



The optimistic future of Artificial Intelligence in higher education

Miguel Ángel Escotet¹

Accepted: 28 May 2023 / Published online: 3 July 2023

© The Author(s) under exclusive licence to UNESCO International Bureau of Education 2023

Abstract Artificial Intelligence is a fast-evolving technology with enormous potential for education, higher education, and learning. AI can also negatively impact how societies and their citizens engage ethically with these generated, still-unexplored tools. These technological breakthroughs present both opportunity and potential peril. The problem of any new technological advancement depends not upon the technology itself but its practitioners. The article takes the optimistic side for the future of higher education. While being cautious about engaging with these technology applications, it presents an overview of generated AI (GenAI) for higher education such as ChatGPT, MidJourney or Codex, and “AI-driven learning”. AI technologies like Natural Language Processing (NLP), automated performance enhancement (APE), intelligent tutoring systems (ITSs), personalized learning systems (PLS), VR and AR, sentiment analysis, and many more can apply to different areas of teaching, learning, research, and service to society. Some AI immediate applications include student support, tutoring personalization, automated qualitative and quantitative grading and assessment, education data analytics, course programs, content development and educational planning, administration, and academic performance.

Keywords AI · Future · Higher education · Learning

Although the first historical references to artificial intelligence date back to the 1930s with Alan Turing, the starting point of AI is, precisely, the year 1950, when Turing published an article entitled “Computing machinery and intelligence” in the journal *Mind*. Already, in 1943, the article “A logical calculus of the ideas immanent in nervous activity”, by Warren McCullough and Walter Pitts, was the first mathematical model for creating a neural network (Escotet, 1987). However, 2023 will likely be considered, in the future, the year of exponential growth in artificial intelligence.

✉ Miguel Ángel Escotet
rector@uie.edu

¹ Intercontinental University of Business (UIE), Rua Nova, 33, Santiago de Compostela, Spain

Artificial intelligence's progress significantly impedes human growth, autonomy, and authority. Harari (2023a) suggests that AI poses a significant ethical concern, and we must take cautious measures to ensure a more optimistic future for both humans and AI since it has already hacked the operating systems of human civilization. Furthermore, Holmes and Porayska (2023) identify that the ethical consequences of engaging with AI remain unexplored tools in education and learning. The problem of any new technological advancement depends not upon the technology itself, but its practitioners. This is precisely where we need to put our attention as a society of learning. As a tool for science, education, and health, AI can take the bright side of human development. As Sampedro (2023) states, overseeing the robot's owner is crucial rather than attacking the robot itself.

Technological advances have opened a world of opportunities for students and teachers lately. With new access to online and traditional learning platforms, the possibilities for furthering educational goals seem limitless. The trend in higher education seems to be toward making education more accessible and on-demand. Technology allows the online delivery of educational materials and rapid information sharing, allowing for quick and secure connections among learners. Students and faculty are no longer limited by physical distances and language barriers, allowing them to teach and learn virtually anywhere.

The rise of distance or online learning technologies has allowed for more customized coursework and blended learning models. This trend has enabled students to learn, work at their own pace, and customize their learning experiences to fit their goals. It opens up many options for the learning community, allowing for more flexible scheduling and access to courses of study and qualifications. But this change in scope and depth will require a significant difference in the teaching-learning process, continuous faculty reconditioning, and students' attitudes.

It is unavoidable that universities are changing rapidly, and the traditional model of higher education is under significant pressure due to an ever-evolving society, culture, and technology. Consequently, universities must become more digital and provide accessible remote learning platforms to remain competitive, up to date in each academic discipline, and attractive to students.

Moreover, universities are beginning to shift away from the traditional model of a classroom to emphasize project-based learning. This groundwork provides a much more enriching experience that encourages students to form their thoughts and create a valuable network of peers. Additionally, universities will increasingly use digital methods to support their teaching, both in the classroom and online, as technology plays an essential role in modern education. It is now possible to provide interactive experiences to students through digital lectures, virtual classrooms, team-teaching projects, virtual practices and applications, and online resources of different types (Escotet, 2023). Other examples include the utilization of e-books, audiovisual material, virtual experiments, laboratories, simulation projects of sciences and humanities, and online tutorials. But reading, one of the most important tools for human cognitive development, is declining dangerously by its partial substitution of images and sound. AI can reinforce this behavior if the school system and society do not work urgently to compensate for this enormous reading deficit that already exists. Are robots the readers of the future?

