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Use of Artificial Intelligence in Under Graduate Computer Education

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Abstract: AI-based educational tools are designed to enhance the effectiveness of students' understanding of programming concepts. These tools provide several benefits for self-paced learners by simplifying the learning process. AI-based tools help to decrease the amount of time required for teachers to complete everyday administrative tasks and enhance student motivation through interactive environments. There are many obstacles to the implementation of AI in education, including high costs, infrastructural needs, and privacy issues, but AI acts as an assistant to teachers and not a replacement for human instructors. In this paper, we discuss the applications, benefits, limitations, and future potential of AI in computer-related education.

Keywords: Artificial Intelligence, technology, Computer Education, UG Students, Teacher,

1. INTRODUCTION

Computer Science has become a vital element of higher education as it provides students with the knowledge and skills needed for a rapidly growing technological economy. A typical undergraduate student's computer science curriculum will include programming languages, data structures, databases, operating systems, and software development courses. The aforementioned topics require continual practice and the ability to comprehend concepts; therefore, the establishment of innovative teaching approaches is necessary if we wish to enhance the effectiveness of computer science education since traditional methods of teaching generally are not suited to accommodate individual variances between students in terms of their pace for learning and their capacity to learn [1],[2].

Artificial Intelligence has established itself as a major player in enhancing the process of teaching and learning in computer science by providing teachers with tools such as intelligent tutoring systems, customized learning environments, automated testing and grading systems, and virtual assistance for students. AI refers to the ability of computer systems to perform tasks such as learning, reasoning, and problem-solving that normally require human intelligence [3]. Through the analysis of student behaviours in learning, these systems are able to provide appropriate feedback and to create unique learning opportunities for the student. According to several studies, using Artificial Intelligence in education increases student engagement and the efficiency of their learning, as well as academic achievement, particularly for computer science courses that require logical thought and the practical application of knowledge [4][2].

2. ARTIFICIAL INTELLIGENCE: BASIC CONCEPT

Artificial Intelligence is a branch of computer science that creates artificial machines to do things similar to human activity. AI creates machines that can perform tasks considered to require human intelligence such as learning, reasoning, decision making, and problem solving. Some technology examples of AI are;

2.1 Machine Learning

Machine Learning is being used widely in the education sector to track students' behaviour, performance, and progress over time. ML enables the learning systems to provide recommendations of suitable learning materials, appropriate coding exercises, and appropriate difficulty levels based on the individual needs of the student. Using the models developed through ML in the area of programming education allows the prediction of student difficulties and provides support to those students based on their expected time needs. It has been shown that machine learning helps to create personalised approaches of learning and improves the outcomes of learning through the use of computers [1].

2.2 Natural Language Processing

Natural Language Processing is being used in the education sector to provide communication for students with AI systems. NLP is used to power chatbots and other virtual assistant systems that provide answers to students' questions, help to explain programming concepts, and support students with their learning outside of formal classroom times. NLP is also being used for automatic rating of written response answers and through the use of discussion forums. The use of NLP provides for better opportunities for improving the accessibility and communication between students and their AI peers in digital classroom settings [4][6].

2.3 Expert Systems

Expert systems are utilized in the area of computer education to aid students in decision making and solving problems, much like human experts do. They use a set of rules already established, along with a knowledge base, to assist students with debugging their programs, determining which algorithm to use, as well as helping to understand complicated materials. Such expert systems are particularly helpful in teaching software engineering and database design. Research has found that expert systems improve students' understanding of concepts, as well as their ability to learn independently [3][5].

2.4 Neural Networks

Neural networks are applied in computer education for "recognizing patterns" and "Adaptive Learning Systems." Neural networks assist in evaluating student's programming assignments, recognizing patterns of student learning, and

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developing Intelligent Tutoring Systems. Neural networks can also be used in automated grading systems and virtual labs, and are advantageous for their ability to provide accuracy and adaptability over more traditional methods. Additionally, neural networks can process data types that were previously unavailable to educators in the form of datasets of greater complexity (e.g., video files, images, etc.) [1][2].

3. APPLICATIONS OF AI IN COMPUTER EDUCATION

In education, AI is used to support students and teachers through smart learning systems.

3.1 Intelligent Tutoring Systems

Intelligent Tutoring Systems are Artificial Intelligence-based systems that offer personalized instruction to learners. Intelligent Tutoring Systems automatically create a personalized learning plan based on student information and a variety of other data. Such system continuously analyzes student responses to determine where a student is making mistakes when learning programming or computer concepts, and provide hints, explanations, and corrective feedback in real-time. This kind of system has proven beneficial in helping students learn complex subjects and develop problem-solving abilities when studying computer education [3][4].

