

THE ROLE OF ARTIFACTS IN HIGHER EDUCATION

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Abstract

AI instruments represent an worldwide research topic, specifically triggered by some critical areas such as education or business. The adoption of AI instruments in higher education is not purely a technological shift but a pedagogical and organizational metamorphosis. Notwithstanding growing interest in AI tools, theoretical or empirical gaps remain in understanding the determinants that drive or maybe hinder AI adoption in higher education. This research aims to reveal the implications of artifacts (e.g. AI instruments) in higher education by examining their impact on teaching and learning processes, institutional strategies and user acceptance.

Keywords: artificial intelligence (AI), higher education, SEM (Structural Equation Modeling), technology acceptance.

1. Introduction

The transformative era of implementing Artificial Intelligence (AI) instruments is an intrinsic result of globalization. The twenty-first century is marked by rapid technological progress even the history of AI field started earlier than the humanity can even imagine. The artifacts continue to extinguish their ramifications until the educational level. A short time ago we couldn't talk about education outside of human resources, being considered a vocational job. Nowadays times have changed and we cannot view the educational system, especially the academic one, outside of AI tools. Why? Because we are going through an era marked by future technological revolution which reshapes also the educational paradigms.

The present research concentrates on identifying the most relevant factors that impact the implementation of AI instruments in higher education. The remainder of the scientific paper is organised as the following: the first Section comprises a structured literature review of the history of artificial intelligence, The second Section comprises focus areas of application of AI in higher education, the third Section presents the benefits of AI in Higher Education, the fourth Section presents the caveats. The last Section presents conclusions, some inherent scientific limitations and future research directions.

2. Artificial Intelligence through the history

The history of Artificial Intelligence begins earlier than the mundane can imagine. In this vein, structurally we present (Table 1) the chronological development of Artificial Intelligence in order to understand deeper the root of this concept.

Table 1: The chronological development of Artificial Intelligence

Period	Founder	Name of foundation	Characteristics	Source
Ancient time - 4 th century BCE	Aristotle	<i>Prior Analytics</i>	Aristotle introduces syllogistic logic (the first formal deductive reasoning system)	Jenkinson, 2019

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1832	Charles Babbage & Ada Byron	<i>Analytical Engine</i>	They create a programmable calculating machine	Hasan, 2022
1854	George Boole	Called <i>laws of thoughts</i>	Boole develops a binary algebra	Hasan, 2022
20 th century	Karel Capek	<i>Robot</i>	Karel Capek's play RUR (Rossum's Universal Robots)	Hasan, 2022
1936-1937	Alain Turing	<i>Turing Machine</i>	The first proposal of a Turing Machine represents the base for computers and computing ideas	AAAI, 2017
1948-1949	William Grey Walter	<i>Machina speculatrix</i>	Walter creates the first robot with the name Elmer and Elsie (ElectroMEchanical Robot, Light-Sensitive)	Inglis-Arkell, 2015
1950	Isaac Asimov	The book <i>Computing Machinery and Intelligence</i>	Asimov writes down three books about the laws of robots and Turing	Hasan, 2022
1955	John McCarthy, Marvin Minsky, Nathaniel Rochester, Claude Shannon	<i>Artificial Intelligence</i>	During the Dartmouth Conference, for the first time, the term <i>artificial intelligence</i> was coined by them	McCarthy et al., 2016
1956	Dartmouth Summer Research Project	<i>Artificial Intelligence</i> as discipline	Through this Research Project, <i>artificial intelligence</i> takes the place as a new discipline	McCarty, 1977
1960	-	<i>Chatbots</i>	The introduction of AI in education is associated with chatbots' development	Weizenbaum, 1966

1977	Thorne McCarty	<i>Taxman</i>	McCarty or <i>the father of AI</i> develops The Knowledge-based System entitled <i>Taxman</i>	Kuźniacki, 2019
Era of industry 4.0	-	<i>Digital revolution</i>	The democratisation of internet and the era of computers starts the digital revolution	Hasan, 2022

Source: Own source

With the help of the existing specialized literature, we analyse the development of the digital revolution. The definitional analysis of the term Artificial Intelligence knows long and evolving progress. Different perspectives for the challenging question „What is AI?” came across different fields and applications. In this regard, in the following (Table 2) we reveal some of the most descriptive definitions of AI:

Table 2: Definitional analysis of AI

Authors	Definitions
Brown and O’Leary, 1995	<i>AI – intelligence, research, business and programming perspectives</i>
Crevier et al., 1993	<i>AI – multidisciplinary science</i>
Huq, 2014	<i>AI – science of creating intelligent machines</i>
Tone and the Top, 2017	<i>AI - automating routine tasks</i>
Rezaee et al., 2002	<i>AI – furnishing financial information through the help of Extensible Markup Language (XML) and eXtensible Business Reporting Language (XBRL)</i>
Odoh et al., 2018	<i>AI – performs tasks better than humans</i>
Lee and Tajudeen, 2020	<i>AI – machines who learn from their own mistakes</i>
Zhang et al., 2020	<i>AI – cognitive technologies as Natural Language Processing, Machine and Deep Learning, Big Data, Blockchain, Machine Learning, Cloud Computing, Enterprise Resource Planning (ERP), etc.</i>
Fenwick and Molnar, 2022	<i>AI – automated version of human being intelligence</i>

Source: Own source

3. Focus Areas of Application of AI in Higher Education

Another veil of definitions came across the application of AI in higher education. Even the number of perspectives is almost unlimited, with the help of a systematic review of the specialized literature we try to capture the most relevant scientific literature.