Technology is revolutionizing how students learn and have access to information, allowing for increased access to learning opportunities, tremendous advancements in personalized education, and a platform for teachers to better reach the minds and hearts of their students. Introducing new and innovative technology, such as machine learning, into the educational sector can be helpful in many ways, from improving the quality of teaching and learning to providing students with greater flexibility and access to resources outside the

classroom. A significant change is developing an open education for all, according to their differences. However, a significant effort must be made to transfer educational technology from one culture to another to preserve cultural differences and world cultural enrichment, a crucial issue that has been on the table since the third quarter of the past century (Escotet, 1991).

The introduction of augmented reality (AR) and virtual reality (VR) technology will revolutionize learning in higher education. For instance, devices such as virtual whiteboards and 3D simulations will enable teachers to bring lessons truly to life. Virtual field trips could also be possible, allowing students to explore virtual environments and gain a more in-depth understanding of their subject. In addition, personalized learning education becomes more accessible with artificial intelligence systems that track individual learning development to help them achieve life goals.

Artificial intelligence (AI) has seen significant advances in various fields, from medical diagnostics to navigation systems for autonomous vehicles. However, its capabilities are also most promising in “AI-driven learning”. Artificial intelligence can revolutionize how education is delivered and received by allowing for personalized instruction and interactive learning experiences (Roumate, 2023). By providing real-time feedback, AI can make human-computer interaction more personalized and conducive to learning. AI technologies, such as Natural Language Processing, can provide lessons and create interactions with the students. AI can be used as an educational tool to personalize instruction for different students based on their needs. Artificial intelligence systems can provide tailored curricula and assessments to students according to their strengths and weaknesses. In other words, this innovative technology can give each student the support they need to succeed and excel rather than forcing them all into an identical mold. It can also assist in identifying educational gaps and providing the appropriate learning solution.

But generative artificial intelligence (GenAI) that can create a wide variety of data, such as images, videos, audio, text, and 3D models, can also make a deep change in how we teach, assist in scientific research, and organize and manage institutions of higher education. Rick Routley and Mark Belan from Visual Capitalist (2023) illustrate GenAI very precisely with the following infographic (Figure 1).

AI technology has changed the face of many industries and enterprises, and the education sector has been no exception. It can potentially revolutionize how schools, colleges, and universities operate with specific applications that dramatically improve the student experience and boost educational outcomes. AI-powered software, such as APE (Automated Performance Enhancement), can grade an essay in a fraction of the time it would take a regular teacher, freeing up more time for them to provide personalized feedback. AI can also review multiple-choice and short-answer tests much faster and more accurately than traditional methods and provide detailed analysis of test performance to the student and the teacher. Using AI-powered software, teachers can monitor each student’s academic progress and tailor the teaching to their individual learning needs, allowing them to focus on topics and other crucial educational teaching processes.

One example of this AI application is the use of intelligent tutoring systems (ITSs). They provide personalized, adaptive instruction and student feedback based on their assessments and progress. For instance, AI can provide students with exercises and activities tailored to their individual learning types and needs. This approach can improve student engagement and academic performance. In addition, ITSs can give students meaningful feedback on their progress and help them develop problem-solving skills. In other words, AI can not only contribute to data-driven decisions or quantitative data, but could also provide paths for learning.



Figure 1 What is Generative AI? A Basic Infographic by Visual Capitalist

An intelligent guidance system could map students' routes to their desired learning outcomes based on their current knowledge and understanding. This personalized guidance, involving psychological and social components, could be used to help students develop based on their existing strengths and weaknesses. The evolution of these tools will significantly change education at all levels and for lifelong learning in the years to come. The job professional market will be aligned with lifelong learning. Several AI language models agree in establishing the current and emerging fields that may create new job opportunities in just the next five years. Here are some of the fields that may have potential growth:

- artificial intelligence and machine learning
- cybersecurity and privacy
- renewable energy and sustainability
- healthcare and telemedicine
- data analysis and management
- robotics and automation
- blockchain technology and cryptocurrency
- content creation and digital marketing
- e-commerce and online businesses
- remote work, e-learning, and virtual collaboration

Of course, since the job market is constantly evolving, especially in these transition years, what we perceive as emerging fields today may not necessarily be the same tomorrow. Therefore, it is important to be adaptable, keep updated, and enhance skills for future job opportunities. This requires flexible vocational and higher education study plans and careers, and learning flexibility is not always available in many countries and educational systems.

