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Artificial Intelligence and Higher Education

Ana Isabel Santos
University of the Azores, Ponta Delgada, Portugal, https://orcid.org/0000-0003-3068-7459

Sandro Serpa
University of the Azores; Ponta Delgada, Portugal, https://orcid.org/0000-0003-4286-4440

Abstract: Artificial intelligence has potentiated changes in higher education. In this position paper, we propose to discuss dimensions that shape higher education and that can be transformed by the mobilization of Artificial Intelligence: teaching-learning processes (from the perspectives of scholars and students), research (from the perspective of professional researchers, students and advisors), management of organizations (from the perspective of managers, subordinates and students), and the relationship with the outside (the look from inside to outside, as well as from outside to inside). To this end, a document collection and analysis was carried out to support our argument about the new challenges and the potential that emerges from the existence and application of artificial intelligence in higher education. As this change, like any transformation, will have positive and negative aspects, some implications of both a theoretical and more practical nature of these challenges for academics, students and other stakeholders in higher education institutions are also discussed.

Keywords: Artificial intelligence, Digital competence, Digital literacy, Higher education, Innovation.

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Introduction

As early as 1990, Aiken considered that "There are sceptics who question the expenditures on research in Artificial Intelligence in general and Artificial Intelligence and Education in particular. The author believes that we don't have a choice – we MUST continue to investigate ways in which Artificial Intelligence will make the computer a better aid for teaching and learning" (Aiken, 1990, p. 12). Especially in more recent years, there has been a growing presence of Artificial Intelligence (AI) in our lives, partly boosted by the COVID-19 pandemic in all contexts, not escaping that of Education (Akinwalere & Ivanov, 2022; Nouhan et al., 2021; Ilieva, 2021; Bearman et al., 2022; Pedró, 2020; Hinojo-Lucena et al., 2019; Ferreira & Serpa, 2018a; Sá & Serpa, 2020, 2023). In fact, as Vicari (2018) points out, nowadays, it is not possible to think of Education without dissociating it from technologies and their use.

Based on the concept of AI "[…] as computing systems that are able to engage in human-like processes such as learning, adapting, synthesizing, self-correction and use of data for complex processing tasks" (Popenici & Kerr, 2017, p. 2), the ultimate goal of introducing AI in Education should envisage the development and qualification of human capital with skills that make 21st-century citizens better able to cope with changes and consequent responses to increasingly global needs (Southworth et al., 2023), based on three basic principles, pointed out by Churi et al., 2022, based on Buckingham (2018):

- Learning: Acquiring and processing the new experience, creating new behaviour models;
- Self-correction: Refining the algorithms to ensure the most accurate results;
- Reasoning: Picking up the specific algorithms to solve a specific task (Churi et al., 2022, p. 3).

In line with this reasoning, higher education institutions were not immune to this growing influence of AI (Crompton & Song, 2021; Mazikana, 2023; Pence, 2019; Manhica et al., 2022; Nouhan et al., 2021; Akinwalere & Ivanov, 2022). AI came, then, to boost changes in higher education at various levels, which encompass faculty members, students, other employees and the institution's management itself (Pence, 2019), even if it generates anxiety (Li & Yang, 2023; Bates et al., 2020), but with the potential to shape innovation (Akinwalere & Ivanov, 2022).

As higher education is a place where research, innovation, problem-solving or the use of the latest technologies are sought to be leveraged by excellence, AI offers, in this context, an opportunity to support students in their learning processes and building skills that better suit today's academic, professional and personal demands, by offering personalized learning processes, intelligent tutoring systems or helping students in the analysis of their path and performance. At the same time, it also helps students and teachers by allowing them to make personalized recommendations on aspects to be improved, whether in terms of the students' educational success or difficulties, or in terms of support that the teacher can develop to help them, at the level of both materials or activities and assessment processes (Al Ka'bi, 2023; Zentner, 2022). Also in the context of higher education, AI can be a useful tool at the service of research, facilitating tasks such as literature review or data analysis and leaving the researcher time for other tasks that require their more direct intervention, as well as at the service of administrative tasks, streamlining processes such as enrolment or preparation of timetables, freeing up staff for other types of tasks (Al Ka'bi, 2023).

In synthesis, artificial intelligence has boosted changes in higher education. In this position paper, we propose to discuss dimensions that shape higher education and that can be transformed by the mobilization of AI: teaching-learning processes (from the perspectives of scholars and students), research (from the perspective of professional researchers, students and advisors), management of organizations (from the perspective of managers, subordinates and students), and relationship with the outside (the look from inside to outside, as well as from outside to inside).

Methods

To enable rigorous and justified reasoning of the potential that shapes higher education and that can be transformed by the mobilization of AI, a document collection and analysis was carried out based on the search, selection and analysis of documentation in two databases, namely B-ON (https://www.b-on.pt/en/what-is-b-on/) and SCILIT (https://www.scilit.net/about), using the following two search terms: "Artificial Intelligence" and "Higher Education". In addition, a self-reflexivity was carried out, given that the authors of this paper have themselves been university teachers for over 20 years, which enabled the controlled mobilization of this experience in the arguments presented (de Verlaine, 2022).