The borderline between AI and higher education is very fine because digitalisation appears to become an intrinsic part of our lives including the educational system. More, higher education as a dynamic environment uses AI as a suitable tool for the advancement of information technologies or the educational acts (Escotet, 2023). Technological progress represents the door for the educational service provider and for the on-line learning technologies. Digital skills are required for digital instruments with AI instruments. Platforms as Grammarly, ChatGPT, Mendeley, Brainly or any online educational forms as virtual classrooms, tutorials or other simulation project are the beginning of a new era of education (Pellas et al., 2021).

In 2021 the European Parliament and also the European Commission propose to regulate AI through strictly and precise guidelines offering a legal framework at the EU level. Moreover, the European Commission (European Commission, 2021, p. 9) added to the present European legislation an AI Monitoring Index (2021) which includes relevant aspects concerning policy makers and further investment for the targeted pillars. For example, university education represents a part of AI Monitoring Index entitled Societal Aspects pillar being assessed on three levels:

- AI in the EU university programmes;
- places in AI – content universities;
- AI intensity in places offered by universities.

In this vein, some authors (Șirghi et al., 2024) reveal that the EU digitisation strategy is on the same wavelength with the implementation of AI technologies in higher education level. The US and China represent the countries which count the highest number of AI research in higher education (Crompton and Burke, 2023). This topic is an extensive research all over the countries for more than 30 years (Nguyen, 2023). This is in line with the constant effort of the AI higher education programmes in all the EU states (European Commission, 2021). The university education system needs a permanent effort from both part (students and teachers) to model the competences and to add value to the educational act changed and challenged by the AI technologies. The need for a more sustainable AI systems in education remains actual because of some ethical consideration (fairness, transparency, issues of plagiarism) and an AI – influenced professional landscape (Rudolph et al., 2023). Some inherent challenges as academic misconduct of cheating facilitations underscore the need for reshaping the university curricula in line with the integration of AI instruments into the educational system. For a full harmonization with AI tools, an update of the academic integrity policies is also necessary (Perkins, 2023).

4. Benefits of implementing AI in Higher Education

In the following we outline the most important advantages and disadvantages of implementing AI in higher education. At the level of the specialized literature review there are studies which emphasize only the benefits or only the caveats of AI implementation in academic fields. As far as we are concerned we consider that the utilisation of AI instruments by academic students implies both of them (advantages and disadvantages) doubtless, maybe having the same weight in total. In this case, in what follows first we collected from recent sources the most relevant benefits in order to build up some arguments for our own hypothesis. Also, we continue to point out the most significant caveats of AI instruments' use in the academic field.

The specialized literature is full of examples of benefits. The majority of the studies shows that students with some exceptions are very satisfied because two major characteristics of AI instruments as the instant responsiveness and the continuous availability (Kamalov et al., 2023). The globalization encourages this type of behaviour by eliminating or diminishing delays offered by the traditional support systems. In this vein, with the help of the specialized literature we write down a list with the most relevant advantages of implementing AI in higher education as the following:

- stimulating and supporting learning process;
- AI applications satisfy the deepest learning needs of the students (Șirghi et al., 2024);
- tertiary education comes in line with the Western standards due to AI technologies;
- the use plagiarism detection programmes (e.g. Turnitin, Copyscale) by both sides (students and teachers);

- the use of correct expressions in different foreign languages (e.g. Grammarly, DeepL) by both sides (students and teachers);
- the use of citation supports or bibliographic references' organisation (e.g. Mendeley, Brainly);
- the use of ChatGPT by students for complex topics or academic tasks in a very real time;
- a tailored tool in task facilitation;
- digital assistant capable to give prompt responses;
- a decrease in administrative costs (Sova et al., 2024);

5. Caveats of implementing AI in Higher Education

Concerning the caveats of the use of AI instruments in higher education the examples appears to be less than the benefits. However the central idea of the majority of the opinions reveals how AI instruments can erode the human element in education through the risk of dehumanization due to an overreliance on AI instruments in the educational experience. At the same time, many studies criticize the diminish development of the level of non-cognitive or soft skills (Saihi et al., 2024). In this case, the human touch in education can balance the technology challenges being pivotal not only in the academic field (Rane, 2023). Not remaining limited of some studies, with the help of the specialized literature we provide a synthesized list with the most common challenges related to the implementation of AI instruments in academic field. The implicit risks of implementing AI in higher education are:

- pressure for digital skills;
- continuous effort from teachers and students (Escotet, 2023);
- excessive automation leads to a decreasing learning act;
- ethical issues (Gînguță et al., 2023);
- moral issues (Saghiri et al., 2022);
- fear associated with the AI-assisted learning process;
- integrity and recognition of contribution;
- potential overreliance on AI instruments;
- replacement of human teachers;
- potential unemployment (Sova et al., 2024);
- negative effects on psychosocial level.

6. Conclusions

Summarizing all the above we conclude that the implementation of AI instruments in higher education represents a very challenging and actual issue nowadays. Both advantages and disadvantages are limited by various factors and unlimited by students' or even teachers' perception. Understanding the dynamics of these assorted cognitions is of paramount importance. In what follows we seek for factors that shape the students' perception and their subsequent impact on implementation AI in higher education.

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