A PERSPECTIVE INTO THE FUTURE OF TEACHING AND LEARNING IN THE CONTEXT OF THE RISING INTEREST IN ARTIFICIAL INTELLIGENCE IN EDUCATION. OPPORTUNITIES AND ETHICAL CHALLENGES

Anamaria-Mirabela POP, Monica-Ariana SIM, Amalia STURZA, Simona-Veronica CACIORA

¹Department of International Business, Faculty of Economic Sciences, University of Oradea, Oradea, Romania
mipop@uoradea.ro
ariana_mona@yahoo.com
amasturza@yahoo.com
veronicaabrudan@yahoo.com

Abstract: *The paper aims to provide an image of the future of teaching and learning in the context of artificial intelligence transforming various industries, including sports, education, and construction. Its place in education is a frequently discussed topic. While some argue that artificial intelligence will revolutionize education, others worry that it will take over to the harm of educators and students. Though robotics in the classroom is still a ways off, artificial intelligence is finding its way into the classroom. AI has the power to improve teaching and learning methods, solve some of the largest issues facing education today, and hasten the achievement of inclusive and equitable quality education. In addition to delivering artificial intelligence courses, EdTech businesses are increasingly using eLearning solutions to personalize learning experiences, pinpoint knowledge gaps, and give focused feedback. Also, AI-driven education is upending conventional teaching methods and influencing how this field will use technology in the future. With the use of complex algorithms and massive data sets, artificial intelligence solutions for education may provide a lot of advantages, yet as with the use of artificial intelligence in any context, there are significant ethical considerations which are a hot topic of discussion in the technology world and beyond, and the majority of university degree programs are including courses on AI ethics in their curricula. Therefore, the paper presents the benefits of AI in the classroom, such as engagement and assistance for students, assessment and evaluation, and individualized learning but also about the difficulties and worries associated with AI in education, including prejudice and privacy issues, as well as the moral issues raised by AI-powered learning. It also discusses the possible effects on the educational system and how students are trained for the workforce of the future as potential applications of AI in education are explored.*

Keywords: *artificial intelligence; education; advantages; disadvantages; ethics.*

JEL Classification: *Z13*

1. Introduction to Artificial Intelligence

Many individuals became aware of artificial intelligence (AI) for the first time when OpenAI released ChatGPT, a chatbot that uses natural language processing, in the fall of 2022 and which represented a turning point (Constantin et al, 2023). AI tools, however, have long been a part of the computer world. Paying chess against a computer, consulting a virtual assistant like Alexa or Siri or even just browsing through social media feed represent interactions with artificial intelligence. The 1968 film "2001: A Space Odyssey," which features a conversation between astronaut Frank and the "Heuristically-programmed ALgorithmic" computer, or "HAL," is credited with popularizing AI consciousness. As Frank

is unable to control the spacecraft on his own, HAL assists Frank in doing so. But when Frank eventually exits the spacecraft, HAL seizes command, and Frank's story does not turn out well. HAL demonstrates actions, speech, and reasoning that are similar to those of a human. Like many AI applications, HAL has potential benefits for people but also carries some unexpected concerns, particularly given that AI has limits and thinks differently than humans do.

A generation of scientists, mathematicians, and philosophers had grown up with the idea of artificial intelligence (AI) deeply ingrained in their culture by the 1950s. Alan Turing, a young British polymath who investigated the mathematical potential of artificial intelligence, was one such individual. Turing argued that if people use accessible data in addition to reason to solve issues and reach choices, why can't machines be able to do the same? His 1950 study, *Computing Machinery and Intelligence*, which covered the construction of intelligent machines and methods for assessing their intelligence, was organized along these logical lines.

In a broad sense, artificial intelligence (AI) refers to any method that makes it possible for computers to replicate human behavior, outperform human decision-making, and do complicated tasks either autonomously or with little assistance from humans (Russell & Norvig, 2021). As such, it refers to a range of tools and methods (e.g., case-based reasoning, rule-based systems, genetic algorithms, fuzzy models, multi-agent systems) and is concerned with a number of central problems, including knowledge representation, reasoning, learning, planning, perception, and communication (Chen et al. 2008). The main focus of early AI research was on formal languages with hardcoded propositions that a computer could automatically reason about using principles of logical inference. The knowledge base approach is another name for this (Goodfellow et al., 2016). Nevertheless, the paradigm has a number of drawbacks because it is typically difficult for people to articulate all of their implicit knowledge, which is necessary to carry out difficult tasks (Brynjolfsson & McAfee, 2017).

