predominant research topics and their key findings.
- (3) The status of major research design elements, including guiding theories, methodologies, and research contexts.

Keywords: AI learning, AI tutoring, smart classrooms, AI ethics, STEM and AI.

Introduction:

Artificial Intelligence (AI) has been transforming various industries, and education is no exception (Yeruva, 2023). AI has the potential to revolutionize the way we learn and teach, making it more personalized, engaging, and efficient (Alneyadi, Wardat, Alshannag, & Abu Al-Aish, 2023). In this review article, we will explore the role of AI in education and how it is changing the face of learning (T. Vinoth Kumar et al., 2022) (Samad, Hamza, Muazzam, Ahmad, et al., 2022). AI in education refers to the use of artificial intelligence technologies, such as machine learning and natural language processing, to enhance the learning experience (Alneyadi et al., 2023). It involves the use of algorithms that analyze data, identify patterns, and make predictions, enabling educators to personalize learning for each student (Khan et al., 2022). The potential benefits of using AI in education are significant.

Artificial Intelligence (AI) is present in our lives and is progressing with efficiency in modern times. The start of AI is often derived to the 1956 Dartmouth summer scientific research, AI technology has been applied to education within the recent twenty years. The Intelligent Tutoring Systems (ITS) cover all major AI topics (e.g., data illustration, machine learning, dialogue, planning, reasoning, explanation), and therefore the systems have shaped a motivating test-bed to formalize psychological feature theories and to experiment with their operationalization. AI in education has been applied to numerous domains, like physics, programming, writing essays, and reading yet because the development of educational systems. the foremost typical AI applications within the academic field involve data illustration, intelligent tutoring, dialogue process, and autonomous agents. AI in education has created powerful learning environments and positive interactive experiences for college students over the decades. The fast advancement of technology, like computer science (AI) and artificial intelligence has compact all industries, together with education. A recent report from IBM, Burning Glass and Business education Forum shows that the quantity of job opportunities for knowledge and analytics skills can increase by 364,000 to 2,720,000 in 2020. which means that the gap between offer and demand of individuals with AI skills is growing, with one report showing a Volume IX, Issue IX, September/2020 Page No:305 Alochana Chakra Journal ISSN NO:2231-3990 worldwide base of three hundred,000 AI professionals, however with several opportunities obtainable, and this gap is leading to even higher salaries for those during this field.

Paving the way for AI tools in education:

Computer-assisted instruction (CAI) began in the 1960s, presenting instructional material with expensive mainframe computers. As computer technology became smaller and more affordable, more schools were able to adopt CAI.

Intelligent tutoring systems emerged with the advent of desktop computers, offering tutorial programs that provided immediate feedback and tailored learning paths based on student responses. These systems demonstrated the potential benefits of personalized learning, making technological adoption in education increasingly attractive.

Literature survey

Artificial Intelligence (AI) is a rapidly evolving field that encompasses machine learning (ML), natural language processing (NLP), computer vision, and robotics. AI is transforming industries such as healthcare, finance, education, and manufacturing by automating tasks, enhancing decision-making, and improving efficiency. This literature review summarizes key research on AI, its applications, challenges, and future directions while identifying research gaps. AI refers to machines that can simulate human intelligence, including reasoning, learning, and problem-solving (Russell & Norvig, 2021). AI-driven robots perform industrial automation, autonomous driving, and robotic surgery (Kober et al., 2013). More research is needed on fairness-aware AI models that mitigate biases in decision-making.

AI regulation and policies for ethical AI deployment require further study. Current AI models are task-specific (Narrow AI); research is ongoing to develop Artificial General Intelligence (AGI) capable of human-like reasoning. One of the most significant contributions of AI to education is personalized learning, where AI-driven platforms adapt to students' learning styles and pace. Studies by Woolf (2010) and VanLehn (2011) highlight that ITS can provide real-time feedback, personalized learning paths, and adaptive assessments. Systems like Carnegie Learning and ALEKS use AI to analyze student responses and tailor instructions accordingly. A study by Luckin et al. (2016) emphasizes how AI can identify knowledge gaps and suggest targeted learning materials. Platforms like Coursera, Duolingo, and Knewton use AI to personalize course recommendations based on learner progress. AI has significantly improved assessment methods, reducing teachers' workload while providing detailed insights into student performance.

