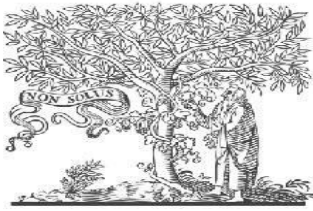




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Link : <https://ijiemr.org/downloads/Volume-12/Issue-05>

10.48047/IJIEMR/V12/ISSUE05/54

Title The Impact of Artificial Intelligence on Students: Shaping Education for the Future

Pages: 576-586

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The Impact of Artificial Intelligence on Students: Shaping Education for the Future

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Abstract

Here it describes the current state of the art in artificial intelligence (AI) and its potential impact for learning, teaching, and education in students. It provides conceptual foundations for well-informed policy-oriented work, research, and forward-looking activities that address the opportunities and challenges created by recent developments in AI. The report is aimed for policy developers, but it also makes contributions that are of interest for AI technology developers and researchers studying the impact of AI on economy, society, and the future of education and learning. The education system and structure should be challenging, competitive, and meet international benchmarks. Artificial intelligence can turn knowledge into a comprehensive system that uses augmented reality tools and simulation.

One of the benefits of using artificial intelligence is the automation of administrative work. Teachers can focus on greater engagement with students while paperwork processes are automated. From school admissions to the grading of exams, technology is a great help here by saving time and energy.

Another benefit of automation is the greater accessibility of quality education regarding intelligent content. Teachers can create customized study materials tailored to students' needs in different regions. New formats include online lectures and video conferences. Artificial intelligence can also help students identify and streamline their career choices. Artificial intelligence has become an integral part of the education industry. The use of AI is not limited to personalized learning and student engagement, but it is also used to identify potential problems and enhance the security of schools.

Introduction

In recent years, artificial intelligence (AI) has emerged as a powerful force transforming various aspects of our lives. One area where AI is making significant strides is education. With its ability to process vast amounts of data, adapt to individual needs, and provide personalized learning experiences, AI is reshaping the way students learn and educators teach. In this blog, we will explore the impact of artificial intelligence

on students and discuss how this technology is revolutionizing education.

1. Personalized Learning and Adaptive Teaching

Personalized learning and adaptive training are two key aspects of artificial intelligence (AI) in education that are transforming the way students learn and educators teach. Let's explore each of these concepts in detail.

1. Personalized Learning:

Personalized learning refers to tailoring the learning experience to meet the individual needs, interests, and abilities of each student. AI technology plays a crucial role in enabling personalized learning by analyzing vast amounts of data and creating customized learning paths for students. Here's how AI facilitates personalized learning:

a) Individualized Content: AI-powered platforms can assess a student's knowledge level, learning style, and preferences to provide customized content. By analyzing data from previous interactions, AI algorithms can recommend appropriate learning resources, such as articles, videos, interactive modules, or simulations, that match the student's specific learning needs and goals.

b) Adaptive Assessment: AI can administer adaptive assessments that adapt to the student's responses in real-time. Instead of using a one-size-fits-all approach, adaptive assessments adjust the difficulty and type of questions based on the student's performance. This ensures that students are appropriately challenged and allows educators to identify areas where additional support may be required.

c) Personalized Feedback: AI-powered platforms can provide immediate and personalized feedback to students. Through natural language processing and machine learning algorithms, AI can analyze student responses and offer tailored feedback, highlighting areas of improvement and suggesting specific strategies to enhance learning.

d) Self-Paced Learning: AI allows students to learn at their own pace. Adaptive learning systems track the progress of each student and adjust the difficulty and

pace of the content accordingly. This ensures that students neither feel overwhelmed nor bored, as the content is dynamically adapted to their individual learning speed.

2. Adaptive Training:

Adaptive training focuses on dynamically adjusting instructional strategies to cater to the unique needs of each student. With AI, educators can provide adaptive training by leveraging data-driven insights and real-time feedback. Here's how AI enables adaptive training:

a) Intelligent Tutoring Systems: AI-powered intelligent tutoring systems act as virtual tutors, providing personalized guidance and support to students. These systems use machine learning algorithms to analyze student performance, identify areas of difficulty, and deliver targeted interventions. By understanding the student's strengths and weaknesses, intelligent tutoring systems can tailor their instructional strategies to address specific learning gaps and provide additional practice or explanations as needed.

b) Personalized Interventions: AI algorithms can detect patterns in student performance and identify when a student is struggling with a particular concept or skill. Based on these insights, adaptive training systems can offer personalized interventions, such as additional practice exercises, alternative explanations, or supplementary resources, to help students overcome their challenges and reinforce their understanding.

c) Real-time Monitoring: AI enables real-time monitoring of student progress and engagement. By collecting and analyzing data on student interactions, AI algorithms can provide educators with insights into how students are engaging with the content, where they might be facing difficulties, and how they are

progressing over time. This allows educators to adapt their instructional strategies and provide timely support when necessary.

d) Continuous Improvement: AI algorithms can track and analyze data from multiple students over time, enabling educators to identify trends, patterns, and areas for improvement in their instructional practices. By leveraging these data-driven insights, educators can refine their teaching methodologies, identify effective instructional approaches, and make evidence-based decisions to enhance student learning outcomes.

