Machine Learning and Students'Digital Skills – A Perspective on Integrating Ai into Education

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ABSTRACT

The rapid expansion of Artificial Intelligence (AI) and Machine Learning (ML) technologies is reshaping higher education, creating new expectations for digital competence and employability. This study explores university students' perceptions of AI integration into education and its perceived impact on their career development. Data were collected through an online survey administered to students from several universities in Western Romania, focusing on three key dimensions: awareness of AI concepts, understanding of ethical implications, and readiness for AI-driven workplaces. The findings reveal a predominantly positive attitude toward AI and ML, with most respondents acknowledging their transformative potential in enhancing learning efficiency, creativity, and professional growth. Over 85% of students agree that AI literacy and basic ML knowledge should be integrated into academic curricula across disciplines. However, the results also highlight a gap in students' understanding of ethical and moral aspects related to AI applications, such as data privacy, bias, and algorithmic accountability. The study underscores the need for higher education institutions to promote both technical and ethical AI literacy, combining computational thinking with digital responsibility. By aligning educational practices with the evolving demands of the labour market, universities can better prepare students for careers in a data-driven and automated society.

Keywords – Artificial Intelligence, Machine Learning, Education, Digital Competence, Career Development, Ethics in AI, Higher Education

INTRODUCTION

The main purpose of this study is to analyze university students' perceptions, attitudes, and readiness regarding the integration of Artificial Intelligence (AI) and Machine Learning (ML) into higher education and professional skill development.

Specifically, the research seeks to evaluate students' perceptions of AI's impact on their professional growth and opportunities within an increasingly automated environment.

It also aims to assess their level of awareness and understanding of fundamental AI and ML concepts across various academic disciplines, identifying potential gaps in knowledge that may affect future employability. Furthermore, the study analyzes students' attitudes toward the inclusion of AI and ML in university curricula, highlighting their acceptance level and motivation to acquire emerging digital competences essential for the labour market of tomorrow.

Another important dimension of this research focuses on students' understanding of the ethical and moral implications of AI, addressing critical issues such as data privacy, algorithmic bias, fairness, and social responsibility.

Finally, based on the empirical findings, the study provides practical recommendations for improving higher education curricula. These suggestions emphasize the integration of both technical and ethical AI literacy,

encouraging universities to foster responsible, informed, and adaptive learning environments that prepare students for sustainable careers in an AI-driven world.

Artificial Intelligence (AI) represents one of the most profound transformations of the 21st century, exerting a significant impact on education, the economy, and professional career development. Over the past decade, technological progress in the field of Machine Learning (ML) and Natural Language Processing (NLP) has enabled the rapid expansion of AI applications in higher education, offering new opportunities for personalized learning, predictive analytics, and the automation of educational processes.

Numerous recent studies have shown that students' perceptions of AI are generally positive, as they view artificial intelligence as a useful tool for learning and professional development. Katsantonis and Katsantonis [1] identified a three-dimensional structure of students' attitudes toward AI - cognitive, emotional, and behavioral - with a predominance of the cognitive dimension, indicating a pragmatic orientation toward new technologies. Similarly, the study by Acosta-Enriquez *et al.* [2] demonstrated that interaction with *ChatGPT*-type applications positively influences learning motivation, particularly when these tools are used within a guided academic framework.

At the international level, Fošner [3] analyzed university students' perceptions of the sustainability of AI-based educational practices, concluding that the responsible use of such tools contributes to the development of digital competence and critical thinking. Other studies, such as the one published in *BMC Psychology* [4] and the research conducted in Greece[5], confirm a global trend of AI acceptance in education, showing moderate cultural differences but consistent concern for ethics and academic integrity.

At the same time, several analyses highlight perceived risks and limitations. For example, the article The Impact of Artificial Intelligence on Students' Academic Learning Processes and Performance [6] notes that while AI improves students' analytical and writing performance, it can also foster cognitive dependency if not integrated within a balanced pedagogical context. Likewise, the "Tool, Threat, Tutor, Talk, and Trend" model proposed in [7] illustrates the ambivalence of student perceptions - AI is simultaneously viewed as a tool, a tutor, a threat, and an inevitable trend.

