ARTIFICIAL INTELLIGENCE IN HIGHER EDUCATION – Analysis of Challenges and Recommendations Based on a Literature Review

R2 – Systematic Literature Review on the Issues Related to the Deployment of GenAI in Formal Educational Systems – collective report

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1. Abstract

The purpose of this study is to precisely define the areas in which generative Artificial Intelligence (AI) can be applied in education—with a particular focus on higher education and the field of pedagogy—and to identify the key challenges and existing gaps in its current implementation. The analysis of best practices, together with ethical and legal challenges, enables the formulation of practical, systemic recommendations for policymakers, university authorities, educational institutions, and teaching staff.

The collected knowledge and developed recommendations form the foundation for subsequent stages of the project aimed at shaping study programmes and training initiatives. The long-term academic outcome will be the creation of a curriculum tailored to the needs of higher education in terms of AI-related competencies. Implementing these guidelines is intended to support the systemic development of skills in the field of AI and to prepare future teachers and educators for the conscious, critical, and creative use of this technology in their professional practice.

This report presents a synthetic analysis of the challenges and opportunities related to the integration of generative Artificial Intelligence (AI) into the educational systems of Poland, Germany, Lithuania, Greece, and Hungary, supplemented by a broader international context. The analysis is based on a review of academic literature, strategic documents, and research reports published between 2022 and 2025.

The main conclusion of the analysis is that effective and responsible implementation of AI in education is currently hindered by a convergent set of universal barriers, regardless of national specificities. These barriers can be grouped into four main, interrelated areas:

Ethical and social issues – The most serious threat is the crisis of academic integrity, resulting from the ease of generating content and new forms of plagiarism. Equally significant are the risks associated with algorithmic bias, which may perpetuate stereotypes and deepen inequalities, as well as the opacity of AI models (“black box”), which makes it difficult to assign responsibility for errors.

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Legal and regulatory challenges – In all the countries analyzed, there is a lack of coherent, proactive policies at both national and institutional levels. Universities and schools act reactively, often relying on outdated regulations. Key legal challenges include ensuring compliance with GDPR when using cloud-based tools, protecting students' personal data, and addressing uncertainties related to copyright and intellectual property of AI-generated content.

Pedagogical and practical challenges – The most commonly identified barrier is a profound competency gap among teaching staff, encompassing deficiencies in technical, pedagogical, and ethical knowledge. The emergence of AI has also fundamentally undermined traditional assessment methods, such as essays, making them vulnerable to misuse, while AI-detection tools have proven ineffective. Implementation is further constrained by infrastructural limitations, high costs, psychological resistance, and the lack of time for educators to innovate.

Impact on learning and personal development – The analysis highlights the ambivalent influence of AI on students. On one hand, the technology offers potential for personalized learning and increased engagement. On the other hand, unreflective use can lead to the erosion of critical thinking, the weakening of intrinsic motivation ("deskilling"), and the deterioration of social skills due to reduced human interaction.

In response to these challenges, the report formulates five key areas of recommendation:
• Developing institutional and national policies to ensure coherent ethical and legal frameworks;
• Designing systemic training programmes for academic staff to enhance their technical, pedagogical, and ethical competencies;
• Transforming curricula and assessment methods towards promoting higher-order thinking skills and authentic, non-automatable tasks;
• Investing in secure infrastructure and GDPR-compliant tools to ensure equal and safe access to technology;

• Implementing monitoring and evaluation mechanisms to ensure that decisions on AI adoption are based on reliable evidence.

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In conclusion, the report highlights the urgent need to develop coherent, multi-level strategies that can minimize identified risks and fully harness the potential of AI in an ethical, legally sound, and pedagogically justified manner. The key to success lies in a human-centered approach, in which technology supports—rather than replaces—essential educational processes and human relationships.

2. Introduction and Purpose of the Report

2.1. Context

The emergence of advanced generative Artificial Intelligence (AI) tools such as ChatGPT, Gemini, and Midjourney has brought about revolutionary changes in society, redefining the ways information is created, processed, and consumed (Knight et al., 2024). This technology exerts a particularly strong influence on the higher education sector, which now faces unprecedented challenges and opportunities (Giannakos et al., 2024; Stracke et al., 2025).

In the educational systems of Greece, Lithuania, Germany, Poland, and Hungary—similarly to global trends—there is a dynamic and often unregulated adaptation of these tools by both students and academic staff (Mironova et al., 2024; Pyżalski, 2025; Hochschule Darmstadt, 2023).

Universities are confronted with fundamental questions regarding academic integrity, assessment methods, personal data protection, and the need to redefine future competencies (An et al., 2025; CHE Centrum für Hochschulentwicklung, 2025; Zadroga, 2025). The countries analyzed in this report demonstrate varied responses to these changes—ranging from grassroots initiatives and pedagogical experiments (GEI, 2024), through the development of the first institutional policies (Károli Gáspár University of the Reformed Church in Hungary, 2024), to attempts at establishing strategic frameworks at national and supranational levels (Kultusministerkonferenz, 2024; Government of Hungary, 2024; OECD, 2024).

This dynamic and often tension-filled transformation process requires systematic analysis in order to understand its implications and to develop responsible models for integrating AI into education (Perera & Lankathilake, 2023).

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2.2.Purpose of the Report

The aim of this report is to synthesize and analyze the key challenges and recommendations related to the implementation of Artificial Intelligence in education, based on a review of scientific literature, reports, and policy documents from Greece, Lithuania, Germany, Poland, and Hungary.

In line with the AP-GAIED project methodology, the report seeks to identify and describe the fundamental ethical, legal, educational, and practical barriers that hinder the responsible implementation of AI. Furthermore, it examines the impact of AI on students' personal development and learning abilities, including cognitive skills such as critical thinking and creativity.

Based on the identified challenges, the report formulates a concise set of recommendations to support policymakers, university authorities, and academic staff in defining directions for future actions. Ultimately, this analysis is intended to serve as a substantive foundation for designing effective study programmes, training initiatives, and institutional policies in subsequent stages of the project.

The report was prepared on the basis of a systematic literature review, aimed at identifying, analyzing, and synthesizing the current state of knowledge regarding the use of Artificial Intelligence in education. The research process consisted of several stages — defining source selection criteria, selecting 50 publications, and conducting thematic and comparative analysis.

3. Methodology

3.1. Source Selection Criteria

To ensure the reliability and relevance of the analysis, the following criteria were adopted:

a) **Geographical context** – publications concerning Greece, Lithuania, Germany, Poland, and Hungary were included, as well as key international publications (e.g., from the USA, Hong Kong, Australia, Vietnam, and OECD reports) to place the findings in a broader context.
b) **Timeframe** – focus was placed on publications from 2023–2025, covering the period of dynamic development of generative AI, including tools such as ChatGPT.

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c) **Types of publications** – included: peer-reviewed journal articles, governmental and policy documents (strategies, parliamentary and ministerial reports), university regulations and guidelines, research and expert reports produced by public institutions, international organizations (OECD), and foundations.

d) **Language of publications** – publications in the national languages of project partners and in English were analyzed. Key excerpts from sources in national languages were translated for the purposes of this report.

3.2. Publication Selection Procedure

The selection process was carried out in multiple stages:

a) Preliminary identification – each project partner prepared a list of at least 10 publications relevant to their country.

b) Systematic review – partners searched academic databases (Scopus, Web of Science, Google Scholar) and institutional repositories using keywords in both national languages and English.

c) Inclusion and exclusion criteria – publications relating to formal education (primary, secondary, higher education) were included. Technical or commercial publications without educational relevance were excluded.

d) Finalization of the list – the coordinating team made the final selection of 50 publications, ensuring geographical and thematic balance.

3.3. Data nalysis and Comparison Method

Thematic analysis was applied, allowing for the extraction and comparison of key issues:

a) Standardization of analysis – each publication was assessed using a literature analysis form (WP202), covering:
   - Main theses and conclusions,
   - Ethical issues (bias, autonomy, transparency),
   - Legal issues (data protection, GDPR, intellectual property),

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- Educational and practical issues (staff competencies, infrastructure, resistance to change),
- AI impact on personal development and learning processes,
- Authors' recommendations.

b) Comparative analysis across countries – data were aggregated and presented comparatively, enabling identification of similarities and differences in regulations, program priorities, and investments in staff training.

c) Area-specific analysis – results were organized into five key areas relevant to the AP-GAIED project:

d) Regulatory, ethical, and legal frameworks,

e) Study programs and educational initiatives,

f) Academic staff training,

g) Use of AI in research and educational practice,

h) AI impact on personal development and learning processes.