In summary, personalized learning and adaptive training powered by AI enable educators to tailor the learning experience to the individual needs of students. By providing customized content, adaptive assessments, personalized feedback, and tailored interventions, AI technology supports students in achieving their full potential and enhances the effectiveness of teaching.

2. INTELLIGENT TUTORING SYSTEMS

Intelligent Tutoring Systems (ITS) are AI-powered educational tools that simulate the role of a human tutor, providing personalized guidance and support to students. ITS leverage artificial intelligence technologies, such as machine learning and natural language processing, to deliver adaptive and interactive learning experiences. Let's delve into the details of Intelligent Tutoring Systems and how they work:

Components of Intelligent Tutoring Systems:

1. Knowledge Base: The knowledge base of an ITS contains a vast repository of domain-specific information, including concepts, rules, and problem-solving strategies. This knowledge is typically

encoded in a formal representation that the system can use to generate personalized instruction and responses.

2. Student Model: The student model represents the learner's knowledge, skills, and progress. It is continuously updated as the student interacts with the system, capturing their strengths, weaknesses, misconceptions, and learning preferences. The student model helps the ITS adapt its instruction and interventions to meet the individual needs of each student.

3. Pedagogical Model: The pedagogical model encompasses the instructional strategies and methods employed by the ITS. It determines how the system delivers content, provides feedback, and scaffolds the learning process. The pedagogical model is designed to support effective learning and engage students in meaningful interactions.

Working of Intelligent Tutoring Systems:

1. Assessment and Diagnosis: Intelligent Tutoring Systems begin by assessing the student's knowledge and skills in the domain. This assessment can take the form of pre-tests, quizzes, or interactive activities. By analyzing the student's responses, the system can diagnose the student's level of understanding and identify areas of difficulty or misconceptions.

2. Personalized Instruction: Based on the assessment results and the student's model, the ITS generates personalized instruction tailored to the student's needs. This instruction can take various forms, including explanations, examples, demonstrations, and interactive activities. The system presents the content in a manner that suits the student's learning preferences and adapts its delivery based on the student's responses and progress.

3. Feedback and Guidance: Intelligent Tutoring Systems provide immediate and personalized feedback to students. The feedback can be in the form of corrective explanations, hints, or suggestions to help the student overcome challenges or correct misconceptions. The system monitors the student's interactions and progress, offering guidance and support whenever necessary.

4. Adaptive Intervention: As the student engages with the system, the ITS continuously monitors their performance and updates the student model. If the system detects persistent difficulties or a lack of progress in a particular area, it can provide adaptive interventions. These interventions may include additional practice exercises, targeted remediation, or alternative explanations to support the student's learning process.

5. Progress Tracking and Assessment: Intelligent Tutoring Systems track and record the student's progress, achievements, and learning outcomes over time. The system generates reports and analytics that provide insights into the student's strengths, weaknesses, and areas for improvement. These reports help educators and students themselves understand their progress and inform further instructional decisions.

Benefits of Intelligent Tutoring Systems:

1. Personalized Learning: ITS provide tailored instruction and support, adapting to the unique needs and learning styles of each student. This personalized approach enhances engagement, comprehension, and retention.

2. Immediate Feedback: Students receive instant feedback on their performance, allowing them to correct mistakes and reinforce learning in real-time.

3. Adaptive Intervention: ITS identify areas of difficulty and provide targeted interventions to help students overcome challenges and build their understanding.

4. Enhanced Engagement: The interactive and dynamic nature of ITS makes learning more engaging, motivating, and interactive for students.

5. Data-Driven Insights: ITS generate valuable data and analytics on student performance, enabling educators to gain insights into student progress, instructional effectiveness, and areas for improvement.

In summary, Intelligent Tutoring Systems leverage AI technologies to provide personalized instruction, adaptive interventions, and immediate feedback.

