

ARTIFICIAL INTELLIGENCE IN HIGHER EDUCATION AND TEACHER TRAINING: RESPONSIBLE INTEGRATION AND IMPACT

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Abstract

This paper aims to investigate the impact of artificial intelligence (AI) on higher education and teacher training with a focus on responsible integration and ethical implications. The study was conducted at the university level and combined the application of a questionnaire to a sample of respondents: students, doctoral students, Department for Teacher Training students, teachers and case studies (Ali Z., *et al.*, 2025; Brezuleanu M-M. *et al.*, 2025). This study showed that AI is mainly perceived as a tool to support documentation, personalization of learning and data analysis, but there are also challenges such as lack of staff training, digital dependency and reduced critical thinking (Castillo-Martínez I. M. *et al.*, 2024; Wang S., *et al.*, 2024). The results highlight both the perceived advantages (quick access to resources, personalization, research support) and the main barriers (insufficient resources, cultural reluctance, ethical issues). At the same time, the analysis highlights the importance of respecting the principles of digital ethics and promoting good academic practices as essential benchmarks for the responsible integration of AI. The conclusions emphasize that AI can contribute significantly to the modernization of the educational process and the training of future teachers, provided that it is integrated in an ethical, equitable and didactically guided manner, in support of smart agriculture and sustainable development.

Keywords: artificial intelligence, teacher training, digital ethics, good university practices, smart agriculture

Introduction. Political, economic, social and cultural transformations in recent decades have led the Romanian education system into a continuous process of reform and innovation. In this context, technological progress, particularly the development of artificial intelligence (AI), exerts a major influence on how universities design their curricula and educate future specialists. At the European level, strategic documents such as Education and Training 2020 and the Digital Agenda for Europe underscore the need to modernize educational processes by integrating digital competences, fostering innovation and preparing young people for a labor market in constant flux (European Commission, 2020a; European Commission, 2020b).

In the context of accelerated digital transition, universities are called upon to redefine educational paradigms to meet both the needs of students and the demands of a knowledge-based labor market. According to the Organisation for Economic Co-operation and Development OECD (2024), more than 65% of emerging occupations require advanced digital competences and AI

integration is becoming a catalyst for pedagogical innovation. Likewise, UNESCO (2024) stresses that AI should be understood not merely as a technology but as a socio-technical ecosystem influencing values, ethics and educational equity. Therefore, responsible integration requires a dual approach: developing the digital competences of teachers and fostering the critical thinking of students to enable reflective interaction with AI.

AI may be defined as a set of technologies and methods that simulate human cognitive processes—learning, reasoning, and decision-making—and that can be applied across multiple domains of knowledge. In education, AI is manifested through tools that support personalized learning, adaptive assessment, automated feedback systems, interactive resources, and digital platforms that promote the active engagement of students, doctoral candidates and Department for Teacher Training participants.

In higher agricultural and technical education, AI offers unique opportunities for modeling decision-making processes, simulating agricultural ecosystems and analyzing

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experimental data, thus fostering evidence-based learning. Moreover, integrating these technologies into Department for Teacher Training programs contributes to developing transversal competences - creativity, collaboration and ethical responsibility - that are essential for 21st-century education.

At IULS, AI is relevant not only for students in agronomy, horticulture, animal science, and veterinary medicine, but also for doctoral candidates engaged in research and for Department for Teacher Training participants preparing for teaching careers. The agriculture of the future and modern teacher education can no longer be conceived without the use of digital technologies: crop monitoring via sensors and drones, disease diagnosis through visual algorithms, as well as the use of AI to develop lesson plans, provide rapid feedback, and build pedagogical competences (Miller T., *et al.*, 2025).

Thus, AI plays a multifaceted role in the work of students, doctoral candidates, and Department for Teacher Training participants at IULS: from supporting independent study and research to strengthening teacher education and professional formation (Liang J., *et al.*, 2025; Tan, L. Y., *et al.*, 2025). The responsible integration of these tools, under the guidance of academic staff, can contribute to preparing specialists and teachers capable of meeting the challenges of smart agriculture and digital education (USV Iași, 2024).