This methodology ensures that the report is based on up-to-date, diverse sources, and that the conclusions and recommendations are the result of a systematic, coherent, and comparative analysis of good practices and challenges across the five countries studied.

4. Analysis of Challenges in Implementing AI in Higher Education

4.1. Ethical Challenges

The use of generative artificial intelligence (AI) in education offers vast opportunities for personalization and learner support but simultaneously raises fundamental ethical dilemmas that demand systemic solutions (Giannakos et al., 2024; Zadroga, 2025). A review of literature from the five partner countries and international sources identifies five main areas of ethical risk:

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4.1.1. Algorithmic Bias and Its Consequences in Education

AI models—especially large language models (LLMs)—are trained on massive text and image datasets sourced from the Internet (Farrelly & Baker, 2023; Digital Education Section of the Polish Academy of Sciences, 2025). These data are not neutral: they reflect historical and cultural biases, stereotypes, and structural inequalities (Nedungadi et al., 2024; Stracke et al., 2025; Więckiewicz-Modrzewska, 2024). As a result, algorithms can produce biased outputs, which may have serious negative implications in educational contexts:

Reinforcement of stereotypes. AI systems may perpetuate harmful stereotypes, for example by assigning certain professions to specific genders. One example is the translation of Turkish sentences lacking personal pronouns, where “nurse” is automatically translated in the feminine form and “doctor” in the masculine (Więckiewicz-Modrzewska, 2024). In educational materials generated by AI, this may strengthen gender, racial, or cultural biases (Digital Education Section of the Polish Academy of Sciences, 2025; Zadroga, 2025).

Unfair assessment and recommendations. Bias may have particularly harmful consequences when AI is used in high-stakes decision-making. Algorithms may unfairly evaluate assignments written by students from minority backgrounds or those using non-standard linguistic patterns, as the models are trained on dominant cultural and linguistic norms (Farrelly & Baker, 2023; Stracke et al., 2025). This may also result in less ambitious career recommendations for underrepresented groups, reinforcing structural inequalities (Perera & Lankathilake, 2023; Vaitkevičienė & Žilinskienė, 2025).

4.1.2. Inequality in Access to Technology

A second dimension of the problem concerns the deepening digital divide. Unequal access to advanced, often paid AI tools—as well as disparities in digital competencies—leads to what is known as augmenting inequality (Pyżalski & Łuczyńska, 2024).

- Privileged vs. excluded learners. Students from wealthier backgrounds, with access to high-performance devices, fast Internet, and premium AI versions, gain a significant educational

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advantage (Butrimė & Zuzevičiūtė, 2025; Farrelly & Baker, 2023; Zadroga, 2025). Meanwhile, those with limited resources—especially in rural or small-town areas—are left behind, which exacerbates existing disparities (Borsodi & Virányi, 2024; Nedungadi et al., 2024; STRATA, 2023).

- Competency barriers. Mere access to technology is insufficient. Students and teachers with low digital and AI literacy are unable to fully leverage these tools and may even be more vulnerable to their negative effects, such as misinformation (Chiu, 2024; Digital Education Section of the Polish Academy of Sciences, 2025; STRATA, 2023).

4.1.3. Lack of Transparency, Explainability, and Accountability

AI systems operating as "black boxes" undermine trust, as users do not understand how recommendations or evaluations are generated (Giannakos et al., 2024; Kwiatkowski et al., 2025). This creates an "accountability gap" — it becomes difficult to assign responsibility for errors, copyright violations, or discrimination (Sobkowiak, 2024; Balaskas et al., 2025). This issue is particularly critical in high-stakes contexts such as recruitment or summative assessment (Stracke et al., 2025). Consequently, some countries, such as Hungary and Lithuania, are developing detailed guidelines to define accountability (Government of Hungary, 2024; Office of the Academic Ethics and Procedures Ombudsman of the Republic of Lithuania, 2024).

4.1.4. Lack of Adequate Human Oversight

AI cannot replace empathy, emotional intelligence, or the teacher–student relationship (Więckiewicz-Modrzewska, 2024). The educator must remain the central figure in the learning process—as mentor, mediator, and final decision-maker (Pyżalski & Łuczyńska, 2024). The absence of institutional guidelines aggravates confusion (Šarlauskienė, 2023).

Therefore, AI should be viewed strictly as a *supporting* tool, not as a substitute for human competencies (Chodak & Filipek, 2025; Zadroga, 2025). Lithuanian academic ethics guidelines clearly state that pedagogical responsibility must remain with the human (Office of the Academic Ethics and Procedures Ombudsman of the Republic of Lithuania, 2024).

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4.1.5. Privacy, Data Protection, and Academic Integrity

The adoption of commercial AI tools such as ChatGPT carries risks of violating student privacy and data protection (Hochschule Bonn-Rhein-Sieg, 2023; Mironova et al., 2024). Data may be stored outside the EU, raising doubts about GDPR compliance (Kultusministerkonferenz, 2024). Moreover, the ease of generating content poses challenges to academic integrity (Balaskas et al., 2025). Experts recommend abandoning unreliable AI detectors in favor of new assessment forms—authentic assignments, oral presentations, and mandatory transparent reporting of AI use (An et al., 2025; Farrelly & Baker, 2023).

4.2.1. Personal Data Protection (GDPR)

The most frequently raised and critical legal challenge in implementing generative AI in education concerns compliance with the General Data Protection Regulation (GDPR) and other privacy laws (Balaskas et al., 2025; Békés et al., 2025; Stracke et al., 2025; Zadroga, 2025). AI systems, particularly cloud-based ones (e.g., ChatGPT), process large amounts of data—including student information, written work, queries, and even biometric data (Giannakos et al., 2024; Mironova et al., 2024; Vaitkevičienė & Žilinskienė, 2025). Implementing these tools without adequate safeguards generates several serious risks:

- **Risk of regulatory violations and unauthorized data transfer.** Many popular commercial AI tools are developed and hosted outside the European Union, leading to personal data transfers without the legal safeguards required by GDPR (Mironova et al., 2024; Pyżalski, 2025; Želvytė & Statkuvienė, 2024). Sending student data to external servers creates risks of unauthorized processing or commercial reuse by service providers (Kwiatkowski et al., 2025; Zadroga, 2025).
- **Lack of transparency and the "black box" effect.** Language models often function as "black boxes," meaning the mechanisms of data collection, analysis, and usage are opaque to users (Giannakos et al., 2024; Leibniz Institute for Media Research, 2025; Więckiewicz-Modrzewska, 2024). This makes it difficult to exercise the fundamental right to know what data are collected and

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for what purpose, in violation of GDPR principles (Office of the Academic Ethics and Procedures Ombudsman of the Republic of Lithuania, 2024; Zadroga, 2025).

- Problematic consent. Obtaining informed, voluntary, and unambiguous consent—especially from minors—is extremely challenging in practice (Office of the Academic Ethics and Procedures Ombudsman of the Republic of Lithuania, 2024). Students often lack full awareness of how their data are used, and consent may be illusory when AI use is mandatory for course completion (Daukšaitė-Kolpakovienė, 2024; Pyżalski, 2025).
- Pilots and good practices. GDPR compliance is a key prerequisite for building trust and scaling AI adoption in education (STRATA, 2023). Projects such as Germany's *schulKI* demonstrate that providing teachers and schools with secure platforms—avoiding external data transfers—significantly enhances readiness to experiment with AI (GEI, 2024). Hungary's AI strategy also emphasizes conducting Data Protection Impact Assessments (DPIAs) for high-risk systems and adopting *privacy-by-design* tools (Government of Hungary, 2024; Károli Gáspár University of the Reformed Church in Hungary, 2024). The absence of such frameworks remains one of the major legal and organizational barriers across all analyzed countries (Hochschule Bonn-Rhein-Sieg, 2023; Kultusministerkonferenz, 2024; Bundestag Scientific Services, 2025).

4.2.2. Intellectual Property Rights

Intellectual property and copyright laws constitute another major challenge that complicates assessment and undermines academic integrity. These issues form a complex legal and ethical dilemma that directly affects the foundations of the educational process. The problem manifests itself in three interrelated areas:

a) blurring the boundaries of authorship and originality,

b) introducing a new dimension of plagiarism and unintentional copyright infringement,

c) lack of consistent institutional regulations on the disclosure and citation of AI-generated support.