Research by Jordan (2014) suggests that AI can accurately grade multiple-choice and short-answer questions, while advancements in Natural Language Processing (NLP) enable AI to assess essays (e.g., ETS's e-rater and Grammarly). A study by Balfour (2013) shows that AI powered writing assistants help students improve their writing by suggesting corrections, grammar checks, and content enhancement. According to a study by Chen et al. (2020), AI powered tools automate administrative tasks like attendance tracking, grading, and scheduling, allowing teachers to focus more on instruction. AI Chatbots and Virtual Assistants: Research by Huang et al. (2019) highlights how AI-driven chatbots (e.g., Jill Watson at Georgia Tech) answer student queries, reducing teachers' workload. Speech Recognition and Assistive Technologies: According to the research by Bouck et al. (2021), AI-powered tools such as text-to-speech and speech-to-text software help students with dyslexia and speech impairments. AI

for Autism Support Studies by Goodwin et al. (2019) indicate that AI-driven emotion recognition software assists autistic students in understanding social cues.

Data Privacy and Security Studies (Selwyn, 2019) caution that AI-driven platforms collect vast amounts of student data, raising concerns about data security and ethical usage. Teacher-Student Interaction Some scholars argue that AI should complement, not replace, human teachers, as social and emotional aspects of learning require human interaction (Holmes et al., 2020). Long-Term Impact of AI on Learning Outcomes Existing studies focus on short-term improvements in learning efficiency, but long-term effects on knowledge retention and critical thinking remain underexplored. Limited research exists on developing AI models that minimize bias in assessments and learning recommendations, particularly for underrepresented groups. Most studies assess AI as an independent tool; further research is needed on hybrid AI-human teaching models that maximize learning effectiveness. While AI-based emotion recognition tools are emerging, research is lacking on their accuracy and ethical implications in real-world classrooms.

Most AI in education studies is based on Western education systems; more research is needed on AI's impact in diverse cultural and socioeconomic settings. Many AI-based educational tools require high computing power and internet access, limiting their application in low-resource environments. Research should focus on cost-effective, scalable AI solutions.

Method Research

The research method used in this study is qualitative descriptive method. The type of data used in this study is qualitative data, which is categorized into two types, namely primary data and secondary data. Data sources are obtained through library study techniques that refer to sources available both online and offline such as: scientific journals, books and news sourced from trusted sources. These sources are gathered based on discussion and linked from one piece of information to another. The data collection techniques used in this study were observation, interview and research. This data is analyzed and then conclusions are drawn.

To research the role of AI in education, start by reviewing existing literature to understand its applications, benefits, and challenges. Look into how AI is transforming teaching, learning, administration, and data analytics. Identify key AI tools used in education, such as intelligent tutoring systems, personalized learning platforms, and automated grading systems. Examine case studies from schools and universities to assess the practical outcomes of AI implementation, both positive and negative. Conduct interviews or surveys with stakeholders,

including educators, students, and developers, to gather insights into the real-world impact of AI. Focus on ethical issues like privacy, bias, and the potential for AI to replace teachers. Analyze the effectiveness and limitations of different AI tools used in education. Investigate how AI is being integrated into existing educational infrastructures and its scalability. Look for emerging trends, such as virtual assistants and AI in student assessments, to predict the future direction of AI in education. Consider the impact of AI on equity in education, particularly how it may help reduce or increase disparities. Assess regulatory frameworks surrounding AI in educational settings. Finally, make recommendations for best practices, future research, and policy development to ensure AI is used ethically and effectively in education.