MATERIAL AND METHOD

The study examined how students, doctoral candidates and Department for Teacher Training participants at IULS perceive and use AI in their academic, practical, and pedagogical activities. Two main directions were investigated: an analysis of curricular documents and an exploration of participants' direct experiences.

Methods employed included:

- administering questionnaires to a sample of 120 respondents (students, doctoral candidates, and Department for Teacher Training participants);
- case studies on the application of AI in practical and pedagogical activities (visual applications, adaptive platforms, machine-learning algorithms).

The methodological design followed a mixed-methods research model, combining quantitative questionnaire analysis with a qualitative approach based on case studies and reflective observations. The sample included participants from four faculties, allowing for significant inter-field comparisons. The qualitative components (semi-structured interviews) explored dimensions such as perceptions of AI ethics, trust

in algorithms, and the role of AI in creating interactive educational resources.

The data were interpreted using descriptive statistical methods and by correlating questionnaire results with information obtained from academic staff. On this basis, recommendations were formulated for expanding and diversifying educational activities through the responsible and creative integration of AI.

RESULTS AND DISCUSSIONS

3.1. GENERAL ANALYSIS

The analysis of questionnaires, interviews, and case studies revealed distinct trends among students, doctoral candidates, and Department for Teacher Training participants. The overall level of familiarity with AI ranges from moderate to low, with clear differences between participant categories. The perceived usefulness of AI also varies: students view it primarily as a tool for rapid information retrieval, doctoral candidates employ it for data analysis, while Department for Teacher Training participants use it for lesson preparation and the simulation of teaching scenarios.

The results showed that 72% of participants use AI weekly, mainly for documentation and academic writing. However, only 28% reported having received formal training on the ethical use of these tools. This discrepancy highlights the need for critical digital literacy - a point also emphasized by Wang *et al.* (2024), who noted that “technological familiarity without ethical awareness amplifies the risks of dependency and cognitive superficiality.”

The distribution of AI familiarity levels is presented in (figure 1).

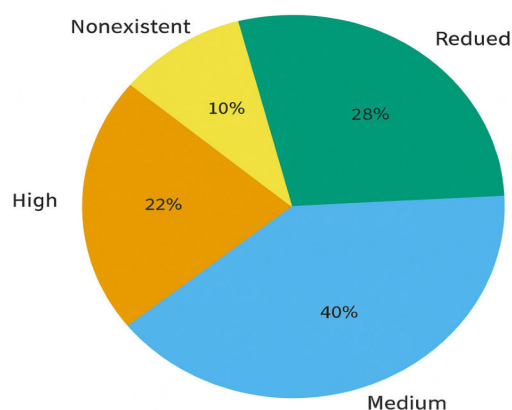


Figure 1 Level of familiarity with AI among respondents

The perceived advantages are shown in (figure 2), confirming the importance of rapid access to information and personalized learning.

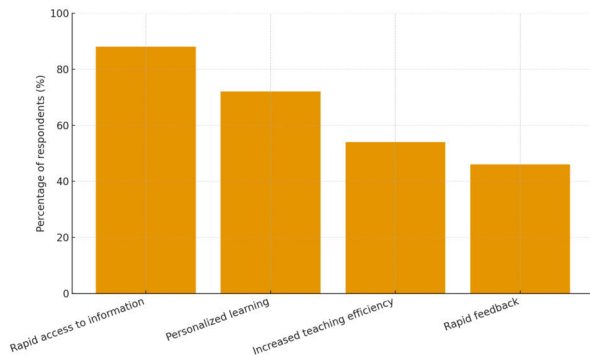


Figure 2 Perceived benefits of using AI in education

The identified challenges are summarized in Figure 3, which highlights insufficient teacher training and the risk of digital dependency as the primary concerns.

