

Increasing Trend of Artificial Intelligence in Colleges

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Abstract – The rapid advancement of technology, such as artificial intelligence (AI) and robotics, has impacted all industries, including education. A recent report from IBM, Burning Glass and Business Higher Education Forum shows that the number of job opportunities for data and analytics skills will increase by 364,000 to 2,720,000 in 2020. That means that the gap between supply and demand of people with AI skills is growing, with one report showing a worldwide base of 300,000 AI professionals, but with millions of opportunities available and this gap is resulting in even higher salaries for those in this field.

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INTRODUCTION

Artificial intelligence (AI) is already providing teachers and schools with innovative ways to understand how their students are progressing, as well as allowing for a fast, personalised, targeted curation of content.

- **Personalised Learning:** Managing a class of 30 students makes personalised learning nearly impossible. However, AI can provide a level of differentiation that customises learning specifically to an individual student's weaknesses and strengths.
- **Teacher's Aide:** Teachers don't only teach, they also spend hours grading papers, and preparing upcoming lessons. However, certain tasks, such as marking papers, could be done by robots, giving teachers a lighter workload and more flexibility to focus on other things.¹³ Machines can already grade multiple-choice tests, and are close to being able to assess hand-written answers. There is also potential for AI to improve enrolment and admissions processes.
- **Teaching the Teacher:** Artificial intelligence makes comprehensive information available to teachers any time of day. They can use this information to continue educating themselves in things such as learning foreign languages or mastering complex programming techniques.

- **Connecting Everyone:** Because AI is computer-based, it can be connected to different classrooms all over the world, fostering greater cooperation, communication, and collaboration among schools and nations.

EXAMPLES OF ARTIFICIAL INTELLIGENCE IN EDUCATION

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

1. **Emotional Well-Being:** A child's emotional state affects how well or poorly they are able to focus, engage and stay motivated to learn. With this in mind, a team from the Department of Artificial Intelligence in Madrid, Spain, led by Dr. Imbernon Cuadrado are working on a robot called ARTIE (Affective Robot Tutor Integrated Environment). ARTIE's chief role is to identify the emotional state of a student through keyboard strokes and mouse action, and then, by running an algorithm that chooses the most appropriate intervention required, give the student personalised educational support. These range from encouraging words, to gestures, or attempts to increase the students' interest and motivation towards a certain learning goal. ARTIE's design team have focused on three cognitive states:

concentrating, distracted and inactive, and have found that the social support behaviours provided by these robot tutors have positively impacted these students' ability to learning.

2. **Spotting and Filling the Gaps:** Artificial intelligence can identify the gaps in a teacher's presentation and educational material. The teacher is alerted by the system when a large number of students submit an incorrect answer to a homework assignment. The teacher can then provide hints to the correct answer for future students in order to improve the conceptual foundation of learning for that topic going forward.
3. **Children Working Alongside AI:**¹⁹ Nao is a humanoid robot that talks, moves, and teaches children from ages seven and up everything from literacy to computer programming. Nao engages children in learning STEM subjects, and provides a fun coding lab for students. This introduction to basic coding allows students to instruct the robot to perform certain things, such as hand gestures, emotional movements, and even choreographed dances. This way, students get the opportunity to become familiar with telling a robot (or program) to do the tasks they want to be done, and better prepares them to apply and train AI in the future.
3. **Content Technologies, Inc.:** Content Technologies, Inc. (CTI) is an AI company that uses Deep Learning to create customised learning tools for students, such as JustTheFacts101, where teachers import syllabi into a CTI engine. The CTI machine then uses algorithms to create personalised textbooks and coursework based on core concepts. Cram101 is another example of their AI-enhanced offering, where any textbook can be turned into a smart study guide, providing bite-sized content that is easy to learn in a short amount of time. It even produces multiple choice questions, saving students time and helping them learn more effectively.
4. **MATHiaU:** Similar to Thinkster Math, Carnegie Learning's MATHiaU offers AI-based tutoring tools for higher ed students who feel lost in lecturer-sized classrooms. The app is guided by each student's unique learning process, keeps them aware of their daily progress, and helps teachers tailor lessons to meet each student's specific struggle.
5. **Netex Learning:** Netex Learning allows teachers to design and integrate curriculum across a variety of digital platforms and devices. The easy-to-use platform allows teachers to create customised student content that can be published on any digital platform. Teachers also get tools for video conferences, digital discussions, personalised assignments, and learning analytics that show visual representations of each student's personal growth.

EDUCATION APPLICATIONS POWERED BY ARTIFICIAL INTELLIGENCE

These educational applications harness the power of AI to improve learning in students of all ages – from primary school through to college – and empower both learner and teacher with more avenues for reaching their educational goals.

1. **Thinkster Math:** Thinkster Math is a tutoring app that blends real math curriculum with a personalised teaching style. They use artificial intelligence and machine learning in their math tutor app to visualise how a student is thinking as they work on a problem. This allows the tutor to quickly spot areas in a student's thinking and logic that have caused them to become stuck, and assist them through immediate, personalised feedback.
2. **Brainly:** Brainly is a platform where students can ask homework questions and receive automatic, verified answers from fellow students. The site even allows students to collaborate and find solutions on their own. Brainly uses machine learning algorithms to filter out spam.