Main aspects are,

1. Literature Review
2. Key Areas of AI Impact in Education
3. Case Studies of AI Implementation
4. Stakeholder Interviews
5. Ethical Issues in AI in Education
6. Technology Assessment
7. Trend Analysis
8. Conclusion and Recommendations

In addition to the previous areas, explore AI tools and platforms specifically designed for education, examining how they support teaching and learning. Investigate how AI is enabling personalized learning, allowing students to progress at their own pace with tailored content. Look into how AI supports teachers in grading, lesson planning, and administrative tasks, enhancing their efficiency. Evaluate the role of AI in student assessment, providing timely feedback and tracking performance. Finally, consider how AI can promote educational equity and accessibility, ensuring that all students, regardless of background, have equal access to quality learning experiences.

Benifits and Challenges

Benefits of AI in Education:

Personalized LearningAI can help personalize the learning experience for each student, allowing them to learn at their own pace and according to their individual needs and abilities. This can lead to improved learning outcomes and increased student engagement. **Increased Efficiency**AI can automate repetitive tasks such as grading, data analysis, and administrative tasks, freeing up time for teachers and students to focus on more meaningful tasks. **Role of AI in Education**AI can help improve student engagement by providing interactive and engaging learning experiences. For example, chatbots and virtual assistants can make learning more fun and interactive, and adaptive learning technologies can help students stay engaged by presenting material at their level of understanding. **Better Data Analysis:** AI can analyze large amounts of data and provide insights into student performance, allowing teachers to better understand their students and tailor their instruction accordingly. This can lead to improved learning outcomes and better student performance.

Challenges of AI in Education:

Privacy and Security Concerns The collection and analysis of large amounts of personal data from students could pose a risk if it falls into the wrong hands. Institutions must ensure that they are taking appropriate measures to protect students' privacy and prevent data breaches. **Lack of Trust** Students may be hesitant to accept grades or feedback generated by an AI system, preferring to have human input and evaluation. It is important to establish trust with students and make them feel comfortable with technology. **Cost**AI systems can be expensive to implement and maintain, which can be a challenge for educational institutions that are already facing budget constraints. Institutions must carefully consider the costs and benefits of implementing AI systems in their classrooms. **Potential Bias**AI systems can be biased, particularly if they are trained on biased data. This can result in unfair treatment of certain students and perpetuate existing inequalities. Institutions must ensure that their AI systems are unbiased and do not perpetuate existing inequalities. **Ethical Considerations** **Ensuring Accessibility:** AI-based education systems must be designed with accessibility in mind, ensuring that all students, including those with disabilities, can access and use technology. **Transparency**AI systems must be transparent, with clear explanations of how they make decisions and why. This can help build trust with students and ensure that they understand technology. **Fairness**AI-based education systems must be fair, ensuring that all students are treated equally and not discriminated against based on their race, gender, or other factors. **Future of AI in Education:** The future of AI in education is bright, with opportunities for innovation and growth. AI has the potential to transform the way we teach and learn, making

education more personalized, efficient, and effective. In the future, we can expect to see more advanced AI systems that can understand and respond to human emotions, Role of AI in Education provide more nuanced feedback, and even create personalized lesson plans for each student.

Findings

Finding the importance of AI in education:

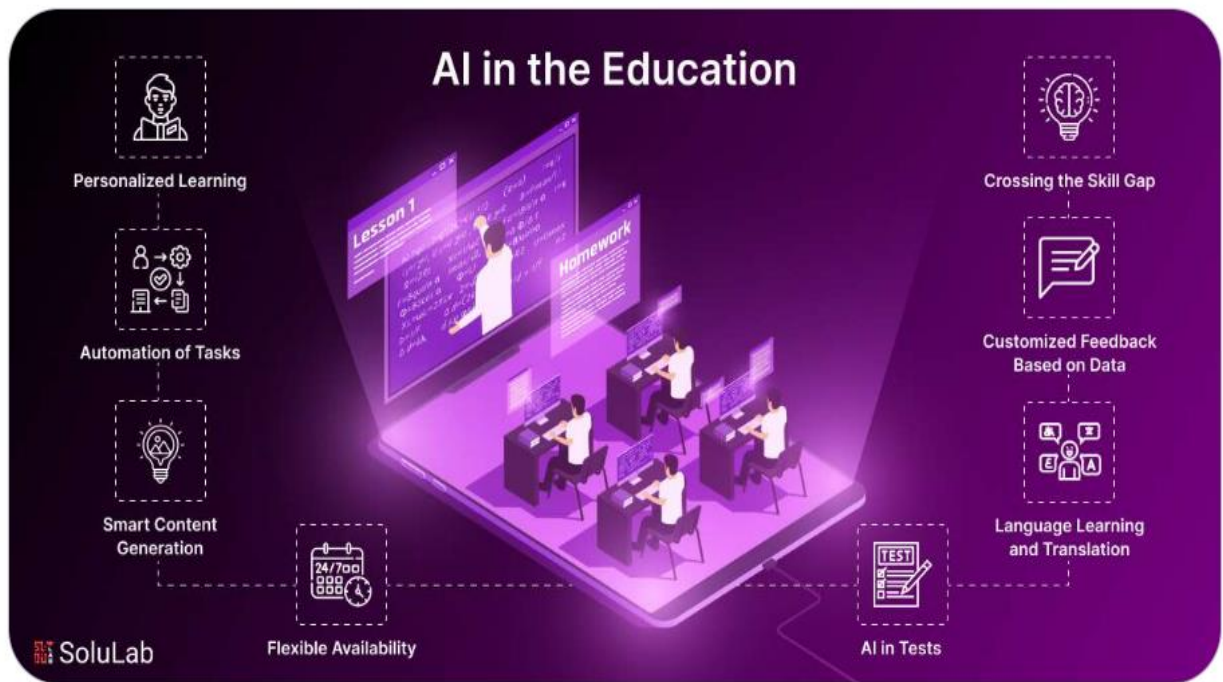
AI-driven education is perturbing traditional teaching methods and altering the industry's technological future. ARTIFICIAL INTELLIGENCE (AI) technologies for education employ complex algorithms to examine large data sets to provide personalized and flexible learning environments. Students benefit from individualized learning, instant feedback, as well as exposure to immersive technology such as augmented and virtual reality in education.

Chatbots and virtual instructors who use conversational AI in education offer quick assistance while promoting learning on one's own CHAT BOTS for education are transforming how students learn.

These chatbots use natural language processing and machine learning methods to give students quick and tailored help, responding to their questions and leading them through the learning process. Creating dynamic and compelling learning experiences helps students understand concepts and remember knowledge more effectively.

AI is transforming education by enabling personalized learning, improving accessibility, and enhancing teaching efficiency. It adapts content to individual learning needs, provides real-time feedback, and automates administrative tasks, allowing educators to focus on student engagement. AI-powered tools like intelligent tutors, predictive analytics, and speech recognition support diverse learning styles and help identify struggling students early. Additionally, AI fosters interactive and immersive experiences through gamification and virtual learning environments, making education more engaging and effective.

Keeping these technological benefits in mind, here are the ten ways AI is altering the education sector.



AI Use Cases in Education:

- **Personalized Learning**

Not every student responds to learning in the same way. Some people understand concepts fast, while others require more time. The conventional learning approach lacked the notion of personalized learning for each individual learner. This is where artificial intelligence may help with online education.

1. **Adaptive Learning Platforms**
2. **Intelligent Tutoring Systems**
3. **Automated Content Creation & Curation**
4. **Natural Language Processing (NLP) for Learning**
5. **Predictive Analytics for Student Performance**
6. **Gamification & Engagement**
7. **Speech Recognition & Assistive Tech**

AI in the education industry guarantees that instructional software is tailored to everyone. Furthermore, AI for educators uses supporting technologies such as machine learning in

education, the system validates how the learner interprets various teachings and adjusts to that process to reduce the strain.

