Using Artificial Intelligence in universities

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Abstract: *The purpose of this paper was to present the impact of Artificial Intelligence (AI) on education. AI helps education in at least two ways: the educational process – assistance and modifications to pedagogy and educator's routine function; and the educational ambit and content – what kind of education is needed. In this article, the author explores the challenges and potentialities that AI offers in education. This paper, which has an extensive literature review, is conducted to reveal how Higher Education Institutions (HEIs) have benefited from AI and must be met to prepare for such powerful technology.*

Keywords: Intelligent Education, Artificial Intelligence Integration, Educational Innovation, Higher education institutions.

1. Introduction

This paper highlights the progress made by "Gh. Asachi" Technical University and the Iași University Centre regarding the introduction and development of Artificial Intelligence Aided Education (AIEd) in the fields of Science, Technology, Engineering, Arts, and Mathematics (STEAM). General Association of Engineers of Romania (AGIR) and Technical Sciences Academy of Romania (ASTR) have permanently supported the efforts of "Gh. Asachi" Technical University from Iasi to update Engineering Education in Romania (Zhang et al., 2024).

The paper addresses implementing educational strategies based on artificial intelligence and promotes a more effective educational environment. The paper is organized as follows: Section 2 focuses on Universities Empowered with Artificial Intelligence. Section 3 provides the Requirements of HEIs to Meet the AI Revolution. Section 4 presents the conclusion and future work.

2. Universities empowered with Artificial Intelligence

AI applications in higher education sectors are classified into three main kinds of applications: institutional, student support, and instructional (Chen, Chen, & Lin, 2020; Alam, 2021; Khatun et al., 2024; Burlacu, 2024; Borisova, Hadzhikoleva, & Hadzhikolev, 2023; Oprea, 2021; Oprea, 2024). These three

broad categories can be broken down into several applications as displayed in Figure 1. The AI systems will play a major role in bringing about effectiveness in the making of institutional decisions via systems in marketing, admission and enrolment, curricula, and resource planning.
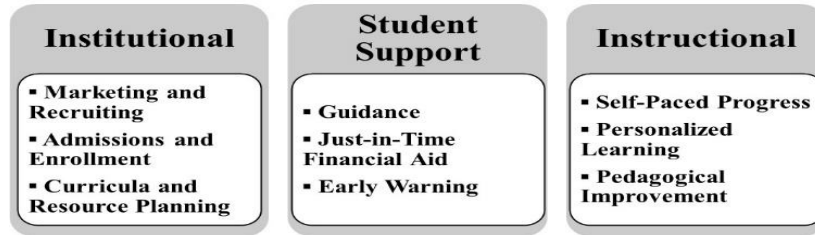

Figure 1. AI applications in higher education (broad categories), (Al-Haimi et al., 2021)

The AI applications that are being used in universities and Higher Education Institutions (HEIs) are based on the student's lifecycle approach, which is classified into two sections: (1) institutional and administration level and (2) academic support system.

Table 1. The AI functions in educational scenarios.
(Chen, Chen & Lin, 2020; European Commission, 2022)

	The work AI can do in Education
Administration	▪ Perform the administrative tasks faster that consume much of instructors' time, such as grading exams, and providing feedback ▪ Identify the learning styles and preferences of each of their students, helping them build personalized learning plans. ▪ Assist instructors in decision support and data-driven work. ▪ Give feedback and work with students timely and direct.
Instruction	▪ Anticipate how well a student exceeds expectations in projects and exercises and the odds of dropping out the school. ▪ Analyse the syllabus and course material to propose customized content. ▪ Allow instruction beyond the classroom and into the higher-level education, supporting collaboration. ▪ Tailor teaching methods for each student based on their personal data. ▪ Help instructors create personalized learning plans for each Student.
Learning	▪ Uncover the learning shortcomings of Student and address them early in education ▪ Customize the University course selection for Students. ▪ Predict the career path for each Student by gathering studying data. ▪ Detect learning state and apply intelligent adaptive intervention to students.

AI systems will greatly assist students through financial aid and early warnings to avoid any risks. Moreover, these systems will increase the effectiveness of teaching and learning through various intelligence systems. The functions of AI in Education are summarized in Table 1.