According to Friedman et al. (2021), AI is "[a]ny computational method that is made to act independently towards a goal based on inferences from theory or patterns in data." The emphasis of this definition is on how AI tools and systems spot patterns and decide what to do next to accomplish a specific objective. The automated recommendations and pattern identification features will be put to use in ways that influence student learning and instructional decision-making by teachers. Modern personalized learning systems, for instance, have the ability to identify indicators of a student's difficulties and suggest a different course of study. Pattern recognition and automatic recommendation systems will become more widespread.

2. Literature review

The rapid development of artificial intelligence (AI) in recent years has had profound effects on civilization, both culturally and economically. This quickly developing technology is changing many parts of daily life, including how we, the educators, teach and how, they, the students, learn. It is destined to become as ubiquitous as email.

In the sphere of education, artificial intelligence has become a revolutionary force that is changing the approach to teaching and learning. The 20th century saw the first attempts at intelligent tutoring systems, which laid the groundwork for the investigation of AI in education. The area has advanced significantly over the years, going from rule-based systems to more complex machine learning and neural network techniques. Early AI education applications centered on Intelligent Tutoring Systems (ITS), which offered individualized guidance and evaluation. The foundation for the creation and assessment of ITS was established by seminal publications by Anderson & Corbett (1989), which emphasized the adaptable nature of AI in meeting the demands of specific learners. More recent literature emphasizes AI's function in adaptive learning systems. By analyzing student performance data using machine learning algorithms, these systems provide

customized interventions and content. Corbalan et al. (2008) and Baker et al. (2019) talk about how adaptable learning environments can help students achieve better results. Developments in Natural Language Processing (NLP) have prompted the development of dialogue systems for education. Scholars like Graesser et al. (2005) and Di Eugenio et al. (2018) investigate how AI-powered conversational agents improve language learning by offering interactive learning experiences and real-time feedback. AI is changing not just how students learn but also how educators develop professionally. Artificial intelligence can help teachers customize their lesson plans and adjust to a range of student needs. From the early innovations of intelligent tutoring systems to the present era of adaptive learning platforms and educational dialogue systems, research highlights the diverse effects of AI on education. The use of AI in education brings up moral questions about prejudice, data privacy, and the socioeconomic effects of technology-driven learning. In their paper *Recommendation on the Ethics of Artificial Intelligence (2022)* UNESCO highlights how critical it is to address these ethical issues in educational environments that use AI, and look for creative methods to use AI to improve teaching and learning experiences as the area develops.

3. The Beginnings of AI in Education

With roots in the later half of the 20th century, artificial intelligence (AI) integration in education has been gradually developing throughout time. The work of psychologists Sidney Pressey, who taught at Ohio State University in the 1920s, and B. F. Skinner, who taught at Harvard University from 1948 until his retirement in 1974 and is regarded as the father of behaviorism, contains the first indications of the use of AI in education. Pressey faced the difficult task of utilizing multiple-choice examinations to both assess and consolidate pupil learning. Later, Skinner expanded on Pressey's methodology by suggesting that human training could benefit from the innovations he made in the operant conditioning of rats and pigeons—which are now known as Skinner Boxes. In 1958, Skinner created his teaching apparatus, a wooden box with a windowed lid. One window displayed questions on paper disks, and the student responded on a roll of paper that was visible through a second glass and would be marked by a teacher later. The mechanism's advancement automatically covered the student's response, making it unchangeable, and simultaneously disclosed the right response. Skinner's teaching device offered automatic, instantaneous reinforcement in this way. As opposed to selecting from a predetermined list of options (as in Pressey's multiple-choice questions), students were compelled to write their own responses because, according to Skinner, learning is reinforced more successfully when students can recall the correct answer than when they can only recognize it. This method also offered the student the chance to contrast their response with the provided model response, which, if thoughtfully created by the instructor and enthusiastically pursued by the student, might potentially enhance learning (Holmes et al.:94).

Intelligent Tutoring Systems (ITS) - In the 1970s, ITS—one of the first applications of AI in education—came into existence. The goal of these systems was to give each student individualized education that would adjust to their unique learning style and speed. The University of Illinois's PLATO system, created in the 1960s, is regarded as one of the first instances of ITS (Nwana:264).