Furthermore, a significant change will affect the need for new jobs related to AI technology and the labor and professional markets worldwide. As a matter of fact, by asking ChatGPT what the new jobs related to artificial intelligence will be, we received the generated answer shown below (formatted into a conventional chart, Figure 2). And this is a hypothetical answer in the middle of 2023. Considerable changes in the professional market will be produced month by month in the coming years.

In synthesis, the future of artificial intelligence technology in education looks promising, potentially improving the efficiency and effectiveness of teaching and learning processes. Some of the possible developments in this field include:

- The transformation in the development of study programs based on AI. Professors can no longer be the prescribers of student learning competencies. The new programs with knowledge, applications, and dispositions will cover in breadth and depth what the *learning person* "should know" rather than being based on what the *teaching person* "knows". New artificial intelligence techniques, data science, and predictive models will become necessary.
- AI will be a powerful tool for curriculum planning, design, and program implementation, matching society, students, and local and world needs.
- Greater integration with Learning Management Systems: AI is expected to become more integrated into LMS platforms, providing teachers and students with a unified and more efficient educational experience.
- Improved personalized learning: AI algorithms will become more advanced, allowing for an even more customized and individualized learning experience.

 Here are some new and unconventional job titles related to AI advancements:

S.No.	Job Title	Job Description
1.	Prompt Engineer	Professionals who create and refine prompts to effectively guide AI systems in generating desired outputs.
2.	Algorithm Inspector	Experts who review and analyze AI algorithms to ensure their performance, safety, and ethical compliance.
3.	Human Machine Trainer	Specialists who work closely with AI systems, training and fine-tuning them for better performance.
4.	AI Ethics Manager	Professionals responsible for overseeing the ethical development, implementation, and usage of AI systems.
5.	Deepfake Reviewer	Experts who detect and analyze deepfake content to prevent its spread and mitigate potential harm.
6.	Authenticity Checker	Individuals who verify the authenticity of information, images, or videos, often using AI-assisted tools.
7.	Kill Switch Engineer	Engineers who design and implement safety mechanisms to stop AI systems in case of malfunction or misuse.
8.	AI Dream Interpreter	Specialists who analyze AI-generated dream simulations to gain insights into human creativity and problem-solving.
9.	Robotic Emotion Designer	Experts who design and program emotions and emotional responses for AI systems and robots to improve user experience.
10.	AI Art Curator	Professionals who evaluate and curate AI-generated art, recognizing the value and creativity in the work of AI artists.
11.	AI Talent Agent	Representatives who promote and manage AI-generated personalities, artists, or influencers in various industries.
12.	AI-Assisted Legal Mediator	Professionals who utilize AI tools to facilitate negotiation and conflict resolution in legal disputes.
13.	AI-Powered Storyteller	Writers who collaborate with AI systems to create compelling stories, novels, screenplays, or other narrative works.
14.	Virtual Reality Therapist	Mental health professionals who use AI-powered virtual reality environments for therapy and treatment.

Figure 2 Some new future jobs generated by ChatGPT in April 2023

- Improved collaborative learning: AI will facilitate better collaboration between students, teachers, and institutions, improving educational and psychological outcomes.
- Virtual and Augmented Reality applications: AI could significantly develop VR and AR educational experiences, providing immersive and interactive learning opportunities.
- Natural Language Processing (NLP): This technology converts text into data that can then be used to analyze, interpret, and generate insights. NLP is used to help identify patterns and trends in large sets of textual data and to find correlations between different elements in data sets.
- Increased automation: AI is likely to automate more and more administrative tasks, freeing up teachers' time to focus on student learning and development.
- Predictive learning analytics: AI algorithms can analyze student performance data and predict future learning outcomes, providing insights into student needs and helping professors or teachers target their teaching efforts better.

- Adaptive learning: AI can adjust learning content and assessments to the needs and abilities of each student, providing a more personalized learning experience.
- Improved assessment and diagnostics: AI could play a significant role in developing more accurate and efficient assessment and diagnostic tools in psychology, helping to identify and treat student behavioral and mental health conditions.
- Human-computer interaction research: AI will significantly advance our understanding of human-computer interaction and how technology can support and enhance learning and psychological processes.
- Advanced personalized learning: AI algorithms will become even more sophisticated, allowing personalized learning experiences based on student data and performance.
- Health education: AI provides the potential for a health delivery system, the acceleration of the development of life-saving treatments, a patient-doctor health AI assistant, and the technological transformation of health systems.
- Mental health and wellness support: AI-powered chatbots and virtual assistants could provide mental health and wellness support, particularly for students in remote or isolated environments.
- Virtual psychologists and educational counseling: AI-powered virtual psychologists and counselors may become more prevalent, offering learning techniques support, learning to learn, and assistance for behavioral or mental health issues in the school or university community.