3.2 AI-Adapted Content

AI-Adaptive Learning system uses AI algorithms to adapt the educational content to fit each individual student, their learning pace, and their performance. Essentially, AI systems track the progress of students, then based on their progress provide customized study materials, coding exercises, and tests for each student. For slower learners this approach allows for gradual improvement while for more accomplished students there are opportunities to delve into more advanced concepts. Studies show that the motivational enhancement and improved academic performance experienced by students who engage in personalized learning processes powered by AI is very significant in the realm of computer education [2],[5].

3.3 Automated Evaluation

Automated assessment is arguably the most powerful use of AI technology within computer education. Automated tools utilize AI technology to analyse quizzes, assignments or programming implementations by scrutinising correctness, logical structure and efficiency. Additionally, automated evaluation enables students to receive immediate feedback so they can make corrections as soon as possible, thus improving their skills and developing confidence within the field. The use of automated assessment also means less time is spent evaluating, therefore providing fair and consistent assessment of students [1][6]

3.4 Virtual Labs

AI-driven virtual laboratories enable learners to conduct hands-on experiments and coding exercises as though they were in an actual lab. Virtual laboratories enable learners to conduct computer-based experiments without the necessity of having an actual laboratory. Virtual laboratories are especially useful in online programs and the Distance Education systems that use virtual laboratories to offer learners greater flexibility, opportunity for practical application and a means of having education accessible to learners at a time and place most convenient for them [2][6].

3.5 Chatbot and Virtual Assistant

Chatbots and Virtual Assistants utilize AI and Natural Language Processing to communicate and interact with students in real-time. Chatbots answer questions regarding Computer Science related to course materials, assignments and exams, in addition to providing students with aid in their studies at any hour of the day or night. Chatbot technology helps students resolve questions outside of class, thus promoting independence within the student. AI Chatbots are a mechanism for continuing the engagement of students and supporting them with continual academic support [4][7].

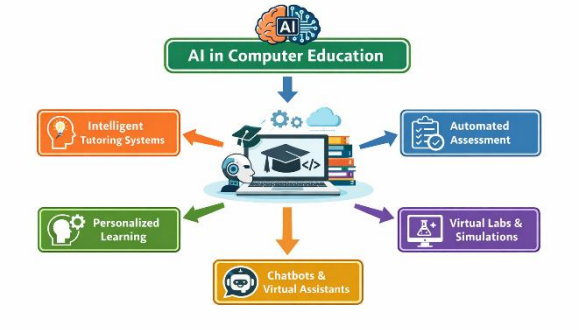

Fig. : Simple Block Diagram of AI in Computer Education

4. ADVANTAGES OF AI IN COMPUTER EDUCATION

Using Artificial Intelligence (AI) students improves understanding of programming concepts that helps their understanding of programming concepts by providing step-by-step guidance and clear explanations during coding practice. AI-based programming tools helps students learns concept of loops, functions, and conditional statements more effectively and also helps to identify errors in syntax and logic as students practice coding and provide recommendations for correcting said errors. Intelligent tutoring systems adapt explanations based on student responses, making learning easier for beginners. Studies show that AI-based tutors significantly improve conceptual clarity in computer programming [3][4].

4.1 Supports Self-Paced Learning

AI-based tools support students to learn computer science subjects to their individual speed and learning ability as a self-paced learning. Students have the opportunity to go back over material they have difficulty with, practice coding exercises as many times as they need, and only proceed once they have demonstrated proficiency with each topic. This flexibility alleviates some of the stress associated with learning for students who may be less confident due to their slower rate of progression. Additionally, AI-created personalized learning spaces have been shown to promote increased student retention and success academically [1][2].

4.2 Providing Immediate Feedback

One of the key benefits that AI provides to the realm of Computer Education is Immediate Feedback to students

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regarding their performance on programming assignments, quizzes and online tests. The automated nature of AI systems enables them to automatically evaluate programming assignments, quizzes and online tests, and to highlight errors with the appropriate suggestion for improving them. In other words, AI systems provide real-time feedback to students on how to correct their errors, therefore improving their coding accuracy. Research has shown that Immediate Feedback has a direct correlation on the efficiency of learning and on reducing repeated errors when completing programming tasks [4][5].

