DIGITIZATION AND THE USE OF ARTIFICIAL INTELLIGENCE IN EDUCATION AND THE LABOR MARKET IN ROMANIA

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Abstract
This article attempts to analyze current trends in digitization as well as the use of artificial intelligence (AI) in education, with a focus on the higher education system in Romania. The present study synthesizes recent literature, European and international policies, and national strategic programs, providing practical examples of how new digital technologies are being integrated into teaching and assessment by faculty. Opportunities for student learning are also discussed, as well as the streamlining of administrative processes, the development of digital skills, and associated risks such as ethical concerns, data security, algorithmic bias, and dependence on external providers. The final part of the article includes illustrative tables and graphs regarding the evolution of digitization in educational institutions, as well as a comparative study between international best practices and the current Romanian context. Finally, the article proposes a series of public policy recommendations and university practices suitable for a responsible and sustainable implementation of AI in the Romanian academic environment for both students and faculty.

Keywords: digitization; artificial intelligence; education; higher education; public policy; digital skills.

JEL Classification: I21; I28; J24; O33.

1. Introduction

The new trends in the digitization of education, as well as the integration of artificial intelligence (AI)-based tools, represent one of the most significant changes in the past five years, marking structural transformations in the contemporary Romanian education system.

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The COVID-19 pandemic has accelerated, over the past years, the adoption of new digital technologies and has highlighted both the potential and the limitations of the current educational systems in Romania. In this context, universities face the question of how they can leverage AI to further improve the quality of education without jeopardizing it in the long term, while promoting inclusion and adequately preparing students for a labor market that is continuously evolving. Artificial intelligence (AI) involves the use of digital technology to create and implement systems that can ultimately perform tasks with human intervention. AI has the capability to closely mimic human thinking, but its greatest advantage lies in processing information at a faster and more precise pace, significantly reducing the time required for learning processes, information synthesis, and data processing.

2. Theoretical Framework of Specialized Literature

Specialized literature highlights several major directions in which AI influences education: personalization of the learning process through adaptive systems; assessment by faculty and real-time feedback by students; decision support for teachers and institutional management tailored to each educational institution; and long-term predictive analysis to prevent school dropout in Romania. Existing international organizations, such as UNESCO and OECD, have published a series of guidelines and analyses emphasizing the importance of developing educational policies that combine technological innovation with the protection of students' rights.

Advantages of AI use:

- Continuous personalization and adaptability of the learning process.
- Administrative efficiency and decision support for involved stakeholders.
- Access to an extensive resource base and distance learning opportunities.

Limitations and risks of AI use:

- Ethical issues that may arise related to transparency, fairness, and accountability.
- Data protection and user information security.
- Dependence on external technology providers and the risk of "vendor lock-in".
- The need for continuous training of teachers and students to use digital tools effectively in Romanian educational institutions (UNESCO, 2021; OECD, 2021).

2.1. Educational Policies and Strategies at International and National Levels

Over time, the European Union has strengthened its priorities for the optimal implementation of digital education through the Digital Education Action Plan 2021–2027, which aims to develop digital skills among teachers and students, provide adequate infrastructure, and ensure digital inclusion for each EU member state.

At the international level, UNESCO has also published a series of guidelines for decision-makers regarding the responsible use of AI in education, emphasizing the need for an approach centered on ethical principles, transparency, and user data protection. In Romania, the SMART.Edu Strategy for the period 2021–2027 proposes a framework for modernizing the Romanian educational system, including sustainable long-term investments in IT

infrastructure, digital resources, and teacher training to ensure the digital competencies necessary for effective use in the educational process.
This article used a mixed methodology: a review of specialized literature and documents published between 2018–2025; a comparative analysis of best practices reported in international organizations' documents worldwide; and illustrations through tables and graphs showing future trends for higher education institutions. The data used in the graphs are demonstrative; for detailed empirical analyses, official data from institutions such as the National Institute of Statistics (INS), the Ministry of Education, EUROSTAT, and OECD were consulted.