Artificial intelligence in higher education

According to Li and Yang (2023), higher education in the AI virtual world has clear differences when compared with higher education considered traditional. Firstly, there is a gap between the evolution of AI and the failure of more traditional higher education institutions to keep up with this evolution, which is also evident at the level of the training itself, its time cycles and the generational issues that they imply. Secondly, there are differences at the level of governance of the institutions, more sustained by empirical judgements in the more traditional cases or more based on big data in the case of those more oriented towards AI. Thirdly, differences are identified in the logic of training models, with the traditional ones clearly more focused on large-scale teaching versus a training perspective more focused on individuality or more personalized in the case of AI. Finally, Li and Yang (2023) also point to differences between the way research is envisaged between these two ways of looking at higher education, pointing to the need, in the case of the integration of AI, for a "[…] new scientific research mode of network collaboration, traceability, and multi-disciplinary integration" in a relatively conservative higher education arena (p.32).

However, the use of AI in higher education is not a straightforward, clear and direct process, entailing obstacles, difficulties and challenges that must be overcome. Recent research has listed some aspects worthy of reflection for the introduction of AI in higher education. If, on the one hand, some concerns regarding users' data and privacy are highlighted, as well as the possible capacity of AI to replace trainers (Al Ka'bi, 2023), on the other hand, it must be acknowledged that AI cannot be a reality that starts only in higher education, but has its beginning much earlier, for students, as for teachers. In this sense, several studies are being developed that imply the introduction of AI much earlier in the school curriculum of younger students (Southworth et al., 2023).

On the other hand, some advantages lead to consider the introduction and development of AI in higher education, as it is deemed that it may be a way to better prepare citizens and future workers for a more competitive labor market, and where AI will be (or already is) a reality (Laupichler et al., 2022), as well as for facilitating learning and administrative processes (Al Ka'bi, 2023).

In general, we can consider, as some of the advantages of AI, aspects such as the following mentioned by Churi et al. (2022, pp. 22-24): high accuracy with fewer errors, high-speed, high reliability, useful for risky areas, digital assistant, quick feedback, ongoing student assessment, platforms for distance learning, adapted teaching content, virtual reality, accessibility, efficient administrative management, data collection, storage, and security. In particular, in the context of higher education, Zentner (2022) highlights several potentials for its use, summarized in Table 1.

Table 1. Examples of AI application in higher education

Adaptive learning platforms	It provides personalized learning experiences for students, adapting to their needs and abilities as they progress through a course.
Automated grading	it allows to grade student assignments and exams, freeing up instructors to focus on more complex tasks and interactions.
Data analysis and visualization	can help researchers analyze large datasets and identify patterns and trends that would be difficult or impossible for humans to detect.
Language translation	translation tools can help students and faculty communicate with one another, even if they do not speak the same language.
Learning management systems	It allows to suggest resources, assignments, and activities to students based on their interests and progress.
Personalized learning systems	can adapt to the needs and preferences of individual students, providing personalized recommendations.
Personalized tutoring	can provide individualized help and support to students, adapting to their specific needs and learning styles.
Plagiarism detection	can be used to identify instances of plagiarism in student papers and assignments, helping to ensure the integrity of academic work.
Predictive analytics	can be used to analyze student data and predict their likelihood of success in a course or program, helping educators identify potential challenges and intervene early.
Recommendation engines	can suggest relevant courses, programs, or resources to students based on their interests and past activities.
Speech recognition	Electronic speech recognition tools allow to transcribe lectures and other audio recordings, making them more accessible to students.
Student support	such as counseling or tutoring, by providing personalized recommendations and referrals.
Text analysis	can be used to analyze large volumes of text, such as research papers or articles, to identify trends, patterns, and connections.
Virtual assistants or chatbots	tools that can help students with frequently asked questions or basic tasks, such as registering for classes or accessing course materials.
Virtual reality	to create immersive learning experiences for students.

Source: Based on Zentner (2022, pp. 1 and 2).

In any case, Aldosari (2020) identifies what he calls 10 fundamental rules or situations where AI can be a reality in education:

- Artificial intelligence can automate some basic activities, such as classification and grading.
- AI makes it possible to redesign educational programs to the needs of students, through advanced technology applications or programs.
- AI enables students to obtain an extra support to serve students to the maximum extent.
- By using programs that rely on AI systems, students and teachers can make useful comments so that others can benefit and share experiences.
- AI systems change the way to find information and interact with it in the way we interact with information in our personal and professional lives.
- AI systems make it possible to improve and fill gaps that may occur in training courses, identifying areas that need to be improved.
- AI systems allow students to learn in a relatively rule-free environment, reducing the fear of learning through trial and error methods, especially when AI teachers can offer solutions for improvement.
- The data supported by AI systems can change the manner schools select their students.
- AI systems can change the teachers' role.
- AI systems will change where students learn, who teaches them, as well as the style of acquiring basic skills.