4.3 Decreasing Teacher Workloads

AI also decreases the Workload of Teachers by automating the repetitive and routine academic functions associated with a teacher's job such as grading assignments, checking the accuracy of codes and responding to student questions. These automated academic functions free up a teacher's time to spend on teaching and mentoring their students as well as on their own research. In addition, through the use of automated assessments, AI improves the consistency and accuracy of a teacher's evaluations. AI greatly enhances the efficiency of teaching by decreasing administrative burdens on teachers [1][6].

4.4 Promoting Student Engagement

AI promotes Student Engagement through interactive, learner-centered computer education applications such as Chatbots, Virtual Labs, and Intelligent Tutoring Systems that facilitate active participation through interactive learning activities and allow continual practice. Interactive AI Environments motivate students to explore independently and remain invested in learning about computer-related topics. In recent years, the evidence of the increased engagement created by AI-enabled Educational Solutions has been linked to positive impacts on student motivation and learning outcomes [2][7].

5. LIMITATIONS OF AI IN EDUCATION

5.1 High Financial Investment to Use AI Tools

The cost of developing, purchasing and maintaining the tools needed to use Artificial Intelligence (AI) as part of an educational system is one of the major limitations for educational institutions implementing AI systems in Higher Education. To successfully implement an AI system, an educational institution must invest significant financial resources into (1) the software they want to use, (2) the hardware associated with using the AI systems, and (3) the professional staff necessary to successfully implement the AI systems. This creates a major barrier to small higher education institutions and those institutions that do not have large budgets; they struggle with financial constraints to adopt AI on a wider scale [1][6].

5.2 Need for Access to an Internet Connection and/or Technical Infrastructure

Institutions using AI-based systems for education require reliable internet connections and/or very sophisticated technical infrastructures to run their systems properly. In addition, many AI-based education systems utilise cloud computing technology and require the capacity to process data in real-time. Unfortunately, this technology is not widely available in many rural or developing locations, and institutions in these locations will not be able to offer access to AI-powered learning systems due to a lack of proper infrastructure; thus, they create a digital divide which will negatively impact access to equal educational opportunities for their students [2][6].

5.3 Privacy Issues Associated with AI Systems

AI systems store and/or collect a large number of data points regarding their students such as academic performance, contact information and financial information, and, consequently, create the potential for a significant number of Privacy Issues associated with the data collected. Therefore, institutions must carefully consider their data protection policies to prevent unauthorised access to confidential information associated with their students. Researchers continue to advocate that among the strongest ethical principles associated with using AI in education are the establishment of strong ethical guidelines and provisions designed to protect student data [6][7].

5.4 Human Teachers Cannot Be Replaced Entirely by AI

The use of artificial intelligence (AI) for teaching and learning does not eliminate the need for human teachers. In fact, teaching is a process that requires emotional awareness, moral guidance, creative thinking, and the ability to interact with students.All of these aspects of teaching cannot be replicated by an AI system. The best way to support student motivation and address individual emotional needs is through a human teacher.Most experts agree that while AI will enhance the learning experience for students in higher education, it should not replace human teachers [2][3].

6. CONCLUSION

The primary reason to use AI for computer education is to provide students with a more interactive, personalized, and efficient means of learning. Students' studies computer science programmes in college, AI will provide more in-depth understanding of programming concepts and increase their programming skills. In addition, AI will allow students to learn at their own pace, with a focus on what is most relevant to them, and will enable students to receive immediate feedback on their assessments. While AI may relieve some of the workload of teachers, it will allow teachers to focus on providing higher-quality mentorship to their students. Despite some of the issues associated with using AI for class instruction, i.e. cost, infrastructure, and data privacy, AI has the ability to enhance rather than replace the role of the teacher if implemented correctly. By providing a better resource to students, AI can improve the overall quality of computer education and prepare students for successful careers in IT and software development.

REFERENCES

[1]. J. A. O'Brien and G. M. Marakas, *Management Information Systems*, McGraw-Hill, 2019.
[2]. W. Holmes, M. Bialik, and C. Fadel, *Artificial Intelligence in Education*, Pearson, 2019.
[3]. S. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach*, 4th ed., Pearson, 2021.
[4]. B. P. Woolf, *Building Intelligent Interactive Tutors*, Morgan Kaufmann, 2010.
[5]. P. Brusilovsky and E. Millán, "User Models for Adaptive Educational Systems," Springer, 2007.
[6]. UNESCO, *AI and Education: Guidance for Policy Makers*, 2021.
[7]. Z. Zhai et al., "Conversational AI in Education," *IEEE Access*, 2021.

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