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4.2.2.1. Blurred Boundaries of Authorship Complicating Assessment

Traditional assessment is based on the assumption that a student's work reflects their individual intellectual effort and originality. AI challenges this premise:

- **The problem of authorship attribution.** When a student uses AI to generate text, code, or analysis, questions arise regarding authorship (Balaskas et al., 2025; Šarlauskienė, 2023; Želvytė & Statkuvienė, 2024). Legal systems assign authorship exclusively to humans (Sobkowiak, 2024), whereas AI-generated content exists in a legal "grey zone" (Stracke et al., 2025). This complicates evaluation and undermines its credibility (CHE Centrum für Hochschulentwicklung, 2025; Giannakos et al., 2024).
- **Inability to verify competence.** If a student's work is largely produced by AI, assessment ceases to be a reliable indicator of competence, which threatens the credibility of diplomas and the entire certification process (Pyżalski & Łuczyńska, 2024; Bundestag Research Service, 2025).

4.2.2.2. Undermining Academic Integrity through New Forms of Plagiarism

Academic integrity is grounded in honesty and respect for intellectual property. AI introduces new forms of misconduct:

- **A new dimension of plagiarism.** Students may present AI-generated content as their own, which constitutes academic dishonesty (Balaskas et al., 2025; Farrelly & Baker, 2023; Hochschule Darmstadt, 2023). The absence of clear institutional guidelines increases the risk of unintentional misuse (Mironova et al., 2024; Perera & Lankathilake, 2023). The problem is further compounded by unreliable AI detectors, which frequently produce false positives (An et al., 2025; Farrelly & Baker, 2023).
- **Unintentional copyright infringement.** AI models are trained on datasets that often contain copyrighted materials but rarely disclose their sources (Więckiewicz-Modrzewska, 2024). Students using such outputs may unknowingly violate copyright laws (Békés et al., 2025; Pyżalski, 2025). Teachers face similar risks (Giannakos et al., 2024).

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4.2.2.3. Lack of Institutional Regulation as a Source of Chaos

The absence of coherent legal and institutional frameworks intensifies the problem:

- **Regulatory gaps.** Most universities have yet to develop detailed policies governing the use of AI. Existing anti-plagiarism regulations are outdated and insufficient (An et al., 2025; Mironova et al., 2024; Stracke et al., 2025; Šarlauskienė, 2023).
- **Lack of disclosure standards.** No unified system for citing or acknowledging AI support exists (Government of Hungary, 2024; Károli Gáspár University of the Reformed Church in Hungary, 2024). This leads to inconsistent practices even among honest students.

Summary. Intellectual property and copyright issues in the AI era are multidimensional. They hinder the reliable verification of authorship, undermine academic integrity, and expose students and educators to unintentional legal violations. Effective solutions require updated legislation, clear institutional policies, and a rethinking of assessment methods (An et al., 2025; CHE Centrum für Hochschulentwicklung, 2025).

4.2.3. Lack of Consistent Regulation

The pace of generative AI development surpasses the ability of legal and institutional systems to produce adequate regulations (Balaskas et al., 2025; Giannakos et al., 2024; Knight et al., 2024). As a result, regulatory gaps and inconsistencies emerge:

- **Reactive and fragmented institutional approaches.** Universities tend to focus on the most urgent issues, such as plagiarism, rather than developing comprehensive strategies (An et al., 2025; Šarlauskienė, 2023). Reliance on outdated anti-plagiarism policies increases uncertainty and inconsistency (Mironova et al., 2024; Farrelly & Baker, 2023; Polish Academy of Sciences – Digital Education Section, 2025).
- **Fragmentation at national and regional levels.** In Germany, differences between federal states hinder the establishment of unified standards (Office of Technology Assessment at the

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German Bundestag, 2024; Kultusministerkonferenz, 2024; Bundestag Research Service, 2025). Similar coordination problems exist across Europe (Stracke et al., 2025).

- **The role of the AI Act.** The proposed EU AI Act classifies certain educational AI systems as high-risk (Békés et al., 2025; Stracke et al., 2025). Educational institutions will be required to ensure transparency, human oversight, control, and risk assessment (Sobkowiak, 2024; Government of Hungary, 2024). Many institutions are not yet prepared to meet these obligations.

4.2.4. Legal Liability

One of the most problematic areas is the lack of clear legal liability for decisions made by AI systems. In education, this particularly concerns assessment, recruitment, and the collection and processing of student data (Balaskas et al., 2025; Knight et al., 2024; Sobkowiak, 2024).

- **Liability gap.** It is often unclear who bears responsibility for AI-generated errors — the software developer, service provider, educational institution, or the teacher using the tool (Giannakos et al., 2024; Mironova et al., 2024). The absence of precise regulations results in legal uncertainty and discourages institutions from adopting AI more broadly.
- **Shifting responsibility to users.** In practice, teachers and administrators are often held accountable for AI-related errors despite having no control over the underlying mechanisms (Perera & Lankathilake, 2023; Zadroga, 2025). This leads to a sense of injustice and excessive burden on academic staff.
- **Lack of clear appeal procedures.** Students and academics frequently lack effective means to challenge AI-driven decisions (Farrelly & Baker, 2023; Stracke et al., 2025). Many countries have yet to introduce regulations ensuring transparent appeal processes or legal protection against algorithmic bias and discrimination.
- **Examples of good practice.** Some countries, such as Lithuania and Hungary, have begun developing regulations that assign ultimate responsibility to educational institutions and mandate human oversight (Office of the Academic Ethics and Procedures Ombudsman of the Republic of Lithuania, 2024; Government of Hungary, 2024). Such measures help prevent unfair liability transfers onto individual educators.

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Summary. The absence of clear rules on legal liability is a major barrier to AI adoption in education. Without coherent institutional and national frameworks, universities remain in a state of uncertainty, which hinders innovation and increases the risk of legal disputes.

4.2.5. The "Responsibility Gap"

A fundamental legal issue concerns the lack of clarity over who is accountable for the negative outcomes of AI operations. This ambiguity—commonly referred to in the literature as the *responsibility gap*—arises because AI systems act in partially autonomous and opaque ways, making it difficult to assign fault to any single actor (Sobkowiak, 2024). The literature highlights three main dimensions of this issue:

- **Uncertainty over responsible parties.** When AI systems produce erroneous, discriminatory, or harmful results, it is unclear who should be held liable (Balaskas et al., 2025; Nedungadi et al., 2024; Šarlauskienė, 2023). Is it the user who trusted the algorithm (Sobkowiak, 2024)? The educational institution deploying the system (Office of Technology Assessment at the German Bundestag, 2024)? Or the AI developer who trained the model on biased or incomplete data (Balaskas et al., 2025; Knight et al., 2024)? This uncertainty paralyzes legal mechanisms and obstructs claims for damages (Giannakos et al., 2024).
- **Risks in automated decision-making.** The responsibility gap is particularly critical when AI makes high-stakes decisions — e.g., in admissions, automated grading, scholarship allocation, or educational advising (Stracke et al., 2025; Zadroga, 2025). A discriminatory evaluation of a student from a minority group can significantly affect their educational and professional future (Farrelly & Baker, 2023). Without clear liability rules, affected students lack effective avenues for appeal (Knight et al., 2024).
- **Human oversight as a key safeguard.** Most studies stress the necessity of maintaining human-in-the-loop oversight (Office of the Academic Ethics and Procedures Ombudsman of the Republic of Lithuania, 2024; Giannakos et al., 2024). Final responsibility and decision-making authority must remain with humans — teachers, examiners, or administrators (Pyżalski & Łuczyńska, 2024; Zadroga, 2025). As Sobkowiak (2024) emphasizes, moral and legal responsibility can only be attributed to conscious and free actions (*actus humanus*), not to a machine.

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Summary. Safe and responsible AI integration in education requires clear regulation of data protection, intellectual property, and legal liability. Coherent frameworks at EU, national, and institutional levels are essential to ensure transparency, accountability, and a well-defined balance between human and technological roles (Perera & Lankathilake, 2023; Zadroga, 2025).

4.3. Educational and Practical Challenges

The implementation of artificial intelligence (AI), particularly generative tools, within the educational systems of Greece, Lithuania, Germany, Poland, and Hungary encounters a range of deep and interconnected educational and practical challenges. Although the potential of AI for personalising learning, supporting students with special educational needs (SEN), and automating administrative tasks is widely recognised (Borsodi & Virányi, 2024; Pyżalski, 2025; Digital Education Section of the Polish Academy of Sciences, 2025), a review of the literature indicates that these barriers hinder responsible and scalable integration (Knight et al., 2024; Stracke et al., 2025).