Beyond the educational dimension, researchers emphasize the importance of developing ethical competences associated with AI use. Mogavi *et al.* [8] underline that higher education should explicitly include reflection on the social impact of algorithms, while Ammari *et al.* [9] show that students tend to use AI without fully understanding its ethical or epistemic implications. In the same direction, Tang *et al.* [10] developed and validated a scale for measuring the acceptability of GenAI tools in higher education, concluding that faculty training and institutional guidance play a crucial role in promoting responsible use.

The literature thus converges on the idea that artificial intelligence is transforming both the content and structure of education, requiring a balance between technical, ethical, and reflective competences. In Romania, the university context is currently undergoing alignment with international trends; however, empirical studies exploring local student perceptions of AI, its career impact, and their readiness for an automated labor market are still limited.

This study aims to contribute to that direction by analyzing data obtained from a survey conducted among students from Western Romania, focusing on:

1. evaluating students' perceptions of AI's impact on their careers;
2. identifying their level of awareness regarding ethical implications;
3. exploring attitudes toward the necessity of training in AI and ML.

By correlating these dimensions, this research provides an empirical perspective on the interaction between digital literacy, professional preparation, and ethical awareness in the age of artificial intelligence.

METHODOLOGY

II.1. Research purpose

The main goal of the research was to investigate the perception of students in western Romania towards the use of artificial intelligence (AI) and machine learning (ML), as well as to identify how they assess the impact of these technologies on their professional training and career. The study also aimed to highlight the level of awareness of the ethical and moral dimensions of the use of AI in their fields of specialization.

II.2. Research Design

The research was quantitative descriptive, conducted through an online questionnaire created in the Google Forms platform. The instrument was developed to collect data on:

1. demographic and educational profile of
2. respondents;
3. level of use of AI-based applications;
4. perception of the role of AI in career development;
5. attitudes regarding the ethics and morality of using artificial intelligence;
6. level of confidence in one's own preparation for an automated labour market.

II.3. Research sample

The participants were university students from institutions located in the western region of Romania, mainly enrolled in fields such as computer science, engineering, and social sciences. The total sample consisted of N = 100 participants. Most respondents were undergraduate students, with a significant proportion in their second and third years of study. The gender representation was balanced, and the average age ranged between 20 and 24 years.

The questionnaire included 25 questions, structured as follows:

- 8 items focused on socio-demographic information;
- 3 items directly addressed the perceived impact of AI on career development (corresponding to question 11 in the instrument);
- 6 items evaluated the level of knowledge and use of AI applications;
- 8 items were Likert-scale questions (ranging from “Strongly Disagree” to “Strongly Agree”), measuring perceptions, values, and attitudes toward AI.

The content validity of the instrument was ensured through expert review by specialists in computer science and educational psychology, while the internal consistency of the scales was verified through response coherence analysis.

II.4. Data analysis methods

The collected data were exported in Excel format and processed for descriptive statistical analysis and visual representation of the results.

Percentage distributions, absolute frequencies, and relationships among the items measuring the following aspects were calculated:

1. students’ perception of AI’s impact on career development;

2. the perceived need for AI-related training;

3. the level of understanding of ethical implications associated with AI use.

The generated visualizations - primarily bar charts and pie charts - provided a clear representation of trends and differences across responses, highlighting a high level of awareness regarding the importance of AI in professional development.

II.6. Research limitations

Like any exploratory study, this research presents several limitations that should be acknowledged when interpreting the results.

First, the relatively small sample size restricts the extent to which the findings can be generalized to the entire population of university students in Romania or to other regions with different educational and sociocultural contexts. While the sample provides meaningful insights into trends within Western Romanian universities, larger and more diverse samples would enhance the statistical validity and external applicability of the results.

Second, the self-reported nature of the data introduces potential subjective biases related to students' personal interpretations, levels of awareness, and willingness to respond accurately. Respondents may have provided socially desirable answers or overestimated their familiarity with AI tools and concepts. Future studies could address this limitation by triangulating data through mixed-method approaches, combining quantitative surveys with qualitative interviews or focus groups to gain deeper contextual understanding.

Third, the study did not conduct a comparative analysis between academic disciplines such as computer science, economics, and social sciences. This restricts the ability to explore how disciplinary backgrounds influence perceptions of AI, levels of digital competence, or attitudes toward ethical issues. Comparative or longitudinal designs could reveal important inter-field variations and changes over time, enriching the theoretical framework for AI education.