3. Enhanced Accessibility and Inclusivity

Enhanced accessibility and inclusivity are significant benefits of utilizing artificial intelligence (AI) in education. AI technology has the potential to bridge the gap and create equal opportunities for students with disabilities or special needs. Let's explore in detail how AI enhances accessibility and inclusivity in education:

1. Assistive Technologies: AI-powered assistive technologies play a vital role in making educational resources accessible to students with disabilities. These technologies leverage AI algorithms to provide alternative ways of accessing information. For instance:

- Text-to-Speech (TTS): AI-based TTS systems convert written text into spoken words, enabling students with visual impairments or reading difficulties to access educational content. TTS systems can also adjust the speech rate, tone, and pronunciation to match individual preferences.

- Speech-to-Text (STT): AI-powered STT systems convert spoken language into written text. This technology benefits students with hearing impairments or those who struggle with written communication.

- Optical Character Recognition (OCR): OCR technology uses AI to convert printed text into digital text, which can then be read aloud or modified according to the student's needs. This helps students with visual impairments or dyslexia to access printed materials.

2. Language Translation: AI language translation tools facilitate language learning and inclusion for non-native English speakers. These tools employ machine learning algorithms to translate educational content into different languages, allowing students to understand and engage with the material effectively. Language translation AI also aids in fostering cultural diversity and creating an inclusive learning environment.

3. Automated Captioning and Subtitling: AI can automatically generate captions and subtitles for educational videos or multimedia content. This feature benefits students with hearing impairments, as well as non-native speakers who may have difficulty understanding spoken language. Automated captioning and subtitling help ensure that all students can comprehend the audiovisual content being presented.

4. Adaptive Interfaces: AI can adapt interfaces and user experiences based on individual preferences and needs. This feature allows students with motor impairments or disabilities to interact with educational platforms more effectively. Adaptive interfaces can modify the size, layout, and navigation options to accommodate various accessibility

requirements, improving usability and inclusivity.

5. Personalized Learning Paths: AI enables the creation of personalized learning paths that consider the unique needs of each student, including those with learning disabilities or special educational needs. AI algorithms analyze student performance, progress, and behavior to tailor instructional content, activities, and assessments. By providing personalized learning experiences, AI supports students in reaching their full potential regardless of their individual challenges.

6. Learning Analytics: AI-driven learning analytics provide valuable insights into student engagement, progress, and performance. These analytics help educators identify patterns, trends, and areas where additional support may be required for students with disabilities. By analyzing data, educators can make informed decisions and implement targeted interventions to ensure equitable access to quality education for all students.

7. Collaboration and Communication: AI-powered communication tools facilitate collaboration and communication among students, including those with disabilities. AI-based chatbots or virtual assistants can assist students in finding information, answering questions, or providing guidance. These tools enhance inclusivity by ensuring that all students can participate and engage in group work or class discussions.

In conclusion, AI enhances accessibility and inclusivity in education by providing assistive technologies, language translation, automated captioning, adaptive interfaces, personalized learning paths, learning analytics, and communication tools. These advancements ensure that educational resources and experiences are accessible

to all students, regardless of their abilities or disabilities, fostering an inclusive and equitable learning environment.

4. Intelligent Content Recommendation

Intelligent content recommendation is a valuable application of artificial intelligence (AI) in education. It involves leveraging AI algorithms to analyze student data and provide personalized recommendations for educational content. By understanding students' learning preferences, goals, and performance, AI-powered systems can suggest relevant and engaging resources that cater to their individual needs. Here's a detailed explanation of how intelligent content recommendation using AI works:

1. **Data Collection:** AI-powered educational platforms collect and analyze a wide range of data points about students. This includes their learning behaviors, interactions with content, performance in assessments, and preferences expressed through explicit feedback or implicit indicators. The data is anonymized and processed to protect student privacy.

2. **Profiling and Modeling:** Based on the collected data, AI algorithms create student profiles and models. These profiles capture information about students' interests, strengths, weaknesses, learning styles, and previous interactions with educational content. The models evolve and adapt over time as more data is collected, enabling the AI system to refine its recommendations.

3. **Content Analysis:** The AI system analyzes the educational content available in its database. This includes textbooks, articles, videos, interactive modules, simulations, and other resources. The content is typically tagged or categorized based on various attributes, such as

subject, difficulty level, format, and learning objectives.