4.3.1. Lack of Teacher Competence and Insufficient Training

The most frequently cited and fundamental problem limiting the responsible integration of AI in education is the insufficient preparation of teachers and academic staff to work effectively with AI tools (Büro für Technikfolgenabschätzung beim Deutschen Bundestag, 2024; Nedungadi et al., 2024; STRATA, 2023; Stracke et al., 2025; Zadroga, 2025). This substantial competence gap is multidimensional, encompassing not only technical deficiencies but also pedagogical, ethical, and legal shortcomings.

- **Lack of technical knowledge.** Many teachers do not understand how AI models function, what their fundamental limitations are, or how to formulate effective prompts. As a result, they often obtain imprecise or unusable outputs (Chodak & Filipek, 2025; Pyżalski, 2025). Educators are often unaware of the phenomenon of so-called *AI hallucinations*, i.e. the generation of false yet seemingly credible information (An et al., 2025; Giannakos et al., 2024). A lack of critical evaluation skills and an inability to verify AI-generated content mean that, even with good intentions, the use of such tools may become ineffective or risky (Chiu, 2024; Pyżalski, 2025).

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- **Insufficient pedagogical preparation.** Even when teachers possess basic technical skills, they frequently struggle to meaningfully and pedagogically integrate AI into the teaching process (Knight et al., 2024; Pyżalski & Łuczyńska, 2024; Šarlauskienė, 2023). There is a noticeable tendency to use AI superficially — mainly for automating administrative tasks — rather than for fostering active learning and student engagement (Nedungadi et al., 2024). In Polish schools, AI often plays the role of a "teacher's assistant" for creating materials, rather than an "interactive tool for students" (Pyżalski, 2024). The lack of established didactic models (Federal Ministry of Education and Research, 2025) and uncertainty about the evolving role of the teacher — from a knowledge transmitter to a mentor and facilitator — further limit adoption (Pyżalski & Łuczyńska, 2024; Digital Education Section of the Polish Academy of Sciences, 2025).
- **Lack of ethical and legal awareness**. Teachers often lack sufficient understanding of risks related to data protection (GDPR), algorithmic bias, intellectual property rights, or academic integrity (Balaskas et al., 2025; Butrimė & Zuzevičiūtė, 2025; Kwiatkowski et al., 2025). This leads to unintentional misuse, such as entering sensitive student data into external commercial tools (Mironova et al., 2024; Pyżalski, 2025), or failing to engage students in discussions about ethics, misinformation, and algorithmic fairness (Perera & Lankathilake, 2023; Digital Education Section of the Polish Academy of Sciences, 2025). This gap is particularly dangerous, as teachers bear direct responsibility for the ethical implementation of technology in the classroom (Perera & Lankathilake, 2023).
- **Lack of systemic and adequate training.** Existing professional development programmes are often fragmented, uncoordinated, and inadequate to meet the challenges of the AI era (An et al., 2025; Stracke et al., 2025). Teachers also report organisational barriers such as the lack of time to experiment with new pedagogical approaches (GEI, 2024; Pyżalski, 2025) and insufficient financial or institutional support (Hochschule Bonn-Rhein-Sieg, 2023; STRATA, 2023).

4.3.2. Technical and Infrastructural Challenges and Implementation Costs

The effective and equitable implementation of artificial intelligence (AI) in education requires a robust, modern, and secure technical infrastructure. However, many educational institutions—particularly in the public sector—lack sufficient resources (Chiu, 2024; Mironova et al., 2024;

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Bundestag Scientific Services, 2025; Stracke et al., 2025). A review of the literature reveals three key and interrelated barriers: infrastructural inequalities, the lack of secure GDPR-compliant platforms, and the high costs of implementation and maintenance.

- **Infrastructural inequalities:**

  - *Hardware and software shortages* – a lack of modern equipment and updated software (Nedungadi et al., 2024; STRATA, 2023; Želvytė & Statkuvienė, 2024);
  - *Limited access to high-speed internet* – a prerequisite for cloud-based solutions (Kultusministerkonferenz, 2024; Želvytė & Statkuvienė, 2024);
  - *Deepening digital divides* – better technological resources translate into educational advantages (Chiu, 2024; Farrelly & Baker, 2023; STRATA, 2023).

- Lack of secure GDPR-compliant platforms: Tools hosted outside the EU pose legal risks and hinder institutional initiatives (Balaskas et al., 2025; Mironova et al., 2024). In Germany, the shortage of such secure solutions has been identified as a systemic barrier (Federal Ministry of Education and Research, 2025; OECD, 2024). Pilot projects such as *schulKI* demonstrate that access to safe, institutionally managed platforms significantly increases readiness for AI integration (GEI, 2024).

- High implementation and maintenance costs:

  - Software licenses and subscription fees *(Borsodi & Virányi, 2024; Zadroga, 2025);*
  - Maintenance and modernization of infrastructure *(Chodak & Filipek, 2025; Želvytė & Statkuvienė, 2024);*
  - Staff training and professional development *(An et al., 2025; STRATA, 2023; Vaitkevičienė & Žilinskienė, 2025).*

Summary: Financial and technical barriers exacerbate inequalities. Public investment in software licenses, infrastructure, and equitable access to AI tools is strongly recommended (Farrelly & Baker, 2023; Government of Hungary, 2024).

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4.3.3. Resistance to Change and Lack of Institutional Strategies

The successful integration of AI in education is hindered not only by competence gaps or infrastructural deficits but also by psychological and organizational barriers (Balaskas et al., 2025; Nguyen, 2025). Resistance arises from ethical and pedagogical concerns, job insecurity, and staff overload—factors further exacerbated by the absence of coherent institutional policies.

- **Ethical and pedagogical concerns:** Educators express reservations about AI due to fears of losing control over teaching, the dehumanization of education, and the erosion of academic standards (Butrimė & Zuzevičiūtė, 2025; Nedungadi et al., 2024; Šarlauskienė, 2023). There are also concerns about AI undermining traditional assessment and promoting academic dishonesty (Balaskas et al., 2025; Butrimė & Zuzevičiūtė, 2025; Šarlauskienė, 2023). Fear of technology replacing interpersonal relationships in education persists (Więckiewicz-Modrzewska, 2024; Zadroga, 2025). In Poland, even the term “artificial intelligence” evokes resistance among some academic staff (Pyżalski, 2025).
- **Job in security and redefinition of the teacher’s role:** The traditional role of the teacher as the primary source of knowledge is being challenged (Knight et al., 2024). The necessary shift towards mentoring and facilitation raises concerns about task automation and potential job reductions (Pyżalski & Łuczyńska, 2024; Digital Education Section of the Polish Academy of Sciences, 2025; Stracke et al., 2025).
- **Lack of time and system icover load:** Chronic time shortages prevent educators from experimenting with innovations. Administrative burdens leave little room for lesson redesign or testing new technologies (GEI, 2024; Hochschule Bonn-Rhein-Sieg, 2023; Pyżalski, 2025).
- **Lack of coherent policies and institutional strategies:** Current actions are largely reactive, relying on outdated plagiarism policies that fail to address AI-related challenges (An et al., 2025; Mironova et al., 2024; Perera & Lankathilake, 2023; Pyżalski & Łuczyńska, 2024; Digital Education Section of the Polish Academy of Sciences, 2025; Šarlauskienė, 2023). Without systemic support, educators are left to navigate these changes alone, which intensifies resistance.