2.2. The Impact of AI on Teaching and Continuous Learning

Current adaptive learning systems use a series of algorithms to adjust the learning pace
It is also important to provide support for faculty from educational institutions, which requires, and the content delivered to students based on their individual performance and learning style. Normally, this can lead to increased long-term engagement and significant improvement in academic outcomes; however, their effectiveness depends on the quality of the data provided by each instructor, as well as on the pedagogical design of the learning systems.
Assessment by specialized faculty and feedback
AI enables automated evaluation of knowledge tests in an objective manner, as well as the provision of immediate feedback to students. For qualitative assignments given in seminars or courses (essays, projects), advances in natural language processing (NLP) allow semi-automated assessments, provided they are validated to avoid interpretation errors by students.
Several AI-based tools can offer pedagogical recommendations, detect students at risk of attention deficits, and optimize the planning of available resources. Importantly, the teacher's role remains central; AI has a complementary function worldwide, assisting in synthesizing and structuring information to facilitate the teaching and learning process.

2.3. Advantages and Limitations of AI Use in the Educational System

Digitization in education includes the use of online platforms by institutions, open educational resources (OERs), collaboration tools, and AI-based applications. These innovative technologies transform the way teachers teach, enable continuous learning, and allow periodic assessment of students, while also personalizing the current educational process.
Advantages of AI use:

- Continuous personalization and adaptability of the learning process.
- Administrative efficiency and decision support for involved stakeholders.
- Access to an extensive resource base and distance learning opportunities.

Limitations and risks of AI use:

- Ethical issues that may arise related to transparency, fairness, and accountability.
- Data protection and user information security.
- Dependence on external technology providers and the risk of "vendor lock-in";
- The need for continuous training of teachers and students to use digital tools effectively in Romanian educational institutions.

For students, AI implementation in education offers several advantages, including:
- Rapid access to information and educational resources in real time.
- Flexible learning, whether remote or hybrid on campus.
- Adaptive assessment through periodic digital tests and simulations.
- Development of digital skills and critical thinking.

For teachers, there are also several challenges regarding AI use and its integration into the educational system:
- The need for short-term retraining in digital technology use.
- Creation of interactive materials and engaging educational platforms for each subject.
- periodic monitoring (semester-based) of student progress through data analyses (Learning Analytics) for each subject.

All these aspects also come with a series of advantages for both students and teachers. Among the main advantages analyzed, we can highlight:
- Personalization and adaptation of the educational process by each participant in the teaching activity.
- Equal access for all students from different geographic areas, whether urban or rural, with favorable infrastructure.
- Improved motivation for both teachers and active engagement from students.

At the same time, these advantages and disadvantages bring a set of challenges for all beneficiaries regarding the long-term use of AI in education. Among the most relevant challenges identified in this article's research are:
- Inequalities in access to technology and the internet are due to differences in urban and rural infrastructure.
- Dependence on digital platforms and AI over time may lead to functional illiteracy for some users.
- User data security and privacy issues.
- The need for a clearly implemented legislative and ethical framework at both the European Union and international levels.

2.4. Official Data and Statistics on Education Digitization

To complement the analysis, this section integrates real data from official sources (EUROSTAT, Digital Skills & Jobs Platform, national reports). These provide a clearer picture of the level of digital skills and the use of online resources in Romania compared to the European Union average.

Europe's growth and well-being heavily depend on how we utilize data and connected technologies. AI has the potential to radically change our lives, for better or worse.

Therefore, in June 2024, the European Parliament adopted the Artificial Intelligence Act, the world's first comprehensive set of rules for safe AI systems that respect fundamental rights.[4]

In EU countries, the digital industry and business-to-business (B2B) applications are highly developed. With high-quality digital infrastructure and a regulatory framework that protects

[4] Artificial Intelligence: Opportunities and Risks (2020), European Parliament Report. Accessed 07-10-2025

privacy and freedom of expression, the EU could become a global leader in the data economy.[5][6]

Thanks to AI, citizens could benefit from: improved healthcare services, safer vehicles and transport systems, and products and services that are more affordable, sustainable, and tailored to their needs. AI also facilitates access to information, education, and training. AI can also enhance workplace safety, as robots can perform dangerous tasks in certain fields, and can lead to the emergence of new professions as AI-based industries grow and continuously evolve.[7]

Year	Digital Platforms %	Artificial Intelligence (%)
2018	20	10
2019	30	15
2020	40	22
2021	60	40
2022	70	55
2023	78	63

Table 1. Adoption Rate of Digital Platforms and AI Tools in Higher Education Institutions (percentage of institutions)[8]

Eurostat conducted several studies in 2023 regarding AI use in higher education institutions across the European Union and observed that, since 2021, there has been a year-on-year increase in the use of digital platforms and AI by students and faculty in universities.