Despite these limitations, the research provides valuable empirical insights into the current level of awareness, preparedness, and perception of students regarding artificial intelligence. It establishes a solid conceptual and methodological foundation for future investigations, which could extend the scope of analysis to include cross-institutional comparisons, advanced statistical modeling, or the integration of behavioral data on actual AI tool usage. Such extensions would contribute to a more comprehensive understanding of how AI literacy, ethics, and employability intersect in contemporary higher education.

RESULTS AND DISCUSSION

The analysis of the data collected through the online questionnaire revealed several significant trends regarding students' perceptions of the impact of Artificial Intelligence (AI) on their professional training and career development. The findings highlight not only students' awareness of the transformative potential of AI in shaping future employment opportunities but also their attitudes toward ethical implications and the integration of AI into academic learning environments.

Overall, the data suggest that the majority of students view AI as a positive and necessary component of professional growth, recognizing its relevance in fostering innovation, efficiency, and adaptability in the workplace. At the same time, variations across responses indicate differing levels of familiarity and confidence in applying AI tools, particularly between students in technical and nontechnical fields.

III.1. General Perception of AI's Impact on Career Development

In response to the statement *"I believe that AI will have an impact on my career,"* the majority of participants selected *"Agree"* or *"Strongly Agree."* This indicates a high level of awareness among students regarding the

direct influence of Artificial Intelligence on their future employment prospects. Only a small percentage of respondents expressed neutral or disagreeing opinions, which confirms that students tend to perceive AI not as a threat but as a catalyst for change in the professional environment.

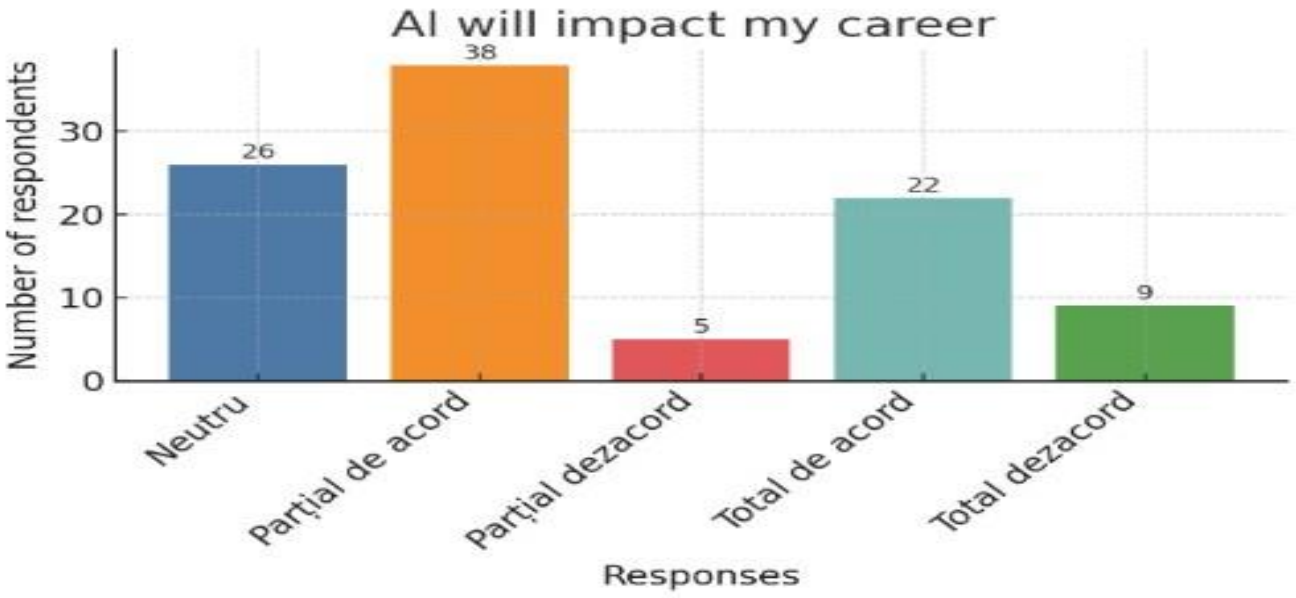

Fig. 1 The impact of AI on your personal career

This finding aligns with international research trends, which report similar patterns among young people, especially those in technical and engineering disciplines. Prior studies have shown that students generally hold a positive attitude toward emerging technologies and demonstrate a growing openness to acquiring the digital competences necessary to adapt to AI-driven transformations in the labour market [1], [3], [5].