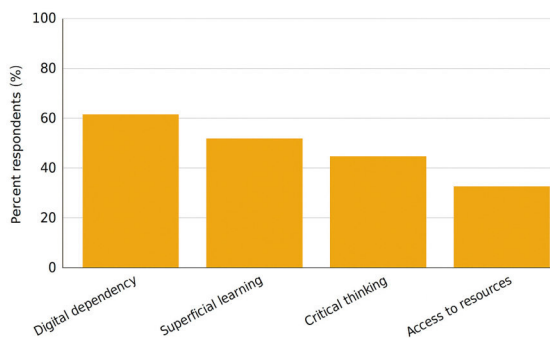


Figure 3 Perceived challenges in integrating AI into education

3.2. THE ROLE OF AI IN TEACHER EDUCATION

The use of AI in teacher education enables the personalization of the educational process, the generation of differentiated instructional scenarios, and the simulation of complex classroom situations. Machine learning algorithms support the analysis of learners' performance, highlighting strengths and areas in need of development. In this way, AI contributes to the development of both digital and pedagogical competences among future teachers.

AI-based learning models, such as ChatGPT, DeepL, or Consensus, facilitate the creation of personalized teaching scenarios and adaptive feedback. Through AI-powered learning analytics platforms, educators can anticipate learners' difficulties and adjust learning content in real time. Moreover, AI supports assisted pedagogical reflection — a concept introduced by (Liang *et al.* 2025) — involving the automated

analysis of teaching strategies through natural language processing algorithms. This leads to more efficient training, oriented toward measurable outcomes and personalized learning experiences.

3.3. ETHICAL CONSIDERATIONS

The integration of AI raises major ethical issues, including algorithmic transparency, the protection of personal data, equity of access, and the risk of replacing the human dimension of education. Universities must ensure an inclusive framework in which AI is employed as a complementary tool, not a substitute for human interaction.

Digital ethics in education requires ensuring algorithmic transparency, equitable access and shared responsibility between the user, the institution, and technology developers. According to the UNESCO Recommendation on the Ethics of Artificial Intelligence (2023), higher education institutions are obliged to establish codes of conduct regarding AI use, particularly in student assessment and academic research. Therefore, it is recommended to implement a university-level AI governance framework based on the FAIR principles (Findable, Accessible, Interoperable, Reusable) for managing educational data responsibly.

3.4. EXAMPLES OF GOOD PRACTICES AT IULS

Examples of good practices include the integration of AI into Department for Teacher Training modules, interdisciplinary projects, digital ethics workshops, support for teaching practice through automated analysis, and international partnerships (Erasmus+, Horizon Europe).

IULS aligns with European trends through the integration of AI Literacy modules within Department for Teacher Training and participation in Erasmus+ projects focused on developing digital competences among teachers. Additionally, the use of computer vision-based visual applications in agricultural practice demonstrates the interdisciplinary transfer of AI between education and applied research.

3.5. PRELIMINARY CONCLUSIONS FROM THE QUESTIONNAIRE

The questionnaire results confirm both the participants' interest in and openness toward AI, as well as the need for a cautious approach. The still modest level of familiarity highlights the importance of digital literacy and teacher training. The main advantages identified are learning personalization and rapid access to resources, while the main challenges concern digital

dependency, critical thinking, and access barriers. Thus, AI can become a valuable tool for the modernization of education—provided that its integration is ethical and pedagogically guided.

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CONCLUSIONS

1. The integration of AI has a significant impact on students, doctoral candidates and Department for Teacher Training participants, providing support for information gathering, learning and research.

2. Practical uses differ: students turn to AI for study, doctoral candidates for research and Department for Teacher Training participants for preparing teaching activities.

3. Academic staff and mentors endorse AI integration but emphasize the need for appropriate digital and ethical training.

4. The identified risks (dependency, superficiality and diminished critical thinking) underscore the importance of balanced use.

5. The case studies demonstrated AI's applicability in agriculture, research and teacher preparation.

6. AI integration should be a cross-cutting process designed to prepare future specialists and teachers for the challenges of smart agriculture and digital education.

These findings confirm that integrating AI into higher education is no longer optional but a strategic necessity. However, the added value of AI depends on the human dimension of education - critical thinking, empathy and social responsibility must be cultivated alongside digital skills. For the future, it is recommended to:

- develop a transversal digital ethics curriculum within Department for Teacher Training;
- establish university centers for AI-assisted educational innovation;
- and promote a culture of transparency and ethical evaluation in the use of emerging technologies.

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