However, there are many challenges facing the application of AI in higher education (Nsoh et al., 2023; Churi et al., 2022; Bates et al., 2020; Popenici & Kerr, 2017; Serpa et al., 2020; Akinwalere & Ivanov, 2022; Salvagno, Taccone, & Gerli, 2023), such as

- issues of equity of access and use of AI in education, including those related to the inclusion of people with disabilities, to avoid bias and promote diversity.
- ethical and security issues arising from the collection, use and disclosure of data, and protecting the privacy of users, including regular ethical data impact assessments of adopted systems, and considering personal information as a fundamental right.
- training issues for teachers and other users, being necessary to ensure that teachers are prepared to deal with AI in the educational context, understanding its benefits and limitations, and help establish clear criteria on when it is appropriate to follow or replace computer-generated perceptions to avoid unfair inconsistencies.
- issues related to students, such as their learning styles and capacity for autonomous learning; or how they communicate and share.
- financial issues, related to the costs of using AI.
- organizational and policy-making issues, such as the monopoly of a few entities, the conservative culture of most higher education organizations, the development of transparent data policies, or the fact that developers' decisions shape how the AI systems are instructed and understood.
- issues concerning the very nature of AI, such as the impossibility of thinking out of the box or no regard for feelings and emotions.

As can be seen, the integration of AI in higher education is not easy, particularly due to the adoption of more

traditional pedagogical practices and policies that are less in line with a new reality that requires everyone to think and look at what is taught and how it is taught (Pence, 2019). This reality, which has profound implications in the academic profession and the mission of higher education institutions, implies dealing with the psychological contract of those who are faced with it, considering that it can be understood as a form of control and de-professionalization (Serpa et al., 2020; Ferreira & Serpa, 2018b). Thus, its development, integration and use in this context should be a participatory process extended to the whole of the institutions (Pedró, 2020).

One way to enhance the application of AI in higher education, minimizing the risks and overcoming challenges such as those mentioned above, is to develop AI literacy beyond digital literacy (Sá, Santos, Serpa, & Ferreira, 2021; Akinwalere & Ivanov, 2022) of all stakeholders, understood as "[…] a set of competencies that enables individuals to critically evaluate AI technologies, communicate and collaborate effectively with AI, and use AI as a tool online, at home, and in the workplace" (Long & Magerko, 2020, p. 2, cit. in Laupichler et al., 2022, p. 1).

In particular, as far as teachers are concerned, Pedró (2020) highlights a set of specific competencies that he considers to be fundamental for AI to be adequately and effectively used, which include a clear understanding of how AI can facilitate learning and the characteristics that make it more appropriate, the development of research and data analysis skills that AI offers students, looking at these data in an appropriate way, the development of new human resources and AI management skills, and the adoption of a critical perspective regarding the use of AI in educational settings. But how to foster this intentional, conscious and knowledgeable use of AI in higher education? In a very clear and pertinent way, Pedró (2020) clarifies that

As there are no universal solutions, it is imperative that research also has a local dimension, in each university's classrooms, recognizing professors and students as actors and not as mere beneficiaries or users of previously packaged technological solutions. There is no doubt that research has a role to play in elucidating the role that technological solutions play in improving the quality of university education (p. 71).

One of the ways to respond to this necessary improvement in the teaching and learning process, which the social sciences cannot be excluded from, may be, it seems to us, for example, through the action-research process (Serpa et al., 2018), by fostering the participation of those involved in this training strategy process by promoting a direct engagement in problem-solving (Jacobs, 2016). In this new context, in which AI will shape higher education competencies, such as soft or transversal skills, where leadership, communication, problem-solving, teamwork and creativity competencies are included (Sá & Serpa, 2018), it will be necessary to complementarily develop AI literacy (Popenici & Kerr, 2017; Akinwalere & Ivanov, 2022), to accommodate new discoveries, technologies and rapidly changing social norms (Long & Magerko, 2020).

At the same time, it is pivotal to reshape the role of the teacher, which implies a change in the way they teach, resulting from changes in expectations about their role and the consequent interaction with students (Akinwalere & Ivanov, 2022; Pence, 2019).

Conclusion

Like all changes that may affect the educational process, research and administration of higher education institutions (Ilieva, 2021; Sá, Ferreira, & Serpa, 2019), the application of AI in higher education will shape aspects that some will consider positive and others negative. However, one thing is certain: each and every stakeholder will be affected. As Li and Yang (2023) advocate, "[…] Higher education can't rely on the traditional teaching, learning, research, and governance structure in a static attitude. In the face of the intelligent era, it can neither coerce education with the rapid development of technology nor ignore technology with the arrogance of education" (p. 37). The best response for the scholar to, in a conscious way, keep up with these new challenges while maintaining indispensable academic freedom in teaching and research, without which there is no University or higher education (Ferreira & Serpa, 2018b; Serpa & Sá, 2022; Pedró, 2020; Schäffer & Lieder, 2022), is to encourage all those involved to discuss and analyze the competencies that AI can bring, understanding the best way to use it and guide future research in this area (Long & Magerko, 2020).

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