As presented in Figure 2, various AI applications being used are categorized into four major areas. These identified areas are profiling and prediction, assessment and evaluation, adaptive system and personalization, and intelligent tutoring system (Metzler & Martincic, 1998; Shute, 1995).
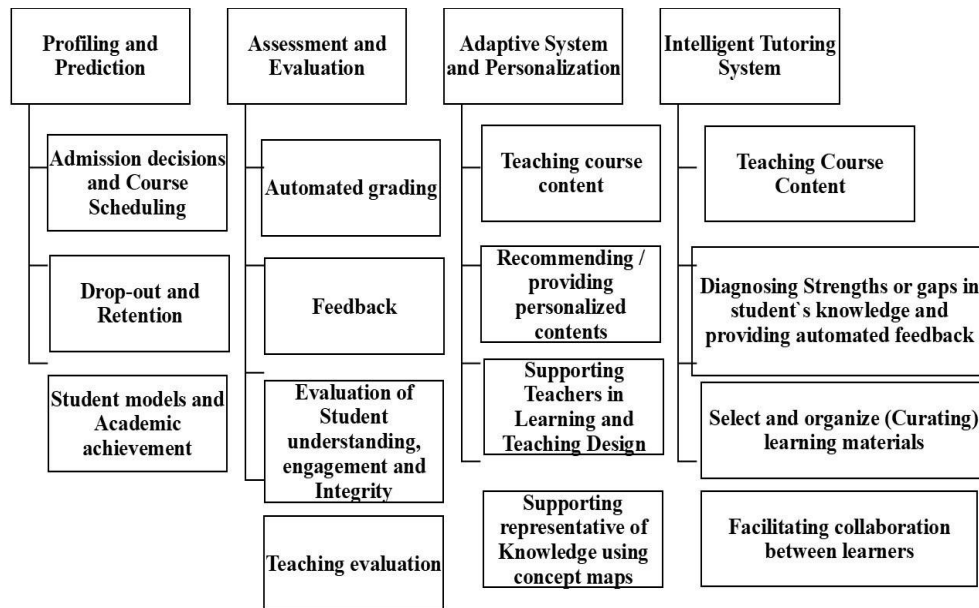

Figure 2. AI applications used in HEIs, (Papaspyridis, 2020; Al-Haimi et al., 2021)

All the mentioned systems and applications enabled by AI technology have led to students' success. Student success in a university or college is a crucial criterion for examining and measuring the success and quality of the educational institution.
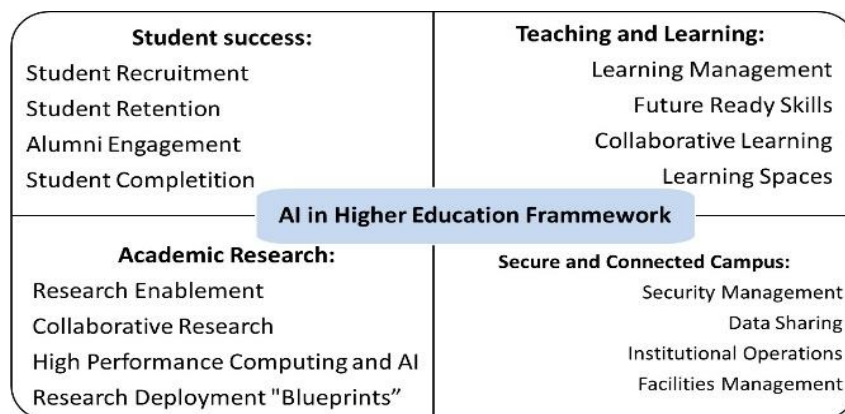

Figure 3. Framework of AI in higher education. Source ((Papaspyridis, 2020)

Consequently, implementing such applications and systems will lead to the success and better performance of any existing higher education. A broader framework of AI in higher education has been presented by the Microsoft Education Transformation Framework (ETF) in higher education, cited in (Papaspyridis, 2020). Based on this framework, higher education (Figure 3) benefits from AI through four major areas: 1) student success, 2) teaching and learning, 3) academic research, and 4) secure and connected campus. These areas are discussed below.