4. **Recommendation Generation:** The AI system employs machine learning algorithms to generate personalized content recommendations for each student. The recommendation process involves the following steps:

a) **Preference Analysis:** The system analyzes students' preferences and interests based on their interactions with content. It identifies patterns in their engagement, such as topics they frequently access, types of resources they prefer, or formats they find most engaging.

b) **Collaborative Filtering:** The AI system also considers the behaviors and preferences of similar students. It looks for patterns among students with similar profiles and identifies content that has been positively received by those with similar characteristics. This approach, known as collaborative filtering, helps to identify relevant content that students may not have discovered otherwise.

c) **Content-Student Matching:** The AI system matches the available educational content with the student profiles and preferences. It takes into account factors such as the student's learning goals, past performance, and the suitability of the content for their current level of understanding.

d) **Dynamic Adaptation:** The recommendations are not static but adapt over time. As students engage with the recommended content, their interactions and feedback are incorporated into the AI system. This ongoing feedback loop helps refine and adjust future recommendations to better align with the students' evolving needs and preferences.

5. **Presentation and Delivery:** The AI system presents the content recommendations to students through user interfaces, such as a dashboard, learning management system, or personalized learning platforms. The recommendations may be displayed as a list, visually organized based on relevance, or accompanied by brief descriptions or ratings to help students make informed choices.

6. **Continuous Evaluation:** The AI system continually evaluates the effectiveness of its content recommendations. It assesses whether students find the recommended resources helpful, whether they engage with them, and how they perform when using those resources. This evaluation process helps the AI system improve its recommendation algorithms and ensure that students receive high-quality and relevant content.

Benefits of Intelligent Content Recommendation:

1. **Personalization:** Intelligent content recommendation provides students with personalized learning experiences, enabling them to access resources that match their individual needs, interests, and learning styles.

2. **Engagement and Motivation:** By offering relevant and engaging content, AI-powered recommendation systems can enhance students' motivation and engagement, as they are more likely to connect with materials that align with their interests and preferences.

3. **Exploration and Diversification:** Intelligent recommendations can introduce students to new topics, resources, or perspectives that they may not have discovered on their own. This encourages exploration, curiosity, and the development of a broader knowledge base.

4. **Time-Saving:** AI-driven content recommendations save time for both students and educators. Instead of spending significant effort searching for appropriate resources, students can rely on the system's recommendations, freeing up time for more focused learning.

5. **Adaptive Learning Paths:** Recommendations can be integrated into adaptive learning paths, ensuring that students progress through content at a suitable pace and receive resources that address their specific learning gaps.

6. **Continuous Improvement:** The AI system's ability to collect and analyze data on student interactions and outcomes allows for continuous improvement of the recommendation algorithms and content quality.

In summary, intelligent content recommendation leverages AI algorithms to analyze student data, preferences, and learning objectives to provide personalized and relevant educational content. This approach enhances engagement, motivation, and learning outcomes by connecting students with resources that cater to their individual needs and interests.

5. Data-Driven Insights for Educators

Data-driven insights for educators using AI refer to the use of artificial intelligence technologies to analyze and extract valuable information from educational data. By leveraging AI algorithms, educators can gain deeper insights into student performance, learning patterns, and instructional effectiveness. These insights can inform decision-making, instructional design, and personalized support. Here's a detailed explanation of how data-driven insights using AI can benefit educators:

1. **Data Collection and Integration:** AI-powered educational platforms collect various types of data, including student assessments, engagement metrics, learning activities, and feedback. These data sources are integrated and consolidated into a centralized repository for analysis.

2. **Data Analysis and Visualization:** AI algorithms analyze the collected data to identify patterns, trends, and correlations. This analysis can be performed at both individual and group levels. The results are often presented in visually appealing and easy-to-understand formats, such as charts, graphs, and dashboards.

3. **Student Performance Monitoring:** AI-based systems can continuously monitor and track student performance over time. Educators can access real-time updates on students' progress, achievements, and areas of improvement. This information allows educators to identify struggling students, intervene when necessary, and provide targeted support.

4. **Learning Analytics:** AI-driven learning analytics provide insights into how students engage with educational content and resources. Educators can examine data on student interactions, time spent on tasks, completion rates, and resource utilization. This helps identify which instructional materials and activities are most effective and engaging for students.

5. **Individualized Instruction:** Data-driven insights can support personalized instruction. By analyzing individual student data, AI algorithms can identify knowledge gaps, learning preferences, and specific areas where additional support is needed. This information enables educators to design customized learning paths and interventions tailored to each student's needs.

6. **Predictive Analytics:** AI algorithms can analyze historical data to predict future outcomes and trends. Educators can use these predictive insights to anticipate student performance, identify at-risk students, and proactively provide targeted interventions. Predictive analytics help educators make data-informed decisions and allocate resources effectively.