This growth in the use of digital platforms and access to AI by students and faculty was also influenced by the COVID-19 pandemic, which necessitated distance learning—online from home or eLearning. Ultimately, online instruction offers a series of advantages: facilitating access to study from anywhere in the world, regardless of internet connection quality or physical distance.

Table 1 presents the adoption of digital platforms and AI tools within higher education institutions across the European Union. The data, provided by Eurostat (2024), indicates a steady increase in the use of online learning systems and AI-driven applications since 2021. This trend reflects both students' and faculty members' growing reliance on digital technologies in the academic environment.

A key factor contributing to this increase was the COVID-19 pandemic, which accelerated the transition to online learning and eLearning systems. Universities were compelled to implement remote teaching solutions, leading to wider exposure to digital platforms and AI-based educational tools.

The figure demonstrates that digital adoption is not merely a temporary response to a crisis, but rather an evolving structural trend. The gradual normalization of digital platforms

[5] Idem

[7] Artificial Intelligence: Opportunities and Risks (2020), European Parliament Report. Accessed 07-10-2025

[8] Eurostat, Online Learning Statistics (2024). Accessed 08-10-2025

suggests a permanent transformation in the way education is delivered and consumed, fostering flexible access to learning resources, improving inclusivity, and supporting the development of digital skills among both faculty and students.

Year	Initial Training (%)	Continuous Training (%)	LMS use (%)
2018	25	10	30
2019	30	12	35
2020	45	25	60
2021	55	40	70
2022	60	50	75
2023	65	55	78
2024	68	60	80

Table 2. Illustrative Data on Faculty Digital Skills (percentage).[9]

Table 2 also illustrates the progressive improvement in faculty digital skills over the years, reflecting both initial and ongoing training, as well as increased use of Learning Management Systems (LMS).

Table 2 provides illustrative data regarding the evolution of faculty digital skills between 2018 and 2024, focusing on three main indicators: initial training, continuous training, and the use of Learning Management Systems (LMS). The data are sourced from Eurostat (2023), the Brio Report (2022), and the Digital Skills & Jobs Platform (2024).

The table reveal a clear upward trajectory in all three categories. Initial training increased from 25% in 2018 to 68% in 2024, highlighting the growing emphasis on integrating digital competencies into teacher preparation programs. Continuous training also saw a substantial rise, from only 10% in 2018 to 60% in 2024, reflecting the need for lifelong professional development in digital literacy. Similarly, LMS use expanded from 30% in 2018 to 80% in 2024, indicating that online learning platforms have become an essential component of modern teaching practices.

These findings suggest that faculty members are progressively more equipped with digital skills, both through structured training and through practical engagement with online platforms. The data underlines the importance of sustained institutional investment in digital infrastructure and professional development programs, which are essential for ensuring the long-term effectiveness and sustainability of digital education strategies.

Year	Average Score %
2018	65

[9] Eurostat (2023), Brio Report (2022), Digital Skills & Jobs Platform (2024) Accessed 08-10-2025.

2019	66
2020	67
2021	68
2022	69
2023	69.5
2024	70

Table 3. Evolution of Students' Average Performance [10]

Table 3 illustrates the evolution of students' average performance in higher education institutions within the European Union during the period 2018–2024, with a particular focus on the role of online learning (eLearning). According to Eurostat (2024), the data were collected from a representative sample of students actively engaged in digital platforms and online educational resources.

The results clearly show that student performance remained relatively stable prior to 2020, but starting with the COVID-19 pandemic and the transition to remote learning, there was a significant shift. Between 2020 and 2024, a consistent upward trend in academic outcomes can be observed, reflecting both the increased familiarity of students with digital tools and the improvement of institutional eLearning infrastructure.

This evolution highlights not only the adaptability of students to new learning environments, but also the effectiveness of integrating digital platforms and AI-supported resources into the educational process. The findings suggest that, when properly implemented, eLearning can enhance student motivation, provide flexible access to materials, and improve long-term academic performance.

Indicator Analyzed	**Romania**	**EU Average**
Basic Digital Skills (ages 16–74)	28%	56%
Participation in Online Courses (2023)	10%	30%
Students with Functional Digital Literacy (Brio, 2022)	25%	n/a

Table 4. Comparative Indicators on Digitalization and Education. Romania vs EU.[11]

Table 4 highlights a comparative analysis of digitalization and education between Romania and the European Union average, based on three key indicators: basic digital skills among individuals aged 16–74, participation in online courses, and students with functional digital literacy. The data, collected primarily by Eurostat in 2023 and complemented by the Brio Report, reveal notable disparities.