Expert Systems - The use of expert systems in education started in the 1980s. These systems imitated human experts' decision-making processes across a range of fields by using AI approaches. Expert systems have been utilized in education to give pupils expert-level direction and assistance in disciplines like science and math.

Learning analytics and data mining - As digital learning platforms and tools became more widely available in the late 20th and early 21st centuries, educational institutions began to

gather vast volumes of data on the behavior and performance of their students. AI tools like data mining and machine learning were used to examine this information and extract knowledge that would enhance instruction and student performance.

Adaptive Learning Systems - In the late 20th and early 21st centuries, adaptive learning systems advanced beyond the idea of ITS. Based on each student's performance and response, these systems use AI algorithms to dynamically modify the material, tempo, and educational tactics. Platforms for adaptive learning, such as EdApp, Adaptemy, or Knewton have grown in popularity recently.

Chatbots and Natural Language Processing (NLP): Applications for education that can comprehend and produce human language have been created using AI technologies like natural language processing (NLP). For instance, chatbots are used in online tutoring programs to give students immediate feedback, respond to their inquiries, and include them in interactive learning.

Personalized Learning Platforms - An important development in education is the rise of AI-powered individualized learning platforms like Khan Academy or Duolingo. These platforms make recommendations for personalized learning materials and activities based on an analysis of students' learning preferences, skills, and shortcomings using AI algorithms.

Although not specifically AI, **virtual reality (VR)** and **augmented reality (AR)** technologies are frequently combined with AI to produce engaging and dynamic learning environments. With the use of these tools, students can now perform experiments, explore virtual worlds, and participate in simulations that would be challenging or impossible in a typical classroom.

All things considered, research and development into the use of AI in education are still in progress, with the goal of utilizing this technology to improve instruction and learning for students of all ages and backgrounds.

4. Opportunities: How AI is Reshaping the Classroom

The concept of "human-like", mentioned earlier, is useful because it can be used to condense the idea that modern computers are far more capable than the edtech applications of the past. Applications for education will be able to interact with teachers and students, co-pilot lesson plans, and take actions that have a wider effect on teachers and students.

The AI education industry is expected to reach $20 billion by 2027 because AI trends accelerate the expansion of EdTech by enhancing student engagement through personalized courses, interactive lectures, gamified classrooms for skill acquisition, etc. Additionally, it is anticipated that by 2023, the worldwide e-learning market would generate $166.60 billion in sales.

The following graph shows how companies are jointly spending billions of dollars on a variety of AI applications, ranging from computer vision and machine learning in education to robots, virtual help, natural language, and education app development.

Figure 1. Revenue in the Global Online Education Market – 2017-2027
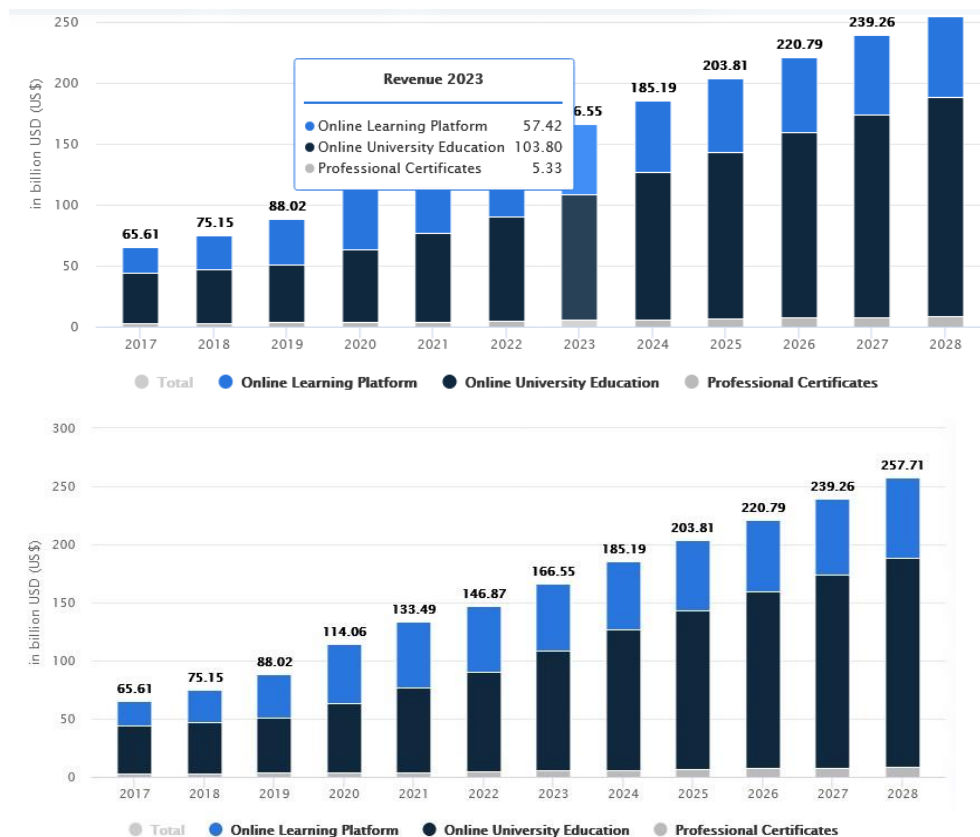
Source: www.statista.com