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4.3.4. Misalignment of Curricula and Assessment Methods

The emergence of generative AI has fundamentally disrupted traditional curricula and assessment systems, which struggle to keep pace with technological change (Federal Ministry of Education and Research, 2025; Giannakos et al., 2024; Nedungadi et al., 2024). Key problem areas include outdated curricula, the crisis of conventional assessment methods, and the unreliability of AI detection tools.

a) **Outdated curricula**: Current programs rarely teach students how to use AI critically, responsibly, and ethically (Chiu, 2024; Fatyga, 2024; Stracke et al., 2025; Digital Education Section of the Polish Academy of Sciences, 2025). Students often use AI tools without understanding their limitations or the risks of misinformation (Chiu, 2024; Leibniz Institute for Media Research, 2025; Perera & Lankathilake, 2023). In the age of AI, higher-order thinking skills are essential; outdated curricula reinforce cognitive passivity and "intellectual laziness" (Fatyga, 2024; Sobkowiak, 2024).

b) **Crisis of traditional assessment:** Generative AI can write essays, solve problems, and code, making conventional take-home assignments vulnerable to misuse (CHE Centre for Higher Education Development, 2025; Giannakos et al., 2024; Farrelly & Baker, 2023; Hochschule Darmstadt, 2023; Balaskas et al., 2025). Research shows that 25% of Polish teachers have encountered AI-generated work submitted as original (Pyżalski, 2025). Reverting to handwritten exams is anachronistic and risks deepening inequalities (Farrelly & Baker, 2023).

c) **Unreliability of AI detection tools**: Detection tools are ineffective and risky, often generating false accusations—especially against international or marginalized students (An et al., 2025; Farrelly & Baker, 2023). Many universities advise against their use (An et al., 2025).

d) Recommended shift to ward authentic assessment: Experts call for a redesign of assessment systems to focus on higher-order thinking and originality (CHE Centre for Higher Education Development, 2025; Federal Ministry of Education and Research, 2025; Hochschule Darmstadt, 2023; Butrimė & Zuzevičiūtė, 2025). The assessment should verify the creation process: drafts, work documentation, and reflective journals (Károli Gáspár University of the Reformed Church in Hungary, 2024; Eötvös Loránd University, 2024). Oral exams, debates, project work, case studies, and portfolios—formats resistant to automation—should be prioritized (An et al., 2025; CHE Centre for Higher Education Development, 2025; Eötvös Loránd University, 2024).

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4.4. The Impact of Artificial Intelligence on Learning and Personal Development

A review of literature from Greece, Lithuania, Germany, Poland, Hungary, and international sources shows that the impact of AI on personal development and learning abilities is complex. On the one hand, AI offers significant potential for personalization and learning support (Nedungadi et al., 2024; Pyżalski & Łuczyńska, 2024); on the other, uncritical or excessive use poses risks to cognitive skills, intrinsic motivation, and social development (Giannakos et al., 2024; Stracke et al., 2025; Zadroga, 2025).

4.4.1. Reduced Learner Autonomy and the Erosion of Critical Thinking

One of the most profound and frequently cited ethical concerns in the educational context is the risk that easy access to generative tools may weaken fundamental cognitive abilities and reduce students' intellectual autonomy (Butrimė & Zuzevičiūtė, 2025; Nedungadi et al., 2024; Stracke et al., 2025). These concerns center on the erosion of critical thinking, creativity, problem-solving independence, and intrinsic motivation to engage in intellectual effort (Fatyga, 2024; Pyżalski, 2025; Želvytė & Statkuvienė, 2024).

- **"Deskilling" and cognitive passivity:** Excessive, unreflective reliance on AI may lead to a gradual loss of essential skills that appear unnecessary in an automated environment (Knight et al., 2024). This applies particularly to writing, information synthesis, and complex problem-solving (Farrelly & Baker, 2023; Giannakos et al., 2024). Instead of engaging in deep cognitive processing, students may become passive, outsourcing intellectual effort to the machine (Mironova et al., 2024; Stracke et al., 2017).
- **Erosion of critical thinking and motivation:** In Poland, 75% of teachers fear that students will stop thinking independently, and 68% anticipate a decline in knowledge depth (Pyżalski, 2025). There is a risk of uncritical acceptance of AI-generated content, which may be inaccurate or biased (Chiu, 2024; Leibniz Institute for Media Research, 2025). The ease of obtaining ready-made

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solutions weakens intrinsic motivation and perseverance (Balaskas et al., 2025; Kultusministerkonferenz, 2024; Stracke et al., 2025).

- **Reduced creativity and originality:** Although AI can support creativity, overreliance risks diminishing originality and authentic expression (Butrimė & Zuzevičiūtė, 2025; Nedungadi et al., 2024; Nguyen, 2025). Students may depend on AI-generated patterns instead of exploring and articulating their own ideas (Mironova et al., 2024; Stracke et al., 2025).

Recommendations: Teaching and assessment methods should be redesigned toward authentic tasks that require reflection, analysis of the creative process, and originality (An et al., 2025; CHE Centre for Higher Education Development, 2025; Eötvös Loránd University, 2024). Systematic implementation of AI literacy education is needed to develop skills in critical evaluation, source verification, and ethical technology use (Chiu, 2024; Perera & Lankathilake, 2023; Digital Education Section of the Polish Academy of Sciences, 2025).

4.4.2. The Impact of AI on Motivation for Self-Directed Learning

The impact of AI on learning motivation is ambivalent and depends on how students use it and how learning environments are designed (Balaskas et al., 2025; Nedungadi et al., 2024).

a) Positive impact on motivation and engagement – through personalization and immediate support:

- *Personalization and instant feedback* – AI systems adapt content and learning pace to individual needs, which enhances motivation (Borsodi & Virányi, 2024; Kultusministerkonferenz, 2024; Nedungadi et al., 2024). Immediate, personalized feedback increases engagement (Chiu, 2024; Daukšaitė-Kolpakovienė, 2024; Perera & Lankathilake, 2023).
- *Support in exploring and understanding complex topics* – AI tools can act as interactive tutors, assisting with exploration, idea generation, and rapid access to information (GEI, 2024; Leibniz Institute for Media Research, 2025). Such support can be motivating, especially when learners face difficulties (Balaskas et al., 2025; Daukšaitė-Kolpakovienė, 2024; Hochschule Darmstadt, 2023).

b) Negative impact – weakened intrinsic motivation and superficial learning:

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- *Using AI as a "shortcut"* – relying on AI to avoid cognitive effort can reduce intrinsic motivation (Farrelly & Baker, 2023; Giannakos et al., 2024; Knight et al., 2024; Kultusministerkonferenz, 2024; Mironova et al., 2024; Stracke et al., 2025; An et al., 2025; Nedungadi et al., 2024).
- *Risk of shallow learning* – easy access to ready-made answers discourages deep analysis and fails to foster higher-order cognitive skills (Giannakos et al., 2024; Nguyen, 2025; Office of Technology Assessment at the German Bundestag, 2024; Fatyga, 2024; Zadroga, 2025).

4.4.3. Concerns About the Decline of Social Competences

Many studies highlight the risk of deteriorating communication, collaboration, and empathy due to poorly designed or excessive use of AI in education (Giannakos et al., 2024; Nedungadi et al., 2024; Stracke et al., 2025).

a) Isolation and reduced human interaction:

- *Decline in authentic communication* – working individually with AI tools may limit peer collaboration and discussion, which are crucial for negotiation, argumentation, and collective problem-solving (Chiu, 2024; Kwiatkowski et al., 2025; Nedungadi et al., 2024). For example, replacing brainstorming with peers by generating ideas in ChatGPT diminishes social learning (GEI, 2024).
- *Risk of forming bonds with AI at the expense of human relationships* – 66% of Polish teachers fear that students may develop emotional attachments to AI tools, weakening peer relationships (Pyżalski, 2025; Mironova et al., 2024).

b) Replacement of relationships and dehumanization of education:

- *Lack of empathy and emotional support* – AI systems lack empathy and the ability to understand complex social contexts (Więckiewicz-Modrzewska, 2024). Automating teacher–student relationships risks dehumanizing education (Zadroga, 2025).
- *Diminished social dimension of education* – excessive focus on individual interactions with technology may undermine communication and collaboration. It is recommended to design tasks in which AI supports group work rather than replaces it (Office of the Academic Ethics and Procedures

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Ombudsman of the Republic of Lithuania, 2024; Stracke et al., 2025; GEI, 2024; Kultusministerkonferenz, 2024).

Conclusion: Despite numerous benefits, excessive and individualistic use of AI may weaken essential social competences. Educational design should ensure that technology supports rather than replaces genuine human interaction. The teacher's role as a mediator remains central.

5. Conclusions from the Literature Review

5.1. The Urgent Need for Ethical and Legal Frameworks as the Foundation for Safe Implementation

- The analysis of literature from all examined countries clearly indicates that the pace of AI technological development significantly outstrips the capacity of legal and institutional systems to create adequate regulations. This leads to dangerous gaps and represents one of the main barriers to safe implementation. Educational institutions, teachers, and students operate in a state of uncertainty, which hinders innovation and increases the risk of misuse. This issue is multidimensional and primarily concerns threats to academic integrity, personal data protection, and ambiguities in copyright and legal liability.
- **Ethics and academic integrity** – The most frequently raised concern is the threat to academic honesty. AI blurs the boundaries of authorship and originality, enabling new forms of plagiarism. Research conducted in Poland shows that as many as 25% of teachers have encountered assignments entirely generated by AI tools and submitted as students' own work. The lack of coherent institutional policies means that students often do not know what constitutes legitimate assistance and what qualifies as cheating, while universities tend to reactively apply outdated anti-plagiarism frameworks. Additional challenges include algorithmic bias and the phenomenon of "hallucination." All analyzed sources call for the urgent development of internal ethical codes that promote transparency and accountability.
- **Law and data protection (GDPR)** – Compliance with the GDPR is identified as a critical barrier in all countries reviewed. Many popular AI tools operate outside the European Union, which

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entails the transfer of students' personal data without adequate safeguards. The lack of transparency in model operation ("black box" issue) complicates the right to information, and obtaining informed consent is practically challenging. Initiatives such as Germany's *schulKI* demonstrate that providing access to legally compliant and secure platforms significantly increases teachers' readiness to use AI in education.