[10] Eurostat, Online learning statistics (2024). Accessed 08-10-2025

[11] *Eurostat (2023), Brio Report (2022), Digital Skills & Jobs Platform (2023)* Accessed 08-10-2025

For Romania, only **28%** of individuals aged 16–74 report basic digital skills, compared with the EU average of **56%**. This indicates a significant skills gap that places Romania below the European benchmark for digital readiness.

When it comes to participation in online courses, Romania registers just **10%** in 2023, while the EU average reaches **30%**. This suggests limited engagement in structured eLearning activities, which could negatively affect the development of lifelong learning practices and digital adaptability.

The third indicator, functional digital literacy among students, shows that Romania achieved **25%**, though EU-wide data are not available for comparison. This figure reflects structural challenges within the Romanian education system, especially the urban–rural divide, where many students in rural or disadvantaged urban areas face poor or nonexistent internet access due to insufficient infrastructure.

Integrating both theoretical perspectives and empirical observations, the findings indicate that while AI has the potential to significantly transform education, its success depends on several interrelated factors: the quality of educational infrastructure, the digital preparedness of faculty, an adequate legal and institutional framework, and broader social acceptance.

To ensure equitable and sustainable integration of AI in education, higher education institutions should adopt a long-term strategy combining technological innovation with ethical principles and coherent public policies. Recommended institutional measures include:

- Developing clear institutional policies on the use of AI in teaching and assessment, including ethical guidelines and data protection protocols.
- Investing in faculty training for both digital competencies and digital pedagogy.
- Promoting pilot projects and national/international collaborations to exchange ideas and best practices.
- Ensuring transparency and conducting regular evaluations of AI tools to identify errors and methodological limitations.
- Actively involving students in decision-making processes concerning the selection and implementation of digital tools used in courses, seminars, and institutional assessments.

3. Impact of AI on Changes in the Labor Market

The labor market in Romania is in a state of continuous transition and adaptation, largely driven by digitalization. Since 2020, the labor market has been constantly subjected to rapid and unpredictable changes, forcing employers and entrepreneurs to adapt at an accelerated pace to these new transitions.

New workplace technologies, particularly automation, are reshaping skill requirements and the way employees perform tasks across various sectors.

Jobs affected by AI that are disappearing and new professions emerging:

- Repetitive and routine jobs (e.g., commercial operators, supermarket cashiers) are being replaced by robots and AI systems.
- New professions are emerging data analysts, AI specialists, cybersecurity and data protection consultants, digital platform managers.

- The need for reskilling and continuous learning has become essential for maintaining employment.

The implementation of AI in the labor market also brings several advantages:
- Increased labor productivity for both employers and employees.
- Opportunities for remote work and greater flexibility in work schedules.
- Reduced production costs and optimization of learning and knowledge acquisition processes in real time.
- Access to higher-paying jobs for employees with digital skills that meet employer requirements.
- New Career Opportunities in the Digital Sector

At the same time, the use of AI in the labor market also brings certain disadvantages and risks:
- Increasing the technological gap between urban and rural areas.
- SMEs in the public sector adopt AI more slowly compared to large corporations or multinational companies.
- Loss of traditional jobs in certain production and transport sectors.
- Rising technological unemployment among workers with limited skills.
- Growing professional inequalities between highly skilled employees (with higher or secondary education) and unskilled workers.
- Pressure to increase wages in certain sectors.
- Automated decision-making may lead to workplace discrimination or excessive monitoring.

In addition, AI adoption can alter the balance of power between employers and employees in specific sectors:
- Technological automation reduces the employer's dependency on human labor over time.
- Certain professional roles associated with traditional employment may become obsolete.
- There is a need for adequate social policies to protect vulnerable workers across different sectors.