Intangible learning, as complementary to real learning methods, will be able to develop virtual scenarios, gaming, and simulation models for exponential learning innovation, artificial intelligence (AI), and knowledge acquisition and transformation. It will change face-to-face and online education for anticipatory and predictive learning. The new methodological approach and standard will be intangible learning to reinforce research-based learning.

Of course, we already use multiple applications for two-way communications, and different media presentations are compelling in dealing with face-to-face or online learning. Figure 3 shows some of the programs using generative AI in text, image, video, audio, 3D, and coding.

Sentiment analysis, or opinion mining, is a powerful tool in teaching, research, and communication as a delivery system. It uses natural language processing and text mining to decipher the emotional context of written materials, and thereby becomes a sophisticated instrument for opinion and attitude studies, and educational evaluation systems measuring emotions and qualitative data. It can also be used to generate text that is specifically designed to have a certain sentiment. For example, a generative AI system could be used to generate social media posts that are intentionally positive or negative to influence public opinion or shape the sentiment of a particular conversation. These can be useful for mitigating the data imbalance issue for the sentiment analysis of users' opinions in many contexts, such as education, customer services, etc. (Dilmegani, 2023).

This discussion has only shown a few more or less sophisticated applications that affect education at different levels and categories. It is only a basic sample. The future of AI in education, at all formal and non-formal levels, holds immense potential to improve how we learn, teach, and assess. AI technology has the potential to greatly enhance our understanding of learning and teaching, leading to improved educational outcomes and enhanced learning, life achievements, and mental and physical health support for individuals and society at large. Generative AI will be one of the most significant technological developments for bringing education to a lifelong learning process. But humans with their hands and minds in artificial intelligence will have a significant and transcendent task to

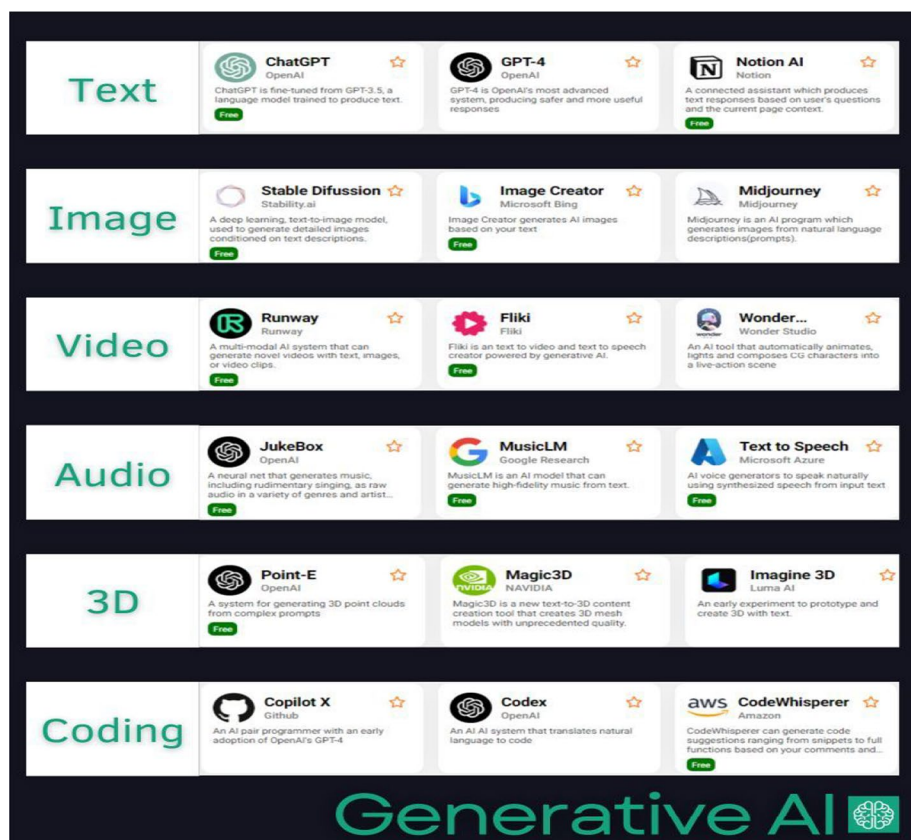


Figure 3 Open access illustration with some of the current generative AI in six dimensions

accomplish, which is first to put all ethical and esthetical obligations on the side of human-kind—a revolution of knowledge that is still missing.