- **Copyright and accountability** – The unclear legal status of AI-generated content complicates authorship attribution and the assessment of a student's original contribution. Models trained on copyright-protected data may produce outputs that infringe on creators' rights. This creates a "liability gap," where it is difficult to identify responsibility for errors, discrimination, or violations. Most guidelines emphasize that ultimate accountability must rest with the human user.

5.2. The Critical Role of Staff Competence as a Key Factor in Success or Failure

The literature consistently shows that even the most advanced AI tools and regulatory frameworks will not be effective without adequately prepared educators. The competence gap among academic staff is one of the most frequently cited practical challenges.

- **A multidimensional competence gap** – Deficiencies concern technical knowledge (understanding AI mechanisms and limitations, prompt formulation), pedagogical preparation (meaningful integration of AI into teaching), and ethical-legal awareness (GDPR, bias, copyright). The result is uncertainty and reactive behavior.
- **Redefining the teacher's role** – The transition from the role of "knowledge transmitter" to that of mentor and facilitator requires new skills and a transformation of professional identity, often accompanied by resistance and fear of job displacement.
- Lack of systemic support and training – Professional development programs are often inadequate, fragmented, and uncoordinated. Organizational barriers include chronic time constraints, insufficient resources, and weak institutional backing.

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5.3. The Need for a Transformation of Teaching and Assessment in Response to AI Capabilities

The emergence of AI systems capable of producing complex texts and solving standard tasks has triggered a crisis in traditional teaching and assessment methods. Maintaining the status quo is no longer effective.

- **The crisis of traditional assessment and the unreliability of AI detectors** – Essays and take-home assignments have become prone to misuse. AI-detection tools are unreliable and risky, often generating false accusations—particularly against students from minority backgrounds. Many universities advise against relying on such tools.
- **Outdated curricula** – Educational programs rarely include systematic instruction in AI literacy or the critical and ethical use of technology.
- **Recommended transformation toward authentic assessment** – Evaluation should focus on higher-order skills and deep understanding by assessing the learning process (documentation, drafts, reflective journals) and employing authentic tasks such as oral exams, debates, projects, case studies, and portfolios.

5.4. The Ambivalent Impact on Students – AI as Both a Support Tool and a Threat to Autonomy

The final impact of AI depends on how technology is used and the pedagogical context in which it is implemented.

- **Risk of critical thinking erosion and "deskilling**" – Excessive and unreflective reliance on AI may lead to the loss of essential skills and cognitive depth. In Poland, 75% of teachers fear that students will abandon independent thinking.
- **Ambivalent effects on motivation** – Personalization, rapid feedback, and exploratory support enhance motivation; however, using AI as a "shortcut" weakens intrinsic motivation, perseverance, and encourages superficial learning.

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- **Deterioration of social competences** – Individualized AI use may reduce peer and teacher interaction and replace empathy-based relationships with automated exchanges.

6. Recommendations for the Responsible Implementation of AI in Education

The analysis of academic and strategic literature from Poland, Germany, Lithuania, Greece, and Hungary reveals a convergent picture of challenges related to the integration of generative artificial intelligence (AI). Despite systemic differences, ethical, legal, pedagogical, and infrastructural issues are universal and require coordinated action. On this basis, five key areas of recommendations have been formulated for policymakers, university authorities, academic staff, and technology partners.

6.1. Developing Institutional and National Policies Based on Risk Analysis

The absence of coherent and proactive regulatory frameworks hinders the safe implementation of AI. Multilevel policies are needed to balance innovation with academic values.

- **Develop national and European ethical–legal frameworks** – defining principles for GDPR compliance, copyright, legal liability, and academic integrity; ensuring transnational coordination aligned with UNESCO guidelines.
- **Implement transparent and flexible institutional policies** – university AI policies should be published, embedded in course syllabi, developed through participatory processes, and reviewed periodically.
- **Establish institutional AI ethics committees** – to provide continuous oversight, risk assessment, and recommendations for updates.
- **Introduce clear authorship and citation rules** – mandatory disclosure and documentation of AI assistance in student work.

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6.2. Designing Systemic Training Programs for Academic Staff

Research from various countries — including the USA, Europe, Poland, Germany, and Lithuania — consistently emphasizes that university teachers often lack the knowledge and skills necessary to assess and supervise AI tools. Many feel uncertain about the technical, ethical, and legal implications, which leads to resistance or chaotic adoption of technology. Therefore, it is essential to introduce comprehensive, systemic, and mandatory training programs to ensure a consistent level of competence.

These programs should cover three integrated domains:

a) Technical Competencies

Training in this area should go beyond basic tool operation. It must focus on building a deeper understanding of how generative AI systems work, their limitations, and how to use them consciously.

- **Practical tool training** – academic teachers should have the opportunity to test various AI tools (e.g., ChatGPT, Claude, Gemini, Midjourney) in practice. Training should include both popular cloud-based platforms and safer, local open-source solutions that provide greater control over data.
- **Prompt engineering** – the ability to formulate precise and effective prompts is one of the key future skills. Training should cover various prompt types and techniques (e.g., step-by-step, role-based, structured) to obtain more accurate and contextually relevant responses. Teachers should not only learn to create prompts themselves but also be able to teach this skill to students.
- **Content verification** – one of the greatest risks is AI "hallucination," i.e., generating false but seemingly credible information. Training must emphasize developing critical evaluation skills and teach verification methods, such as triangulating sources and consciously fact-checking AI outputs.

b) Pedagogical Competencies

Integrating AI requires rethinking and redesigning traditional teaching and assessment methods. Teachers must transition from being transmitters of knowledge to tutors and facilitators of the learning process.

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- **Workshops on AI-enhanced course design** – training should provide ready-made instructional scenarios and templates for integrating AI across disciplines. It should demonstrate how to use AI to personalize learning, create engaging materials, and support project-based and collaborative work. The goal is for AI to enhance, not replace, critical thinking, creativity, and cooperation.
- **Workshops on AI-informed assessment** – traditional assessment methods such as essays have lost their relevance in the age of AI. Training must introduce alternative, authentic assessment strategies resistant to AI support, such as oral exams, projects, presentations, process-based assignments (requiring documentation of progress), or portfolio evaluation. Educators should also learn how to use AI for formative assessment — e.g., generating instant feedback for students.

c) Ethical and Legal Competencies

The rapid evolution of technology surpasses current legal and ethical frameworks, creating uncertainty and a risk of misuse. Training in this domain is the cornerstone of responsible AI integration.

- **GDPR and data protection** – one of the major legal challenges. Teachers must be aware of risks associated with transferring students' personal data to external, cloud-based AI tools. Training should include practical guidance on data anonymization (e.g., masking, tokenization) and promote GDPR-compliant tools.
- **Copyright** – issues of intellectual property and plagiarism concerning AI-generated content remain highly ambiguous. Teachers must understand the risks and teach students how to properly attribute and cite materials created with AI assistance.
- **Bias and misinformation** – AI models may reproduce biases and stereotypes present in training data. Teachers should be trained to recognize algorithmic bias and help students critically assess generated content to counter disinformation and promote equity in education.

One-off training sessions are insufficient. A sustainable support system is needed to enable continuous professional development and knowledge exchange.

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- **Sharing scenarios and best practices** – universities should build repositories of tested teaching materials, course designs, and examples of AI use. Communities of practice facilitate knowledge sharing and collaborative problem-solving.
- **Local AI leaders within faculties** – appointing local leaders or mentors to support colleagues in implementing new technologies is an effective bottom-up strategy. Such leaders can organize workshops, offer consultations, and promote innovation at the faculty level.

Effective AI integration requires not only knowledge but also time and financial resources. Academic teachers are often overburdened, which remains one of the main barriers to innovation.

- **Dedicated teaching load hours** – universities should formally recognize time spent on didactic innovation. Including hours for course redesign, material creation, or participation in training within teaching loads is key to motivating staff.
- **Grants for course redesign** – internal grants or innovation contests can stimulate bottom-up initiatives and encourage thoughtful experimentation with new technologies in alignment with learning goals.