2.1 Student success

Student success is the cornerstone and the core function of any existing university. HEIs are expected to produce a high-quality and skilful workforce. Over time, technologies keep changing and thus universities and colleges are coping with the changes to prepare their students to meet the marketplace needs. For this reason, the emerging powerful technology of AI will benefit the HEIs.

For instance, because of the disruptive nature of AI classroom technology, it possesses a significant ability to modify or alter the teaching styles and the manner of presenting educational resources in the process of preparing students to achieve their career goals. Faculty members will have to be faced with new experiences and opportunities which they need to brace up to. Consequently, this situation will enable faculty members to identify and properly instil AI in the syllabus and the style of teaching, thereby bringing higher education into new instructional styles. To ensure student success, many applications of students' admissions, retentions, engagement, and tracking performance are being used in some HEIs.

In the field of teaching and learning (Dennis, 2018; Fattoh, 2014), AI is widely involved in applications that affect the methods of teaching and learning in universities. In fact, higher education has already taken the first step towards an unknown zone of the opportunities opened by AI in teaching and learning as well as institutions and governance. AI has created a new environment for teaching and learning, thus leading to further collaborations among students.

Global classrooms and massive open online courses (MOOCs) are examples of successful applications that turned the higher education environment into a new normal. MOOCs courses that are useful and interesting have been in use since 2008. Other applications, such as intelligent tutoring systems, have numerous benefits for teaching and learning. These benefits can be reflected in the teaching of course content, diagnosis of strengths or gaps in students' knowledge, automated feedback, curating of learning materials, and facilitation of collaboration between learners.

For example, the University of Georgia uses AI in administrative processes and in monitoring and tracking individual student's performance, predicting marks and dropouts or course withdrawals. Along with other universities, it also uses AI chatbot technology and other applications to simplify students' lives. Chatbot

technology, such as chatterbots, talkbots, virtual assistants, or conversation systems, are AI applications that use natural language to interact with users, such as university students, to facilitate teaching processes and to help the librarian. This kind of technology is widely used in Poland universities.

An AI application responds to questions from freshmen. Another AI application, a monitoring system, utilizes student data to predict student's performance and the possibility of dropping out. Thus, AI is promising and will benefit HEIs in terms of streamlining students' success, given that students nowadays are engaged with technology.

2.2 Teaching and learning

In the future, AI applications will be used beyond our expectations because they will reshape the perspective on the skill sets that students must gain to prepare them for the workplace. Several insights into how AI has helped higher education in teaching and learning: (1) AI helps lecturers analyse and recognize students' comprehension of topics through their facial expressions; it also assists in evaluating homework (e.g., activities in Coursera). (2) AI provides constructive feedback for students and lecturers. (3) AI will be used as a substitute for the teaching-and-learning process in which lecturers act as facilitators.

During the pandemic ages of COVID-19, the majority of HEIs worldwide have completely moved to online teaching and learning; however, handling online exams remains an obstacle. Many universities have started using AI application services and systems, such as remote Proctorio, Examity, Honorlock, and ProctorU, to monitor and record students during their online exams. Another example of AI application being used for teaching and learning in higher education is called teacherbot and IBM's Watson (Teaching Assistant) which afford an automated teacher presence throughout the course duration. The development of AI Technology will reshape the teaching and learning process of higher education.

2.3 Academic research

The number of publications worldwide reveals a considerable expansion of knowledge and data access. In 2018, a total of 2.6 million publications on science and engineering were issued; this number is a great indicator of how academic research is rapidly expanding. With such vast knowledge and data, AI plays a vital role in empowering researchers to analyse, share, visualize, and disseminate data in an effective manner through various tools.

Currently, AI technology facilitates the work of academic researchers by enabling search engines to perform quick and real-time searches. In addition, AI applications contribute to research and academic integrity. HEIs use detection systems to check plagiarism whereas publishers use AI to automate systematic academic literature reviews to detect ethical research behaviour before publication.

Furthermore, AI can write an essay instead of human writing; thus, AI will also be able to distinguish between human- and AI-written essays.