It is fascinating, but also a little scary, to think about how artificial intelligence might improve education, help instructors, and support more successful tailored learning. Yet, in order to engage in a meaningful discourse regarding artificial intelligence (AI) in education, it is necessary to go past fantastical science fiction narratives in which computers and robots instruct students, taking the place of instructors, and eliminating the human element from an activity that is essentially human.

Similar to chatbots and virtual tutors, conversational AI in education provides prompt support, encouraging self-directed learning. The way students study is being revolutionized by AI chatbots for education. These chatbots, which use machine learning and natural language processing, offer students immediate, individualized help by responding to their inquiries and assisting them with their studies. Developing interactive and captivating educational experiences facilitates students' comprehension of concepts and improves their retention of knowledge. With its ability to create assignments, lesson plans, presentations, study materials, examples, evaluation rubrics, and more, AI may be a great help when developing curricula. For instance, you can request that ChatGPT design a lesson plan based on the learning objectives you specify or provide a ton of examples huge help students understand the ideas they are studying. Moreover, a number of AI tools can assist in producing or modifying multimedia study content, including papers, videos, and photographs.

Another area where AI has shown to be quite beneficial is assessment. AI may assist with a variety of assessment tasks, including case study situations, quiz questions, and course rubric creation. Also, when designing a course, teachers can save a ton of time by having AI come up with early concepts or the first draft of a syllabus or lesson plan, all the while

investigating new pedagogical approaches. In general, educators can increase their productivity, efficiency, and creativity by utilizing AI solutions for idea generation and content creation.

Institutions have come to some crucial realizations as a result of the sudden shift to online learning during the last years. The most important of these is the requirement to provide an accessible and inclusive learning environment that takes into account the varied needs of students and removes obstacles to learning. In order to attain high-quality education, diversity, equality, and inclusion (DEI) have been regarded as one of the main goals at many schools. Faculty members must thus make sure that students with various learning styles, needs, and histories have fair access to opportunities for meaningful learning as well as prompt assistance and support. With a large student body and learners coming from different parts of the country, teachers have a lot of work ahead of them. They have to spend a lot of time marking tests, providing feedback, and putting students in groups for group projects. This leaves them with little time to customize the learning experiences.

The ability of AI technologies to handle these tiresome duties, freeing up faculty members to interact with students and concentrate on more difficult pedagogical responsibilities including developing real-world skills, data analysis, and student evaluation bring up a lot of challenges.

Addressing these action items is clearly difficult, though. Startups, academic organizations, and large technological businesses are all actively involved in these advancements. A few instances of businesses using AI in education are Google, Microsoft, IBM, Amazon, and other edtech firms.

5. Ethical Challenges

Writing in "My Vision for the Future of Artificial Intelligence in Education," https://www.theedadvocate.org/vision-future-artificial-intelligence-education/ one of the top experts on the advantages of artificial intelligence in education, Matthew Lynch, considers both the advantages and potential drawbacks, noting that "the use of AI in education is valuable in some ways, but we must be hyper-vigilant in monitoring its development and its applications." Therefore, it is important to consider ethical concerns, data privacy, and the need for a balanced approach that combines technology with effective teaching practices.

The year 2023 has been characterized by a boom in generative artificial intelligence, like ChatGPT. This has generated both optimism over its potential and apprehension regarding its limitations, particularly in the context of global education systems.