6.3. Adapting Curricula and Assessment Methods

The introduction of generative artificial intelligence (GenAI) fundamentally transforms the educational landscape, challenging traditional approaches to teaching and knowledge verification. Curricula and assessment methods must evolve to reflect these changes and prepare students for life and work in an AI-pervasive world. The following section elaborates on key recommendations.

6.3.1. Integrating AI Literacy into Curricula

Education can no longer ignore the fact that students widely use GenAI tools, often without supervision or awareness of associated risks. Therefore, developing AI literacy — competencies related to understanding, using, and critically evaluating AI — must become a core educational objective across all disciplines and levels.

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These competencies encompass three essential dimensions:

- **Critical use of AI tools**

  - *Information verification* – one of the greatest risks is AI "hallucination." Students must learn to critically evaluate AI-generated outputs, cross-check information across multiple sources (triangulation), and consciously verify facts.
  - *Bias recognition* – AI models are trained on data that may contain hidden biases and stereotypes. Curricula should address algorithmic bias to help students identify and question prejudiced or unbalanced content.
  - *Understanding limitations* – AI literacy involves not only operational skills but also awareness of AI's limitations, opacity ("black box" effect), and contextual dependencies.

- **Conscious use of AI tools**

  - *Prompt formulation* – the ability to ask precise and purposeful questions is a key future skill. Curricula should include training in various prompting techniques to elicit accurate and meaningful responses.
  - *Integration with the learning process* – students must be taught to use AI as a supportive rather than substitutive tool. AI can assist in idea generation, summarization, language refinement, or tutoring — but ultimate responsibility must remain with the student.

- **Ethical use of AI tools**

  - *Academic integrity and intellectual property* – students must understand plagiarism rules and how to properly cite and label AI-assisted content. Universities should establish clear policies on these matters.
  - *Data protection (GDPR)* – using public AI tools may involve transmitting sensitive data beyond controlled infrastructure, potentially breaching privacy regulations. Both students and educators need training on safe AI use.

6.3.2. Promoting the Transformation of Assessment Methods

Generative AI renders traditional take-home essays obsolete, as such tasks can easily be automated. Educational institutions must urgently update their assessment practices to ensure reliability and

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fairness. Instead of focusing on detecting cheating, emphasis should shift toward designing assessments that are AI-resilient and measure higher-order skills.

Recommended directions for change:

- **Authentic**, originality-based tasks
- **Projects and case studies** – require analysis of real-world problems, synthesis of diverse information, and creation of original solutions.
- **Oral exams and debates** – allow verification of understanding, reasoning, and spontaneous thinking.
- **Portfolios** – enable longitudinal evaluation of skill development through a collection of varied works.
- **Assessing the process rather than only the final product**
- **Draft versions** – reviewing successive drafts helps identify students' individual contributions and reasoning.
- **Reflective journals and process documentation** – students can be asked to document their use of AI, the prompts employed, and their critical evaluation of outputs.
- **Mandatory AI usage disclosure** – many institutions now require students to mark AI-assisted sections, promoting transparency and accountability.

6.3.3. Avoiding Detection Tools

In response to the rise of GenAI, many institutions have turned to software designed to detect AI-generated content (e.g., Turnitin). However, research consistently warns that such tools are unreliable, inaccurate, and should not be treated as sole evidence of academic dishonesty.

- **Risk of false accusations** – detection tools generate a high rate of false positives, potentially leading to unjust plagiarism charges. Students for whom academic language is not native, as well as neurodiverse individuals, are particularly vulnerable.
- **Lack of transparency and legal basis** – these tools often operate on opaque algorithms, and their use may infringe on students' rights, particularly in the context of data protection.

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- **Shift from pedagogy to policing** – excessive reliance on detection diverts attention from the more important task of redesigning teaching and assessment methods to foster authentic learning.

6.4. Investments in Secure Infrastructure and GDPR-Compliant Tools

Ensuring security and equality of access requires sustained investment:

- Promoting and providing access to GDPR-compliant AI tools **– priority should be given to solutions that meet European data protection standards.**
- Institutional investments in licenses and infrastructure **– modern equipment and high-speed internet help reduce inequalities among students and staff.**
- Implementing transparent procurement procedures **– institutions should require transparency in AI models, data provenance, security certification, and the right to audit, in line with the principles of the EU AI Act.**

6.5. Implementing Monitoring and Evaluation Mechanisms for AI Impact

The effective and responsible integration of Generative Artificial Intelligence (GenAI) into educational systems must be guided by solid data and evidence, rather than technological enthusiasm or intuition. As emphasized by experts from Poland, Germany, Lithuania, and other countries, the dynamic development of GenAI requires continuous assessment of its impact to avoid large-scale deployment of solutions that lack pedagogical, ethical, orlegal foundations. Therefore, establishing robust monitoring and evaluation frameworks is crucial for making informed decisions and continuously improving practices.

- **Conducting implementation research and pilot projects.** A fundamental step involves conducting implementation studies and pilot programs in authentic educational contexts. Before

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new tools are deployed on a large scale, their effectiveness and safety must be verified under controlled conditions. Initiatives such as the German *schulKI* project—where 71 schools tested GDPR-compliant GenAI tools—demonstrate that removing legal and technical barriers significantly increases teachers' readiness to experiment.

State-funded pilot projects allow not only to assess benefits but also to identify unintended side effects and gather evidence on the effectiveness of new AI-resilient assessment methods. Long-term research is also necessary to evaluate the impact of AI on students' cognitive skills and personal development.

- **Creating systems form on itoring and data collection**. Equally important is the creation of permanent monitoring and data collection systems that provide continuous feedback from students and staff. Universities and schools should regularly conduct institutional audits to map AI usage and identify risks, as has been done in Hungary.

Systematic surveys, interviews, and focus groups offer invaluable insights into how AI technologies are actually used, what challenges users face, and what their needs are. Monitoring should also track graduates' career outcomes to assess how AI competencies contribute to their employability and professional success.

- **Promoting anevidence-based approach.** Decisions regarding the scaling of specific AI solutions must be supported by robust evidence. This means promoting an evidence-based approach, avoiding technological determinism and the implementation of tools merely because they are novel or popular.

Public and institutional investments should focus solely on tools and methods whose positive impact has been validated through pilot studies. Scaling up unverified pedagogical solutions not only wastes resources but may also harm educational outcomes.

- **Fostering international cooperation.** The challenges posed by AI are global in nature, meaning no single institution or country can independently develop optimal solutions. International collaboration is therefore essential to exchange experiences, research findings, and best practices among universities.

International consortia—such as those involving Hungarian universities—enable the creation of shared resources and common standards.

Cooperation at the European Union level is critical to harmonize policies and benefit from other

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countries' experiences, helping to avoid repeated mistakes and establish coherent legal and ethical frameworks.

7. References

1. An, Y., Yu, J. H., & James, S. (2025). Examining higher education institutions' guidelines and policies for generative artificial intelligence use in teaching, learning, research, and administration. *International Journal of Educational Technology in Higher Education*. https://doi.org/10.1186/s41239-025-00507-3
2. Balaskas, S., Tsiantos, V., Chatzifotiou, S., & Rigou, M. (2025). The determinants of ChatGPT adoption intention in higher education: Extending the Technology Acceptance Model (TAM) with the mediating roles of trust and risk. *Information, 16*(2), 82. https://doi.org/10.3390/info16020082
3. Békés, G., Grad-Gyenge, A., & Horváth, P. (2025). *Művészet a platformokon – A generatív MI elterjedésének hatása a szerzőkre, előadóművészekre és a művészetoktatásra az AI Act tükrében*. Onlineplatformok.hu.
4. Biuro Rzecznika ds. Etyki Akademickiej i Procedur Republiki Litewskiej. (2024). *Guidelines on the ethical use of artificial intelligence in education and research*.
5. Borsodi, Zs., & Virányi, A. (2024). Tanulás és technológia: a mesterséges intelligencia szerepe az oktatásban, különös tekintettel a gyógypedagógiai alkalmazásra. *Új Pedagógiai Szemle*, 11–12.
6. Budapest University of Technology and Economics (BME). (2024). *BME to enhance certain master's programmes with AI skills (Panoraima)*.
7. Büro für Technikfolgenabschätzung beim Deutschen Bundestag (TAB). (2024). *Application potentials and challenges of artificial intelligence in education*.
8. Butrimė, E., & Zuzevičiūtė, V. (2025). Creativity in contemporary higher education in the context of the artificial intelligence expansion. *Creativity Studies*.
9. CHE Centrum für Hochschulentwicklung. (2025). *GenAI and its implementation in German higher education: Examination practices*.