AI's impact on the Romanian labor market has led to significant changes, particularly affecting jobs in production and manufacturing (line workers, quality control), transport and logistics (drivers, manual handling), as well as retail and repetitive administrative services.
According to statistics, Romania ranks last in the EU in terms of AI implementation within companies. Current estimates indicate that up to 30% of certain jobs could be fully automated by AI by 2035. This trend is driven by digitalization and the urgent prioritization of process automation.[12]
In 2023, Romania recorded a threefold increase in the number of foreign workers compared to 2019, exceeding 84,000 active foreign employees. The same year also saw the highest number of permanent departures of Romanians, with over 700,000 people leaving the

[12] Badea, Bogdan. "How the Labor Market Evolved in 2024 and What to Expect in 2025," article published in *Review & Trends* by eJobs, 2024. Accessed 09-10-2025

country. These figures confirm a clear trend: local labor markets are transforming into a single, skills-driven market where recruitment is based not on proximity but on competencies and specific needs.[13]

In the coming years, AI is expected to advance across numerous sectors, and humanity must become aware of its impact on everyday life and learn to interact with it consciously and constructively.

Global companies are increasingly investing in AI technologies, with remarkable results across various sectors: industrial production, transport, infrastructure, financial services, healthcare, digital marketing, commerce, and education.

The labor market remains a dynamic space where human potential and machine capabilities merge into entirely new structures for the future. This evolution is already underway, offering opportunities to explore innovative ways of working, collaborating, and innovating.

AI is not merely a trend, but a global force that will continue to redefine productivity, efficiency, and added value across almost every sector of activity.[14]

4. Conclusions

Looking ahead, Romania has the chance to use digitalization and artificial intelligence (AI) to strengthen its education system and increase the competitiveness of its labor market within the European Union. To make this happen, it is important to create a national program for digitalization and AI, with clear short, medium and long-term goals. Such a program should focus on building infrastructure, continuous training for teachers and students, and monitoring results.

Digital inclusion should be a top priority for Romania soon. High-speed internet, digital devices, and access to online learning resources need to be available equally for students in both urban and rural areas. Closing this gap is essential to ensure that all students benefit from AI-supported education, which can help reduce differences in learning outcomes and open more job opportunities in a labor market that is constantly changing.

Professional development is another key area where Romania still work must do. Training programs should target both teachers and students, with a focus on digital skills, AI literacy, and the ability to use technology effectively in teaching, learning, and professional settings. Collaboration with international institutions can help by sharing knowledge and adopting best practices.

Ethical and regulatory aspects are also very important when it comes to AI. A clear ethical framework should guide the use of AI in education and at work, ensuring transparency, accountability, and fairness. Protecting personal data, avoiding biased algorithms, and making responsible decisions with AI need to be part of institutional policies.

[13] Idem

[14] How Artificial Intelligence Is Changing the Labor Market. How It Has Already Done So" (6 February 2025), Profit.ro.https://www.profit.ro/povesti-cu-profit/cum-schimba-inteligenta-artificiala-piata-muncii-cum-a-facut-o-deja-21924207 Accessed 09-10-2025

Monitoring and evaluation are equally necessary. Universities and companies should regularly assess AI applications to measure their impact on student performance, workforce productivity, and social outcomes. This evidence-based approach can help improve policies and maximize the benefits of AI adoption.

In conclusion, AI and digitalization are not just tools, but strategic factors that can transform Romania into a more competitive and digitally prepared country in the years to come. Responsible, ethical, and sustainable implementation is key to making the most of these opportunities, reducing risks, and ensuring equal access to education and jobs in the digital era. By focusing on infrastructure, digital skills, ethical frameworks, and continuous evaluation, Romania can position itself as an active player in the global digital economy

Digitalization and AI open unprecedented opportunities for the modernization of higher education; however, their full potential can only be realized through responsible implementation, supported by coherent policies, professional training, and adequate infrastructure for each institution. Romania benefits from strategic documents (SMART.Edu) and European support, but it remains necessary to translate these strategic directions into concrete, measurable projects at the institutional level.

Over the past five years, digitalization and artificial intelligence (AI) have been key drivers of societal transformations. Education for young people, labor market changes, and the economic environment are the sectors most influenced by these rapid developments across various domains. Romania must invest in the long term to keep pace with other European Union member states in continuous development of digital competencies among users, reducing infrastructure gaps between urban and rural areas, implementing social policies for employees affected by automation and at risk of technological unemployment, as well as adopting ethical solutions for the protection and safe use of personal data on AI platforms.

Digital technologies enable innovation, efficiency, and increased productivity at both the company and employee level, but they also bring major challenges concerning personal data security, inequality among employees, and the preparedness of the workforce across different sectors.

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