- **Automation of Tasks**

AI automates various educational tasks, including grading, attendance tracking, and administrative work, reducing the burden on educators. It personalizes learning by curating content based on student needs and provides instant support through AI-powered chatbots. AI also optimizes lesson planning and curriculum design while analyzing student performance to identify learning gaps early. By enhancing efficiency and improving the learning experience, AI is transforming education for both teachers and students.

Artificial intelligence (AI) improves efficiency in education by simplifying numerous processes in virtual and traditional classrooms. AI solutions cater to a range of administrative duties, from grading tests and checking homework to organizing research papers and creating presentations. By automating these processes, AI optimizes the learning environment, allowing educators to focus more on personalized teaching methods.

Here are a few examples of AI-powered intelligent content creation:

Data Visualization

Artificial Intelligence (AI) smart content production increases the real-life experience of visualizing web-based learning settings, when traditional education approaches can only present lab tries as visual elements. With 2D and 3D representation, where kids might receive information differently, technology helps.

Digital Creation of Lessons

AI in education can facilitate bit-size learning by providing digital classes and study materials with reduced storage requirements. In this manner, the complete study material may be utilized by specialists and students without using much system space. You don't need to worry about distant learning either because these resources are available on any device.

Frequent Changes to the Content

AI makes it simple for users to create and update content often, which helps to keep the teachings relevant over time. Users also benefit from alerts anytime new content is released, which aids in organizing their workload.

- **Flexible Availability**

Users may now make use of AI's benefits in education since they have total access to information. A recent survey found that over 60% of businesses in the education sector rely on AI/ML-driven education applications that are supported by modern tools and features. Features like multilingual support make it easy to translate material into several languages, which improves learning and teaching for native speakers.

How does AI help with education is also evident in its necessity for teaching people who are deaf or blind. Presentation Translator, an AI-driven translation tool, provides simulated lectures with real-time translations.

- **Assessing the Vulnerabilities in the Classroom**

Using remote learning to maintain a good environmental effect is one of the many educational benefits of AI technology. Nonetheless, a lot of experts think AI will eventually take the role of human interaction in education. While it might not be applicable to the education sector, this nevertheless holds true for other industries. AI and education combine to improve online learning as well as traditional classroom training.

Artificial intelligence only helps experts by customizing the educational experience for every student.

- **Crossing the Skill Gap**

Expanding students' skill sets is a crucial strategy for businesses looking to bridge the technological gap. Software and application development solutions driven by AI and ML provide broadly accessible and reasonably priced upskilling options for students.

This is additionally beneficial for students: improving the skills of the present workforce in the corporate world might boost morale and encourage a commitment to innovation and advancement throughout the whole organization.

Furthermore, by examining how individuals learn new skills, the application of AI in the education industry has an influence on the L&D (Learning and Development) field. The

technology automatically adjusts the learning process to individual study and learning styles as soon as it detects them.

- **Customized Feedback Based on Data**

When it comes to creating learning experiences, either in the classroom or the workplace, feedback is an essential component. Effective teaching includes ongoing feedback, which is the primary distinction between it and material delivery alone. Since it is crucial that feedback originates from a reliable source, how does AI help with education evaluate and assign grades based on routine data?

A data-driven evaluation system improves student satisfaction, lessens learning bias, and facilitates the identification of situations in which a student's skills are lacking. This feedback is customized based on each employee's and student's performance as documented in the system.