In terms of immediate and specific AI applications to higher education as well as general basic education, here are a few plain examples:

- Student support: AI-powered chatbots can assist students anytime, anywhere, and help address their concerns and questions.
- Tutoring personalization: AI-generated tutoring and feedback to students can provide a personalized intelligent learning experience based on their interests, aptitudes, cognitive and affective competencies, and learning styles. It also allows professors to personalize their feedback to each student's unique needs.
- Automated qualitative and quantitative grading: AI-assisted grading, self-assessment, and continuous evaluation of student assignments and tests can ease teachers' workloads. Grading systems can scale to accommodate large classes, offer distance-learning individualized instruction, and provide immediate feedback to students, promoting quality performance.
- Education Data Analytics: AI can help analyze large amounts of education quantitative/qualitative data, such as testing to forecasting prevention, formative assessment,

and criterion-referenced assessment data. In addition, AI is an important technology in test scoring for students and faculty evaluation, participation, attendance, and demographics, to provide insights that help educators improve student performance and learning outcomes, and teaching improvement.

- Educational planning, administration and academic performance: AI is becoming a crucial tool in educational management, institutional planning and evaluation, curriculum development, course content design and relevance, and preventive forecasting of external social and technological becoming.

But what will be next? We need to be educated to solve unknown problems. However, our educational system emphasizes the understanding of problems already solved. AI technology works to move ahead of what we know. It is part of AI reasoning. It is part of the machine learning DNA. “For the first time, we’ve invented something that takes power away from us...and I do not know if humans can survive”, says Yuval Noah Harari (2023b), author of *Sapiens*. I want to think from my optimistic side that we will survive, and a new advanced lifelong education for uncertainty will be the answer. We need to start thinking in line with Pliny the Elder, that “the only certainty is uncertainty”.

References

- Dilmegani, C. (2023). Top 70+ Generative AI applications/Use cases in 2023. *AI Multiple*. <https://research.aimultiple.com/generative-ai-applications/>
- Escotet, M. A. (1987). *Los modelos matemáticos del aprendizaje* [Mathematical models of learning]. OEI Research Reports Series.
- Escotet, M. A. (1991). *The transfer of technology in education*. Batthyány Association.
- Escotet, M. A. (2023). La universidad del futuro para una educación en red y a lo largo de la vida [The university of the future for a networked and lifelong education]. In M. A. Santos Rego, M. L. Moledo, and J. G. Álvarez (Eds.), *La educación en red. Una perspectiva multidimensional* [Online education: A multidimensional perspective] (pp. 161–192). Ediciones Octaedro.
- Harari, Y. N. (2023a). Yuval Noah Harari argues that AI has hacked the operating system of human civilisation. *The Economist*. <https://www.economist.com/by-invitation/2023/04/28/yuval-noah-harari-argues-that-ai-has-hacked-the-operating-system-of-human-civilisation>.
- Harari, Y. N. (2023b). I don't know if humans can survive AI. *The Telegraph*. <https://www.telegraph.co.uk/news/2023/04/23/yuval-noah-harari-i-dont-know-if-humans-can-survive-ai/>.
- Holmes, W., & Porayska, K. (Eds.). (2023). *The ethics of artificial intelligence in education. Practices, challenges, and debates*. Routledge.
- McCullough, W., & Pitts, W. (1943). A logical calculus of immanent ideas in nervous activity. *The Bulletin of Mathematical Biophysics*, 5, 115–133.
- Roumate, F. (2023). *Artificial Intelligence in education: Promises and implications for teaching and learning*. Springer.
- Routley, R., & Belan, M. (2023). Infographic: Generative AI explained by AI. *Visual Capitalist, Technology*.
- Sampedro, J. (2023, May 4). The bright side of artificial intelligence. *El País*. <https://english.elpais.com/opinion/2023-05-04/the-bright-side-of-artificial-intelligence.html>.
- Turing, A. M. (1950). Computing machinery and intelligence. *Mind*, 59, 433–460.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted

manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.

Miguel Ángel Escotet is professor emeritus and former dean of the University of Texas System, as well as a former Frost professor at Florida International University. He was executive director of the Interamerican University Council for Economic and Social Development and secretary general of the Organization of Iberoamerican States for Education, Science and Culture (OEI). Presently he is rector of the Intercontinental University of Business (UIE) and the UNESCO Honorary Chair on the History and Future of the University. More information at: www.miguelescotet.com