Secure and Connected Campus. The fourth dimension of the AI framework in higher education is a secure and connected campus. With the revolution of technologies and its effect on students' lives, innovative ways of learning are required. The world is shifting to "smart" buildings, cities, campuses, universities, and homes, which all require substantial IT infrastructure.

Nowadays, a successful model of smart and connected campuses is Birmingham City University, where a strong technological infrastructure costs £180 M. As a result, physical infrastructure, data and research sharing, operations, and facility management within the universities and campuses will have a secure and safe environment, that is conducive to students' learning experiences.

3. Requirements of HEIs to meet AI revolution

The benefits and promises of AI reveal how AI transforms businesses and the workforce and skills required by the marketplace and industries (Al-Haimi et al., 2021). Figure 4 shows the different ways in which the action plan has adapted higher education institutions in China to the new opportunities and benefits that AI can produce.
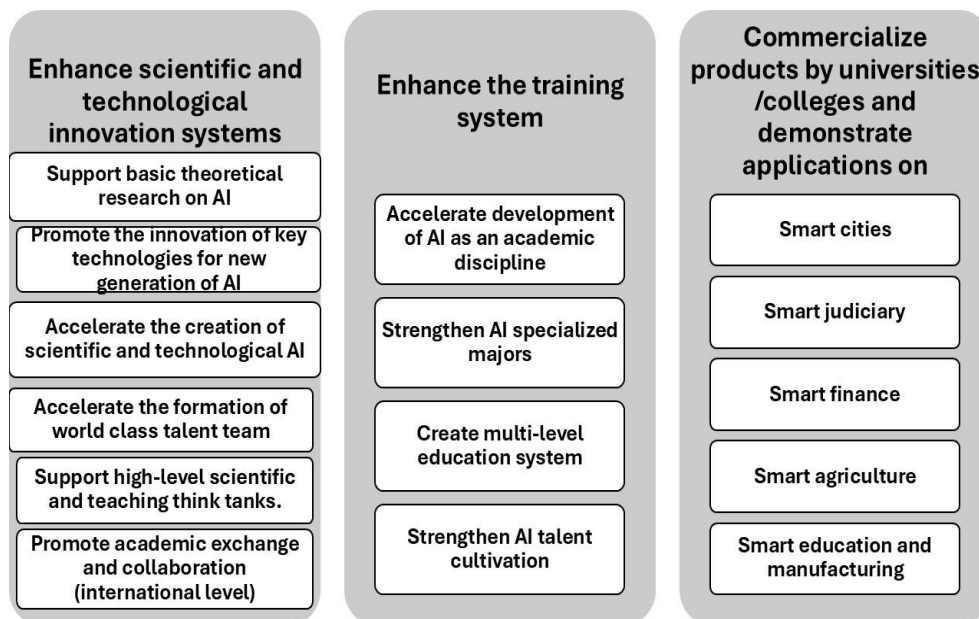

Figure 4. Key tasks in China's AI action plan for HEIs (Al-Haimi et al., 2021)

AI technology will drastically reshape the workforce, thus making higher education institutions prepare students to deal with such changes. Higher education institutions (Papaspyridis, 2020) need to plan, design, prepare, and

develop strategies on how to deal with the upcoming wave of the 4IR (Fourth Industrial Revolution) in general and the AI revolution in particular.

Governments, industries and sectors, including higher education institutions, have initiated several initiatives and allocated budgets for such projects. In line with these initiatives, the researchers published several articles on how higher education institutions should prepare for 4IR in general and the AI revolution in particular. China's AI Innovation Action Plan for Higher Education Institutions has launched several initiatives and requirements to prepare higher education institutions for their role in AI development.

Figure 5. Six dimensions for assessing AI readiness (Al-Haimi et al., 2021)

The strategy focuses on human capital as it aims to produce AI-related skills at different levels of education by creating networks, establishing a regulatory and ethical framework, and creating a data infrastructure for AI.