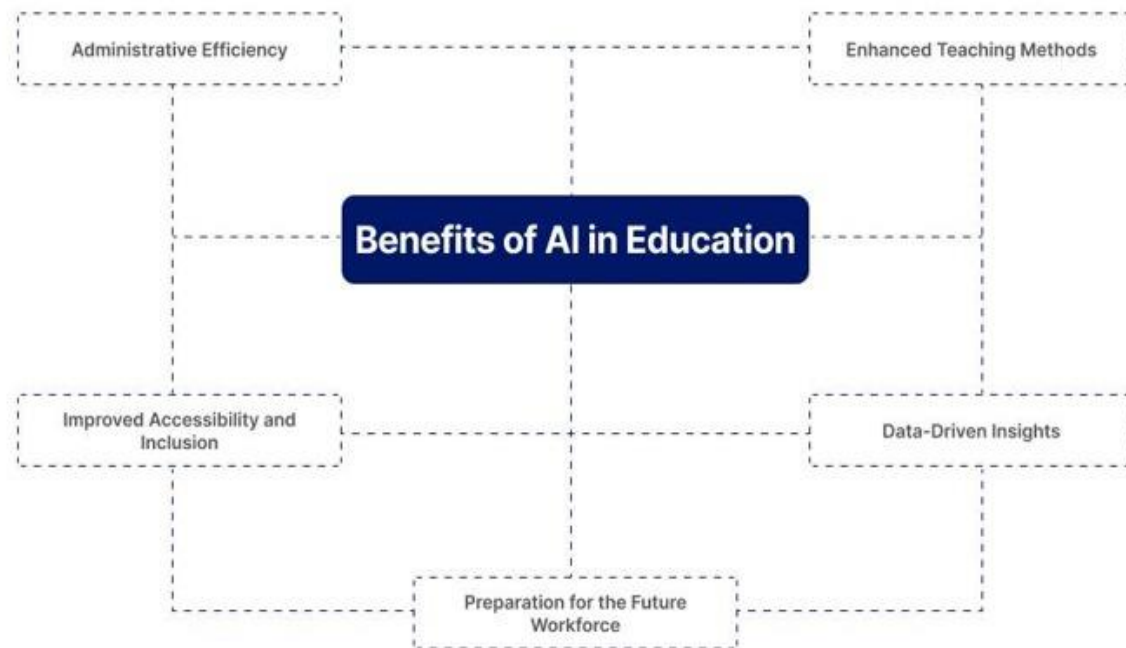
- **Any time Support for Conversational Artificial Intelligence**

Chatbots are one growing instance of AI in education to collect data and provide pertinent information and help. Whenever it comes to student engagement in tailored learning, this benefits both educators and corporate leaders.

By closely monitoring the pattern of information consumption and adapting to meet the demands of the learner, conservative artificial intelligence in education provides intel

- **AI in Tests**

Software that uses artificial intelligence (AI) may be employed to spot questionable behavior during interviews and tests and alert the supervisor. Through the use of webcams, mics, and web browsers, machine learning algorithms keep an eye on every individual and scrutinize their keystrokes, notifying the system of any movements.



Here are some key benefits of AI in education:

- 1. Enhanced Teaching Methods:** AI-powered tools, such as intelligent tutoring systems and virtual assistants, provide educators with valuable support in delivering high-quality instruction. These tools offer real-time feedback, explanations, and guidance to students, allowing educators to focus more on personalized teaching methods and student interaction.
- 2. Administrative Efficiency:** AI automates various administrative tasks, such as grading assignments, organizing course materials, and scheduling classes. By handling routine tasks, AI frees up educators' time, enabling them to devote more energy to teaching and mentoring students.
- 3. Improved Accessibility and Inclusion:** AI technologies can improve accessibility and inclusion for students with disabilities by providing assistive tools such as speech recognition and text-to-speech conversion. These tools empower students with diverse needs to access educational materials and participate fully in the learning process.
- 4. Data-Driven Insights:** AI analytics tools can analyze vast amounts of educational data, including student performance, attendance records, and learning patterns. By providing

valuable insights into student progress and behavior, AI enables educators to make informed decisions and tailor instruction to individual student needs.

5. Preparation for the Future Workforce: By integrating AI into education, students gain exposure to emerging technologies and develop essential digital literacy and problem-solving skills. This prepares them for the demands of the future workforce, where AI and automation are expected to play increasingly prominent roles across various industries.