The responses in this study therefore suggest that AI is perceived as a career-enhancing tool, fostering innovation, adaptability, and new professional opportunities rather than displacement. This perspective reflects a generational shift toward embracing technology as an integral component of personal and professional development.

III.2. The Need for AI Education and Training

The item “I believe that students should learn the basic elements of Artificial Intelligence” elicited an almost unanimous positive response. More than 75% of respondents either agreed or strongly agreed that higher education should integrate dedicated courses or modules on Artificial Intelligence and Machine Learning.

This result highlights a clear educational need: students are not only interested in understanding AI at a theoretical level but also express a strong desire to develop practical skills in areas such as programming, data analysis, and algorithm interpretation. The inclusion of such competencies in university curricula would significantly enhance students’ employability and contribute to the formation of a digitally adaptable workforce prepared for the challenges of an AI-driven economy.

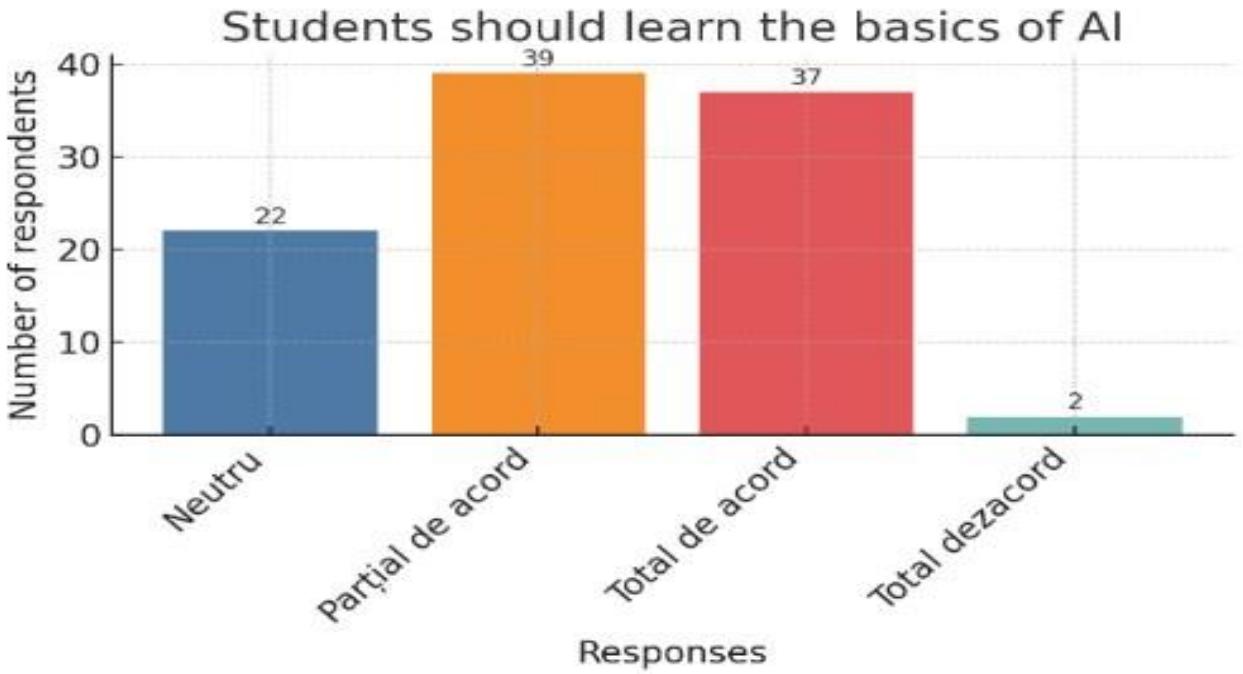

Fig. 2 The need to learn the basics of AI

These findings are consistent with recent international research, which emphasizes that future graduates view AI literacy as an essential component of professional qualification and lifelong learning [2], [6], [8]. By advocating for a stronger presence of AI in academic programs, students demonstrate both awareness of technological trends and motivation to align their education with the evolving demands of the labour market.