7. **Curriculum Design and Improvement:** Data-driven insights can inform curriculum design and improvement efforts. By analyzing student performance data, educators can identify areas where the curriculum may need adjustment or enhancement. This enables continuous refinement of instructional materials, activities, and assessments to better align with student needs and optimize learning outcomes.

8. **Evidence-Based Decision Making:** AI-powered data analysis provides educators with evidence-based insights. By considering objective data rather than relying solely on intuition or anecdotal evidence, educators can make informed decisions about instructional strategies, resource allocation, and student support.

9. **Professional Development and Teacher Training:** Data-driven insights can support professional development and teacher training initiatives. Educators can use analytics to assess their own instructional practices, identify areas for improvement, and access personalized professional development resources and recommendations.

10. **Feedback Loop and Continuous Improvement:** AI systems facilitate a feedback loop, where data-driven insights inform instructional decisions, and the outcomes of those decisions generate further data for analysis. This iterative process supports continuous improvement in teaching practices,

student engagement, and learning outcomes.

In summary, data-driven insights for educators using AI enable the analysis of educational data to gain valuable insights into student performance, learning patterns, and instructional effectiveness. By leveraging AI algorithms, educators can make data-informed decisions, personalize instruction, improve curriculum design, and enhance student support, ultimately leading to improved learning outcomes for students.

Examples of AI in education

AI is already being applied successfully in several educational instances and improves learning and student development, as well as educators' performance.

Let's take a closer look at a few applications:

1. **Emotional well-being:** A child's emotional state affects how well they can focus, engage, and stay motivated to learn. Virtual schools can be just as effective as face-to-face learning environments when they use emotion recognition technology. Thanks to gamification, learning can also be adjusted to be fun. Furthermore, AI can determine where students struggle and help them to improve and, ultimately, excel.⁹
 2. **Spotting and filling the gaps:** AI can identify the gaps in teachers' presentations and educational material, and suggest adjustments where needed.¹⁰
 3. **Children working alongside AI:** Nao is a humanoid robot that talks, moves, and teaches children everything from literacy to computer programming. Nao engages children in learning science, technology, engineering, and mathematics (STEM) subjects, and provides a fun coding lab for students. This introduction to basic coding allows students to instruct the robot to perform specific tasks, such as using hand gestures or doing choreographed dances. This way, students get the opportunity to become familiar with telling a robot (or program) what to do, thereby preparing them for a future where robots and humans work together.¹¹
- The following educational applications harness the power of AI to improve learning in students of all ages:¹²
1. **Thinkster Math:** Thinkster Math is a tutoring app that blends the math curriculum with a personalized teaching style. The app uses AI and ML to visualize how students think as they work through a math problem. This allows the tutor to quickly spot areas in the child's thinking and logic that need work. It then assists them by giving them immediate, personalized feedback.
 2. **Brainly:** Students can ask homework questions on this education platform and receive automatic, verified answers from fellow students. Brainly, which ultimately helps students learn faster, uses ML algorithms to filter out spam.
 3. **Content Technologies, Inc. (CTI):** This AI company uses deep learning to create customized learning tools for students. One of these tools, JustTheFacts101, makes it easy for teachers to import syllabi into a CTI engine. The machine then uses algorithms to create personalized textbooks and coursework based on core concepts. Cram101 is another example of an AI-enhanced offering, where any textbook can be turned into a smart study guide, providing bite-sized content that's easy to learn in a short space of time. The tool even produces multiple-choice questions, saving students time and helping them learn more effectively.
 4. **Gradescope:** This platform makes grading less time-consuming (teachers' grading time is reduced by 70 percent or more) and provides student data that can indicate where they need additional assistance.

5. **Duolingo:** With more than 120 million users worldwide, Duolingo has a broad audience that reaches beyond the classroom. It offers 19 languages and helps anyone using the app to learn a foreign language, building their skills over time. With quizzes and other tests, the program adapts to each user's abilities to offer new challenges.

Conclusion

Artificial intelligence is revolutionizing education by transforming traditional classrooms into personalized, adaptive, and inclusive learning environments. Through personalized learning, intelligent tutoring systems, enhanced accessibility, intelligent content recommendation, and data-driven insights for educators, AI is empowering students to reach their full potential and enabling educators to deliver tailored instruction. While AI cannot replace human teachers, it serves as a powerful tool that complements their expertise and enhances the learning experience. As AI continues to advance, it is crucial for educators and policymakers to embrace this technology and harness its potential to shape education for the future. By leveraging AI effectively, we can create a more equitable, engaging, and effective educational system that prepares students for the challenges and opportunities of the 21st century.

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