Billionaire Elon Musk claimed that, despite the ongoing feud between him and the other tech titan, Facebook CEO Mark Zuckerberg, the latter has a "limited understanding" of artificial intelligence (AI) in the future.

"I have exposure to the very cutting-edge AI, and I think people should be really concerned about it. ... AI is a rare case where we need to be proactive about regulation instead of reactive. Because I think by the time we are reactive in AI regulation, it's too late." (Elon Musk)

"I think people who are naysayers and try to drum up these doomsday scenarios ... I just, I don't understand it. It's really negative and, in some ways, I actually think it is pretty irresponsible." (Mark Zuckerberg)

As evidenced by the conversation between Elon Musk (SpaceX, Tesla) and Mark Zuckerberg (Facebook), the implications of AI in the future are actually still somewhat uncertain. However, investments and advancements keep rising at an exponential rate, making artificial intelligence a necessary, ubiquitous, and unavoidable—albeit frequently unseen—part of our everyday life. There is a growing trend in schools and colleges to use so-called intelligent, adaptive, or personalized learning systems, whether or not students, instructors, parents, and policymakers approve of it. However, there are many unanswered problems about using AI in education. "We should ask what happens when we remove care from education.... What happens to thinking and writing when... the whole educational

process is offloaded to the machines—to "intelligent tutoring systems," "adaptive learning systems," or whatever the latest description may be? What sorts of signals are we sending students?" (http://hackeducation.com/2015/08/10/digpedlab)

One of the challenges of using AI in the educational process is the absence of infrastructure and access. It is possible that many educational institutions, particularly those in developing nations, lack the resources and infrastructure needed to successfully integrate AI technologies. There may be restrictions on contemporary electronics, high-speed internet access, and other technological needs.

Another problem concerns the security of data and privacy aspects. AI in education frequently entails gathering and processing vast volumes of student data. In China, one school "has installed facial recognition technology to monitor how attentive students are in class. Every movement of pupils ... is watched by three cameras positioned above the blackboard.... Some students are already changing their behaviour due to the increased monitoring.... "I don't dare be distracted after the cameras were installed in the classrooms. It's like a pair of mystery eyes are constantly watching me." The system works by identifying different facial expressions from the students, and that information is then fed into a computer which assesses if they are enjoying lessons or if their minds are wandering.... The computer will pick up seven different emotions, including neutral, happy, sad, disappointed, angry, scared and surprised. If it concludes that the student is distracted with other thoughts during the class, it will send a notification to the teacher to take action." (https://www.telegraph.co.uk/news/2018/05/17/chinese-school-uses-facial-recognition-monitor-student-attention/) This is not to argue that analyzing classroom video streams using artificial intelligence is inherently immoral. In order to improve teaching strategies, there are researchers using AI and classroom recordings to gain a deeper understanding of how student involvement, classroom talk quality, and lively discussion contribute to effective learning. (Kelly et al, 2018) It is essential to guarantee the security and privacy of sensitive data. Strict policies and regulations are required to safeguard private data and stop illegal access.

Moreover, in order to guarantee that students feel at ease utilizing AI-driven educational systems, training programs are required for both teachers and students. Therefore, to be able to use AI in education, teachers and students must be conversant with the technology. Another issue regarding the integration of AI in higher education raises ethical questions about the effects on the academic staff since it may cause job displacement for institutions. Academic staff members who are displaced may encounter difficulties securing alternative work prospects, especially if they lack the requisite skills or resources to adjust to new positions or industries.

In its report, *Ethics of Artificial Intelligence* (2024) UNESCO claims that in the absence of moral guidelines, AI runs the risk of replicating prejudice and discrimination found in the real world, escalating conflicts and endangering basic human rights and liberties. In order to empower individuals to think critically and make informed decisions when clicking, UNESCO promotes the growth of media and information literacy for all. Through its Media and Information Literacy (MIL) program, in particular, it aims to provide training and resources to educators so they can support students in the digital environment.

Stakeholders, including academic staff, administrators, legislators, and technology developers, must have an honest and open discussion about the implications of AI integration in higher education in order to resolve these ethical concerns. To ensure that AI is used in ways that preserve ethical principles and values and benefit academic staff as well as students, collaboration is essential.