III.3. Understanding the Ethical and Moral Implications of AI

When asked about their understanding of the ethical and moral implications of Artificial Intelligence in their field of study, students' responses were more diverse compared to the previous items. While approximately half of the participants indicated that they understand or strongly understand the ethical dimensions of AI, the remaining respondents expressed uncertainty or limited awareness of such issues.

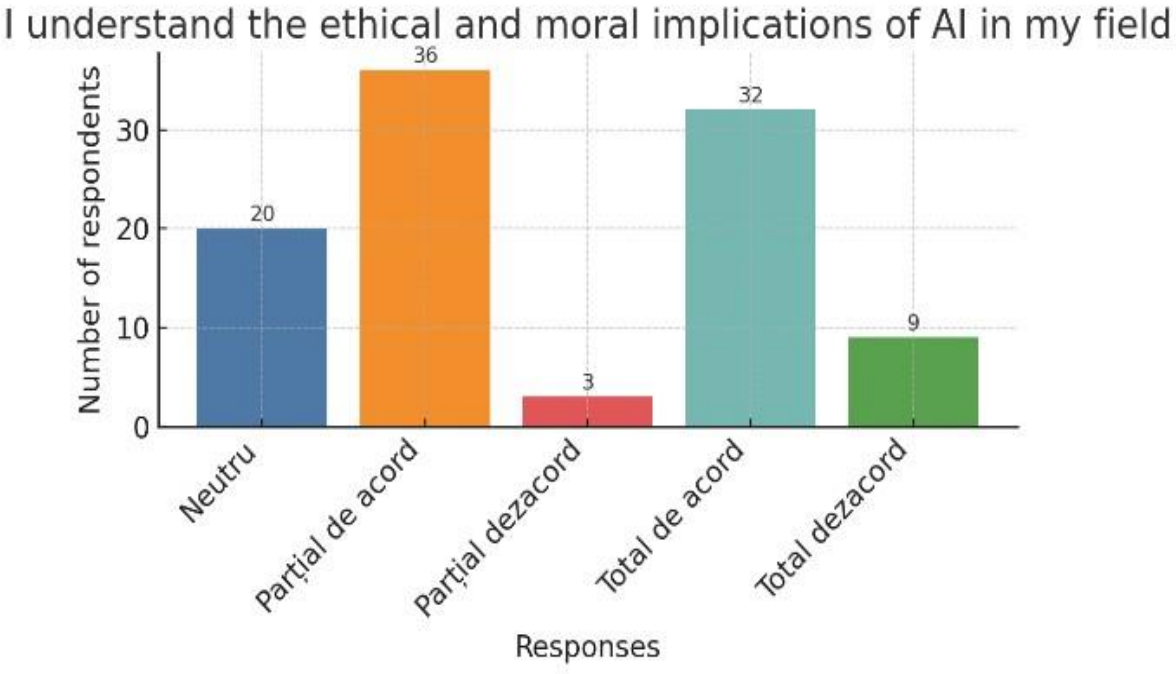

Fig. 3 Understanding the ethical and moral applications of AI

This distribution reveals an important gap in ethical and digital literacy. Although students generally demonstrate enthusiasm toward technological innovation and recognize AI's professional relevance, their understanding of the ethical consequences of its application - such as data privacy, bias in algorithms, decision transparency, and accountability - remains underdeveloped.

These findings mirror conclusions drawn in the international literature, which consistently highlights that ethical education in AI often lags behind technical instruction [9], [10], [11]. Several studies recommend that universities adopt integrated approaches combining technical courses with ethics modules, thus promoting critical thinking and social responsibility among future professionals.

In this context, the results of the present study underscore the urgent need for systematic inclusion of AI ethics in higher education curricula. Developing students' ability to identify, analyze, and respond to ethical dilemmas generated by intelligent systems would not only strengthen their professional integrity but also prepare them to make informed decisions in a technology-driven society.