Conclusion

AI has the potential to revolutionize education by personalizing learning, improving efficiency, and assisting teachers in administrative tasks. AI-driven tools like virtual tutors and intelligent feedback systems can identify learning gaps and provide targeted interventions. However, ethical concerns such as data privacy, bias, and accessibility must be addressed to ensure equitable implementation.

The integration of AI in education also plays a crucial role in preparing students for the future workforce. The World Economic Forum emphasizes the need to enhance both STEM and soft skills, as students must learn to utilize AI effectively and collaborate in problem-solving. Microsoft predicts that by 2030, students must master adapting to evolving technologies and working in teams to solve complex issues. Early exposure to AI can help equip students with the skills necessary to navigate a digital work environment.

A systematic review of 138 studies on AI in higher education (AIED) highlights a shift in research dominance from the U.S. to China. The majority of studies focus on undergraduate students, with language learning being the most common subject. AIED applications in higher education fall into five key categories: (1) Assessment/Evaluation, (2) Predicting student outcomes, (3) AI Assistants, (4) Intelligent Tutoring Systems (ITS), and (5) Managing student learning. These tools assess student progress, predict academic success, and provide customized support through virtual assistants and adaptive tutoring systems.

This study employs a mixed-methods approach, integrating bibliometric and content analysis to explore AIED concepts. It underscores the need for advancing AI technologies, expanding

research in early education, enhancing collaboration across disciplines, and prioritizing theoretical contributions. As AI in education continues to grow, these findings serve as a foundation for future research and policy development.

References

1. Role of AI in Education, March 2023 [Interdisciplinary Journal and Humanity \(INJURY\)](#) 2(3):260-268 DOI:[10.58631/injury.v2i3.52](#) License [CC BY-SA 4.0](#).
2. <https://www.researchgate.net/publication/347606819> The role of educators in modern education, October 2020 [International Journal on Integrated Education](#) 3(10):180-183 DOI:[10.31149/ijie.v3i10.717](#) ,[CC BY 4.0](#)
3. Al-Bahrani, M, Gombos, Z. J., & Cree, A. (2018). The mechanical properties of functionalised MWCNT infused epoxy resin: A theoretical and experimental study. *Int. J. Mech. Mechatronics Eng*, 18, 76–86.
4. Al-Bahrani, Mohammed. (2019). The Manufacture and Testing of Self-Sensing CNTs Nanocomposites for Damage Detecting Applications. University of Plymouth.
5. Al-Bahrani, Mohammed, Alhakeem, Mohammed Ridh H., & Cree, Alistair. (2020). Damage sensing and mechanical properties of a laminate composite material containing MWCNTs during low-velocity impact. *Journal of Petroleum Research and Studies*, 10(4), 147–164.
6. Al-Abboodi, Hamid, Fan, Huiqing, Mhmood, Ibtiha A., & Al-Bahrani, Mohammed. (2022). The dry sliding wear rate of a Fe-based amorphous coating prepared on mild steel by HVOF thermal spraying. *Journal of Materials Research and Technology*, 18, 1682–1691.
7. <https://www.researchgate.net/publication/351082272> Role of Artificial Intelligence in Education, Kandula Neha Assistant Professor, Dept of Artificial Intelligence, Vidya Jyothi Institute of Technology, Aziz Nagar, Hyderabad-75 nehak.ai@vjit.ac.in .
8. Predicting instructor performance using data mining techniques in higher education *IEEE Access*, 4 (2016), pp. 2379-2387, [10.1109/ACCESS.2016.2568756](#).
9. Artificial intelligence in education: Addressing ethical challenges in K-12 settings *AI and Ethics*, 2 (2022), pp. 431-440, [10.1007/s43681-021-00096-7](#).
10. Crompton and Burke *Int J Educ Technol High Educ* <https://doi.org/10.1186/s41239-023-00392-8>

11. his report is in the public domain and available on the U.S. Department of Education's (Department's) website at <https://tech.ed.gov>.
12. Educational AI Tools for Students <https://www.iu.org/blog/ai-and-education/best-ai-tools-for-students/>