6. Conclusions

Machines may now perform jobs that have historically required human cognition thanks to artificial intelligence. AI has the ability to understand and mimic conversational language, solve problems, make decisions, and learn from unstructured data. There will be hazards

that need to be recognized and managed in addition to chances to do things far better than we do now. However, because AI analyzes information differently than people do, the "human-like" shorthand is not always helpful. If we ignore the distinctions between humans and computers, we risk creating AI policy for education that is not quite right.

It is crucial to remember that, even if AI might alter some job positions, it is unlikely to completely replace the need for human instructors. AI is unable to replace the human element, emotional intelligence, or the capacity to encourage and inspire students. Furthermore, rather than completely replacing educators, ethical AI adoption should seek to improve educational outcomes and provide support for them. To guarantee a seamless transition, steps should be taken, such as offering programs for educators impacted by these changes to retrain and upskill.

References

1. Anderson, John R., Frederick G. Conrad, Albert T. Corbett. (1989). "Skill acquisition and the LISP tutor". *Cognitive Science*, Volume 13, Issue 4, October–December 1989, pp. 467-505.

2. Baker, T., Tricarico, L. and Bielli, S. (2019*). Making the Most of Technology in Education: Lessons from school systems around the world*. London: Nesta. Retrieved 20 February 2024. https://media.nesta.org.uk/documents/Making_the_Most_of_Technology_in_Education_03-07-19.pdf

3. Brynjolfsson, E., & McAfee, A. (2017). "The business of artificial intelligence". *Harvard Business Review*, pp. 1–20.

4. Chen, S. H., Jakeman, A. J., & Norton, J. P. (2008). "Artificial intelligence techniques: An introduction to their use for modelling environmental systems". *Mathematics and Computers in Simulation, 78*(2–3), pp. 379–400. https://doi.org/10.1016/j.matcom.2008.01.028.

5. Corbalan, G., Kester,, L. And Van Merrienboer, J. (2008). "Selecting learning tasks:
 Effects of adaptation and shared control on learning efficiency and task
involvement". *Contemporary Educational Psychology* 33(4). pp. 733-756
, DOI:10.1016/j.cedpsych.2008.02.003

6. Di Eugenio, Barbara & Fossati, Davide & Yu, Dan & Haller, Susan & Glass, Michael.
(2005). "Aggregation Improves Learning: Experiments in Natural Language
Generation for Intelligent Tutoring Systems." *ACL-05 - 43rd Annual Meeting of the
 Association for Computational Linguistics, Proceedings of the Conference*.
10.3115/1219840.1219847.

7. Friedman, L., Blair Black, N., Walker, E., & Roschelle, J. (2021). "Safe AI in
education needs you". Association of Computing Machinery blog,
 https://cacm.acm.org/blogs/blog-cacm/256657-safe-ai-in-education-needs-you/fulltext

8. Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep learning*. The MIT Press.

9. Graesser, Arthur & Chipman, Patrick & Haynes, Brian & Olney, Andrew. (2005).
"AutoTutor: An Intelligent Tutoring System With Mixed-Initiative Dialogue".
Education, IEEE Transactions on. 48, pp. 612 - 618. 10.1109/TE.2005.856149.

10.Holmes, Wayne & Bialik, Maya & Fadel, Charles. (2019). *Artificial Intelligence in Education. Promise and Implications for Teaching and Learning*. Center for Curriculum Redesign.

11. Kelly, S., Olney, A.M., Donnelly, P., Nystrand, M., and D'Mello. S.K. (2018). "Automatically measuring question authenticity in real-world classrooms." *Educational Researcher* 47. https://doi.org/10.3102/0013189X18785613

12. Nwana, H.S. (1990). Intelligent tutoring systems: an overview. *Artif Intell Rev* 4, pp. 251–277. https://doi.org/10.1007/BF00168958

13. Russell, S. J., & Norvig, P. (2021). *Artificial intelligence: A modern approach* (4th ed.). Pearson. Volume 13, Issue 4, pp. 467-505, https://doi.org/10.1016/0364-0213(89)90021-9

14. UNESCO - Ethics of Artificial Intelligence (2024) - https://www.unesco.org/en/artificial-intelligence/recommendation-ethics

15. Watters, A. (2015). "Teaching Machines and Turing Machines: The History of the Future of Labor and Learning, http://hackeducation.com/2015/08/10/digpedlab, retrieved 25 February, 2024.

16.   https://www.telegraph.co.uk/news/2018/05/17/chinese-school-uses-facial-recognition-monitor-student-attention/