III.4. Comparative Analysis and Implications

A comparative examination of the three items under Question 11 reveals an intriguing contrast. While the level of acceptance and interest in Artificial Intelligence among students is remarkably high, the level of ethical understanding remains moderate. This discrepancy suggests that young people tend to perceive AI primarily through the lens of professional opportunity and technological innovation, rather than through that of social and ethical responsibility.

This pattern reflects a broader global tendency, where enthusiasm for adopting intelligent technologies often outpaces awareness of their potential moral and societal implications [6], [9], [10]. The findings emphasize the importance of integrating ethical reflection and digital responsibility into AIrelated education, ensuring that future professionals can balance innovation with accountability.

Furthermore, the analysis identified a positive correlation between the level of study and familiarity with AI. Senior students and those already engaged in technical or computer science disciplines demonstrated a deeper understanding of AI applications compared to their peers in earlier years of study. This result reinforces the idea that exposure to specialized courses and practical experience enhances not only technical competence but also the capacity for critical evaluation of AI's role in society.

In summary, the comparative analysis highlights a dual educational challenge: to sustain students' enthusiasm for AI while strengthening their ethical awareness and critical thinking. Addressing this gap through targeted curricular reforms and interdisciplinary initiatives could foster a new generation of digitally skilled professionals who are both technically proficient and ethically conscious.

III.5. General Interpretation of Results

The findings of the study confirm the initial hypothesis that Artificial Intelligence is perceived by students as an essential component of modern professional development. Students recognize AI not merely as a technological tool, but as a transformative force reshaping the skills, knowledge, and attitudes required for success in the contemporary labor market.

At the same time, the results emphasize the importance of integrating into university programs courses that combine technical dimensions - such as programming, machine learning, and data analysis - with ethical and social perspectives, including issues like the impact of automation on employment, algorithmic justice, and digital responsibility. This balanced approach would enable higher education institutions to cultivate graduates who are not only technically proficient but also socially aware and ethically grounded.

Therefore, the research provides empirical evidence that can inform the reconfiguration of university curricula toward a more responsible and interdisciplinary digital education. By bridging the gap between innovation and

ethics, academic institutions can better prepare students for a future in which artificial intelligence is both a driver of opportunity and a test of human accountability.

CONCLUSIONS AND RECOMMENDATIONS

The study highlighted the perceptions, attitudes, and levels of knowledge of students from Western Romania regarding the use of Artificial Intelligence (AI) and Machine Learning (ML), particularly in relation to the impact of these technologies on their future careers.

IV.1. Main Concluzions

The results indicate a predominantly positive attitude toward AI, with most students recognizing its potential to transform the labour market and create new professional opportunities. Nearly all participants agreed that universities should integrate fundamental AI and ML concepts into their study programs, reflecting a growing awareness of the importance of digital literacy in higher education.

However, the analysis also uncovered a discrepancy between students' high interest in AI and their moderate understanding of its ethical and moral implications. While young people are generally open to technological innovation, their education in areas such as algorithmic ethics, data privacy, and social responsibility remains underdeveloped. This finding underscores the need for academic programs to complement technical skills with ethical and critical awareness, ensuring a balanced and sustainable approach to the use of emerging technologies.

Based on the findings of this research, several recommendations can be formulated for universities and educational policymakers:

1. Gradual integration of AI and Machine Learning courses into curricula across both technical and non-technical fields, to promote interdisciplinarity and widespread digital literacy;
2. Inclusion of modules on ethics and digital responsibility, aimed at fostering awareness of the social and professional impact of AI;
3. Development of practical competencies through laboratories, applied projects, and partnerships with the IT industry, in order to bridge the gap between theory and real-world application;
4. Promotion of student-led research projects on AI, especially those exploring the educational and psychosocial dimensions of intelligent technologies.

In conclusion, the study demonstrates that while students perceive AI as an essential driver of professional growth and innovation, the success of its integration into education depends on achieving a harmonious balance between technological expertise and ethical responsibility. By embracing this dual perspective, universities can play a crucial role in preparing graduates who are digitally competent, socially responsible, and capable of shaping the future of intelligent society.

4.2. Future Research Directions

To gain a more comprehensive understanding of this phenomenon, future studies could broaden the scope of investigation by expanding the sample to a national or even international level, enabling comparative analyses across different regions and educational contexts. Such an approach would provide valuable insights into how cultural, economic, and institutional factors shape students' perceptions of Artificial Intelligence (AI) and Machine Learning (ML).