AI IN EDUCATION

The birth of AI goes back to the 1950s when John McCarthy organised a two-month workshop at Dartmouth College in the USA. In the workshop proposal, McCarthy used the term artificial intelligence for the first time in 1956 (Russel & Norvig, 2010, p. 17):

The study [of artificial intelligence] is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves.

Baker and Smith (2019) provide a broad definition of AI: "Computers which perform cognitive tasks, usually associated with human minds, particularly learning and problem-solving" (p. 10). They explain that AI does not describe a single technology. It is

an umbrella term to describe a range of technologies and methods, such as machine learning, natural language processing, data mining, neural networks or an algorithm.

AI and machine learning are often mentioned in the same breath. Machine learning is a method of AI for supervised and unsupervised classification and profiling, for example to predict the likelihood of a student to drop out from a course or being admitted to a program, or to identify topics in written assignments. Popenici and Kerr (2017) define machine learning “as a subfield of artificial intelligence that includes software able to recognise patterns, make predictions, and apply newly discovered patterns to situations that were not included or covered by their initial design” (p. 2).

The concept of rational agents is central to AI: “An agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators” (Russel & Norvig, 2010, p. 34). The vacuum-cleaner robot is a very simple form of an intelligent agent, but things become very complex and open-ended when we think about an automated taxi.

Experts in the field distinguish between weak and strong AI (see Russel & Norvig, 2010, p. 1020) or narrow and general AI (see Baker & Smith, 2019, p. 10). A philosophical question remains whether machines will be able to actually think or even develop consciousness in the future, rather than just simulating thinking and showing rational behaviour. It is unlikely that such strong or general AI will exist in the near future. We are therefore dealing here with GOFAI (“good old-fashioned AI”, a term coined by the philosopher John Haugeland, 1985) in higher education – in the sense of agents and information systems that act as if they were intelligent.

Given this understanding of AI, what are potential areas of AI applications in education, and higher education in particular? Luckin, Holmes, Griffiths, and Forcier (2016) describe three categories of AI software applications in education that are available today: a) personal tutors, b) intelligent support for collaborative learning, and c) intelligent virtual reality.

Intelligent tutoring systems (ITS) can be used to simulate one-to-one personal tutoring. Based on learner models, algorithms and neural networks, they can make decisions about the learning path of an individual student and the content to select, provide cognitive scaffolding and help, to engage the student in dialogue. ITS have enormous potential, especially in large-scale distance teaching institutions, which run modules with thousands of students, where human one-to-one tutoring is impossible. A vast array of research shows that learning is a social exercise; interaction and collaboration are at the heart of the learning process (see for example Jonassen, Davidson, Collins, Campbell, &

Haag, 1995). However, online collaboration has to be facilitated and moderated (Salmon, 2000). AIEd can contribute to collaborative learning by supporting adaptive group formation based on learner models, by facilitating online group interaction or by summarising discussions that can be used by a human tutor to guide students towards the aims and objectives of a course. Finally, also drawing on ITS, intelligent virtual reality (IVR) is used to engage and guide students in authentic virtual reality and game-based learning environments. Virtual agents can act as teachers, facilitators or students’ peers, for example, in virtual or remote labs (Perez et al., 2017).

With the advancement of AIEd and the availability of (big) student data and learning analytics, Luckin et al. (2016) claim a “[r]enaissance in assessment” (p. 35). AI can provide just-in-time feedback and assessment. Rather than stop-and-test, AIEd can be built into learning activities for an ongoing analysis of student achievement. Algorithms have been used to predict the probability of a student failing an assignment or dropping out of a course with high levels of accuracy (e.g. Bahadır, 2016).

In their recent report, Baker and Smith (2019) approach educational AI tools from three different perspectives; a) learner-facing, b) teacher-facing, and c) system-facing AIEd. Learner-facing AI tools are software that students use to learn a subject matter, i.e. adaptive or personalised learning management systems or ITS. Teacher-facing systems are used to support the teacher and reduce his or her workload by automating tasks such as administration, assessment, feedback and plagiarism detection. AIEd tools also provide insight into the learning progress of students so that the teacher can proactively offer support and guidance where needed. System-facing AIEd are tools that provide information for administrators and managers on the institutional level, for example to monitor attrition patterns across faculties or colleges.

In the context of higher education, we use the concept of the student life-cycle as a framework to describe the various AI based services on the broader institutional and administrative level, as well as for supporting the academic teaching and learning process in the narrower sense.

CONCLUSION

The World Economic Forum estimates that, by 2022, a large proportion of companies will have adopted technologies such as machine learning, and therefore strongly encourages governments and education to focus on rapidly raising education and skills, with a focus on both STEM (science, technology, engineering and mathematics) and non-cognitive soft skills, in order to meet this impending need.²⁵ Microsoft’s recent study shows

that, by 2030, students will need to have mastered two facets of this new world by the time they graduate.²⁶

- Know how to utilise ever-changing technology, such as AI, to their advantage
- Understand how to work with other people in a team to problem solve effectively

Preparing students to work alongside AI in the future can start early. As most children are comfortable with digital technology by the time they are of school age, teaching them the skills they'll need to thrive in a digital workplace is important.²⁷ Add the inclusion of AI in education, and the workforce of the future will be better prepared to face the unknown challenges of the workplace of tomorrow.

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