Each country needs to establish a strategy for the use of AI in education, including Higher Education. Figure 5 presents a comprehensive framework that assesses the readiness of any government organization for AI. This framework encompasses six important dimensions: strategy, people, processes, ethics, data and technology, and platforms. An interesting example of a framework for implementing AI in universities is the AI Center at the University of Malaysia Kelantan.

The major components of this framework are presented in Figure 6. These components are classified into two levels: The Ministry of Higher Education level and the University level. At the Ministry of Higher Education level, AI policies, standards, AI centres, and AI leadership are among the main components. At the university level, AI applications, AI infrastructure, and infostructure are needed to ensure the implementation of AI technology in the country. Developing strategies for AI implementation is an important element, as AI is a transformative technology that requires considerable effort and budget.

The second dimension for assessing the AI readiness of any organization is managing the problem of people in the organization. Problems in this dimension can be presented in the form of accessing, and attracting the necessary qualified

and talented people, training existing employees, and changing management in the organization.

The third dimension is assessing the implementation of AI. The assessment of this main dimension is done by measuring policies, allocating resources that increase the number of graduates and enrolments, and delivering through increased advocacy and promotion, as outlined in the AI Action Plan. The assessment can also be done through a strong and clear governance system to ensure the successful implementation of AI.

Figure 6. AI implementation in the University. (Al-Haimi et al., 2021)

The second dimension for assessing the AI readiness of any organization is managing the problem of people in the organization. Problems in this dimension can be presented in the form of accessing, and attracting the necessary qualified and talented people, training existing employees, and changing management in the organization. The third dimension is assessing the implementation of AI. The assessment of this main dimension is done by measuring policies, allocating resources that increase the number of graduates and enrolments, and delivering through increased advocacy and promotion, as outlined in the AI Action Plan. The assessment can also be done through a strong and clear governance system to ensure the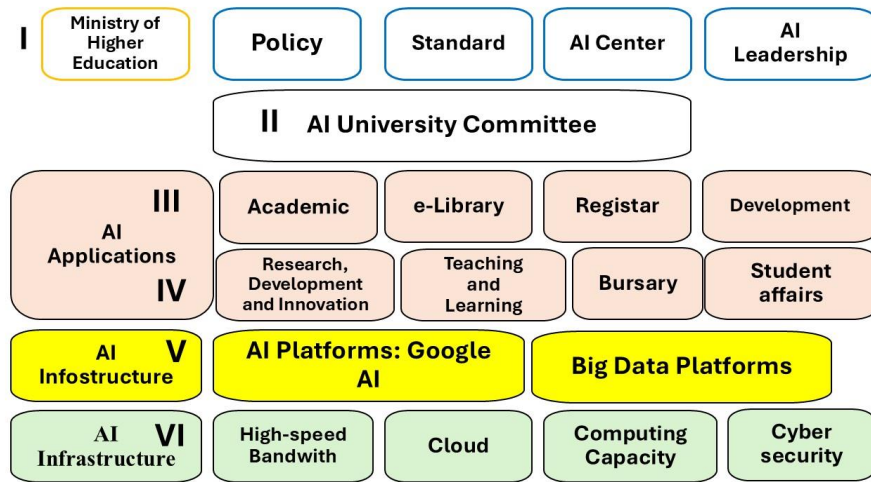 successful implementation of AI. The fourth dimension is ethics. AI is a digital technology that will affect our lives and society; therefore, the advantages and disadvantages that this technology can bring and how we can control or avoid the risks to benefit from it must be determined.

4. Conclusions

The objective of the article was to present, analyse and evaluate the impact of AI on education. Articles from journals, professional publications, and professional conference reports were identified and used in an analysis that

facilitated the achievement of the study's objective. AI technologies can contribute to a more personalized, efficient and inclusive education system. This information and conclusions are relevant for academic institutions and policymakers seeking to adapt education systems to the demands of the digital age. AI will mainly help students with learning difficulties and evaluate performance with constructive feedback.

Teachers will use artificial intelligence technology to help students (chatbots to recognize and solve questions asked by students during classroom lectures). Artificial intelligence will help improve the quality of distance and online education (Ng, Leung, Su, et al., 2023; Railean et al., 2023). AI is used in learning technology systems that include virtual reality (VR), and augmented reality (AR).

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