Further research should also explore the differences between various fields of study, such as computer science, economics, and social sciences, in order to determine how disciplinary orientation influences attitudes,

familiarity, and readiness for AI adoption. Additionally, correlating students' perceptions with their academic performance and the actual frequency of AI tool usage could deepen the understanding of how knowledge and practice intersect in shaping digital competences.

The application of predictive models or machine learning analyses in educational research may also prove valuable for identifying the most significant factors influencing students' attitudes toward AI, offering data-driven insights that can guide curriculum design and institutional strategies.

In conclusion, the findings of this study reaffirm that Artificial Intelligence is not perceived by students as a threat, but rather as a transformative force that redefines both education and career development. To ensure that this transformation remains balanced and beneficial, higher education must adopt an integrated pedagogical approach that combines technical proficiency with ethical reflection, social responsibility, and critical thinking. Only through such a holistic educational model can universities prepare graduates who are not only digitally skilled but also ethically aware and capable of contributing responsibly to an AI-driven society.

REFERENCES

1. A. Katsantonis și I. G. Katsantonis, "University Students' Attitudes toward Artificial Intelligence: An Exploratory Study of the Cognitive, Emotional, and Behavioural Dimensions of AI Attitudes," Educ. Sci., vol. 14, no. 9, art. 988, 2024.
2. https://doi.org/10.3390/educsci14090988
3. B. G. Acosta-Enriquez, C. G. Arbulú, O. Huamaní, M. A. Arbulú și A. E. Paredes, "Exploring attitudes toward ChatGPT among college students: An empirical analysis of cognitive, affective, and behavioral components using path analysis," Computers and Education: Artificial Intelligence, vol. 7, art. 100320, 2024. https://doi.org/10.1016/j.caeai.2024.100320
4. A. Fošner, "University Students' Attitudes and Perceptions towards AI Tools: Implications for Sustainable Educational Practices," Sustainability, vol. 16, no. 19, art. 8668, 2024. https://doi.org/10.3390/su16198668
5. B. G. Acosta-Enriquez et al., "Analysis of college students' attitudes toward the use of ChatGPT in their academic activities," BMC Psychology, 2024.
6. https://doi.org/10.1186/s40359-024-01764-z
7. A. Saklaki and A. Gardikiotis, "Exploring Greek Students' Attitudes Toward Artificial Intelligence: Relationships with AI Ethics, Media, and Digital Literacy," MDPI, vol. 14, no. 12, art. 248, 2024. https://doi.org/10.3390/soc14120248
8. I. M. García-López, "The Impact of Artificial Intelligence (AI) on Students' Academic Learning Processes and Performance," Educ. Sci., vol. 15, no. 3, art. 343, 2025. https://doi.org/10.3390/educsci15030343
9. Yu, S.-C.; Huang, Y.-M.; Wu, T.-T. Tool, Threat, Tutor, Talk, and Trend: College Students' Attitudes toward ChatGPT. Behav. Sci. **2024**, 14, 755. https://doi.org/10.3390/bs14090755.
10. R. H. Mogavi, C. Deng, J. J. Kim et al., "Exploring User Perspectives on ChatGPT: Applications, Perceptions, and Implications for AI-Integrated Education," arXiv:2305.13114, 2023. Available: https://arxiv.org/abs/2305.13114
11. T. Ammari, M. Chen, S. M. M. Zaman și K. Garimella, "How Students (Really) Use ChatGPT: Uncovering Experiences Among Undergraduate Students," arXiv:2505.24126, 2025. Available: https://arxiv.org/abs/2505.24126
12. X. Tang, S. Chen, Y. Cheng, N. V. Chawla, R. Metoyer și G. A. Ambrose, "Understanding Student Attitudes and Acceptability of GenAI Tools in Higher Ed: Scale Development and Evaluation," arXiv:2508.01926, 2025. Available: https://arxiv.org/abs/2508.01926
13. L. J. Wiese, A. E. Schultze, and E. Albayrak, "AI Ethics Education: A Systematic Literature Review," Computers and Education: Artificial Intelligence, 2025. doi: 10.1016/j.caeai.2025.100482.