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or National Agency. Neither the European Union nor National Agency can be held responsible for them. Grant no: 2024-2-HU01-KA220-HED-000282245

10. Chiu, T. K. F. (2024). The impact of generative AI (GenAI) on practices, policies and research directions in education: A case of ChatGPT and Midjourney. *Interactive Learning Environments, 32*(10). https://doi.org/10.1080/10494820.2023.2253861

11. Chodak, J., & Filipek, K. (2025). *Generatywna sztuczna inteligencja (GenAI) w badaniach naukowych. Przewodnik po inteligentnych narzędziach i rozwiązaniach*. Wydawnictwo UMCS.

12. Daukšaitė-Kolpakovienė, A. (2024). Lithuanian university students' opinions and experiences of using AI tools for learning English as a foreign language. *Language Education and Technology, 4*(2), 136–150.

13. Eötvös Loránd University (ELTE PPK). (2024). *Materials on AI for reconsidering learning results, activities, and assessment*.

14. Eötvös Loránd University – Faculty of Economics (ELTE GTK). (2025). *AI in student work: Not only allowed, but encouraged*.

15. Eurydice. (2025). *Hungary: Review of the role of artificial intelligence in higher education*.

16. Farrelly, T., & Baker, N. (2023). Generative artificial intelligence: Implications and challenges for higher education practice. *Education Sciences, 13*(11), 1109. https://doi.org/10.3390/educsci13111109

17. Fatyga, B. (2024). Przepełniony dysk: kompetencje poznawcze i cyfrowe współczesnej młodzieży. W J. Pyżalski & A. Łuczyńska (Red.), *Sztuczna inteligencja, prawdziwe zmiany w edukacji?* (s. 72–81). Fundacja Szkoła z Klasą.

18. Federal Ministry of Education and Research (BMBF). (2025). *Künstliche Intelligenz in der Schule — Review / Report*.

19. GEI (Gesellschaft für Empirische Interventionsforschung). (2024). *Generative AI as an educational medium — Interview study exploring implementation of specific AI for schools in classrooms (projekt schulKI)*.

20. German Bundestag's Scientific Services. (2025). *Zum aktuellen Einsatz von Künstlicher Intelligenz in Bildung und Forschung*.

21. Giannakos, M., Azevedo, R., Brusilovsky, P., Cukurova, M., Dimitriadis, Y., Hernandez-Leo, D., Järvelä, S., Mavrikis, M., & Rienties, B. (2024). The promises and challenges of generative AI for education. *Behaviour & Information Technology*. https://doi.org/10.1080/0144929X.2024.2394886

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or National Agency. Neither the European Union nor National Agency can be held responsible for them. Grant no: 2024-2-HU01-KA220-HED-000282245

22. Hochschule Bonn-Rhein-Sieg / HSBI. (2023). *Generatywna sztuczna inteligencja w szkole — wnioski z badania dotyczącego niemieckich szkół*.

23. Hochschule Darmstadt (HDA). (2023). *Artificial intelligence in studies — use of ChatGPT and AI-based tools: A nationwide survey of students*.

24. Hungarian Government. (2016). *Magyarország Digitális Oktatási Stratégiája*.

25. Hungarian Government. (2024). *Magyarország Mesterséges Intelligencia Stratégiája 2020–2030*.

26. Károli Gáspár University of the Reformed Church in Hungary (KRE). (2024). *Guide on the use of artificial intelligence – Rector's order*.

27. Knight, S., Gulson, K. N., McArdle, F., Gibson, A., Sellar, S., & Pangrazio, L. (2024). What makes generative AI revolutionary? Rethinking innovation and expertise in the age of ChatGPT. *Technology in Society, 80*. https://doi.org/10.1016/j.techsoc.2024.102516

28. Kultusministerkonferenz (KMK). (2024). *Bildung in der digitalen Welt — Jahresbericht 2023–2024*.

29. Kwiatkowski, K., Jędrzejowski, A., & Worek, A. (Red.). (2025). *Generatywna AI w badaniach i ewaluacji: Przewodnik po zastosowaniach modeli językowych w sektorze publicznym*. PARP.

30. Leibniz-Institut für Medienforschung | Hans-Bredow-Institut (HBI). (2025). *Use and perception of generative AI for information search in Germany*.

31. Mironova, J., Riiashchenko, V., Bondarenko, A., Kinderis, R., & Verdenhofa, O. (2024). Generative tools of AI in education. W *Business and Management 2024 Conference Proceedings*. Vilnius Gediminas Technical University.

32. National Office for Research, Development and Innovation (NKFIH). (2024). *The state and artificial intelligence (AI) – Focus-area discussion*.

33. Nedungadi, P., Tang, K.-Y., & Raman, R. (2024). The transformative power of generative artificial intelligence in achieving Sustainable Development Goal 4: Quality education. *Sustainability, 16*(22), 9779. https://doi.org/10.3390/su16229779

34. Nguyen, K. V. (2025). Navigating the use of generative AI tools in higher education: Ethical and pedagogical principles. *Journal of Academic Ethics*. https://doi.org/10.1007/s10805-025-09607-1

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or National Agency. Neither the European Union nor National Agency can be held responsible for them. Grant no: 2024-2-HU01-KA220-HED-000282245

35. NŠA (Nacionalinė švietimo agentūra). (2022). *Dirbtinis intelektas mokyklose: mokymosi analitikos plėtojimo gairės*.

36. OECD. (2024). *OECD artificial intelligence review of Germany*.

37. Perera, P., & Lankathilake, M. (2023). Preparing for the revolution in education with the multimodal GenAI tool Google Gemini: The way for effective policymaking. *Journal of Advances in Education and Philosophy, 7*(8). https://doi.org/10.36348/jaep.2023.v07i08.001

38. Pyżalski, J. (2024). Generative artificial intelligence: Verification of educational applications model. *Forum Pedagogiczne, 2*, 257–270. https://doi.org/10.21697/fp.2024.2.1.19

39. Pyżalski, J. (Red.). (2025). *Generatywna Sztuczna Inteligencja w szkole – przecieranie szlaków*. NASK – Państwowy Instytut Badawczy.

40. Pyżalski, J., & Łuczyńska, A. (Red.). (2024). *Sztuczna inteligencja: prawdziwe zmiany w edukacji?* Fundacja Szkoła z Klasą.

41. Sekcja Edukacji Cyfrowej Komitetu Informatyki PAN. (2025). *Sztuczna inteligencja w polskiej szkole. Biała księga*.

42. Sobkowiak, J. A. (2024). „Actus humanus" w kontekście sztucznej inteligencji a odpowiedzialność osoby. *Kultura – Media – Teologia, 60*, 271–286. https://doi.org/10.21697/kmt.2023.60.15

43. Stracke, C. M., Griffiths, D., Pappa, D., Bećirović, S., Polz, E., Perla, L., Di Grassi, A., Massaro, S., Skenduli, M. P., Burgos, D., Punzo, V., Amram, D., Ziouvelou, X., Katsamori, D., Gabriel, S., Nahar, N., Schleiss, J., & Hollins, P. (2025). Analysis of policies on artificial intelligence in higher education in Europe. *International Journal of Interactive Multimedia and Artificial Intelligence, 9*(2). https://doi.org/10.9781/ijimai.2025.02.011

44. STRATA (Vyriausybės strateginės analizės centras). (2023). *Dirbtinis intelektas: įgūdžių problematika Lietuvoje*.

45. Šarlauskienė, L. (2023). Dirbtinis intelektas aukštajame moksle: viešosios komunikacijos Lietuvoje aspektas. *Mokslo taikomieji tyrimai Lietuvos kolegijose, 1*(19), 188–197.

46. Vaitkevičienė, G., & Žilinskienė, R. (2025). Personalizavimas mokymosi procese dirbtinio intelekto pagrindu: tendencijos, iššūkiai ir perspektyvos. *Pedagogika, 157*(1), 173–193.

47. Vilniaus kolegija. (2025). *13th International Student Scientific-Practical Conference "Youth in a Changing Society" – Proceedings*.

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48. Więckiewicz-Modrzewska, J. (2024). Sztuczna inteligencja w edukacji – szanse i zagrożenia. *Szkoła Specjalna, 2*, 89–103. https://doi.org/10.5604/01.3001.0054.7035

49. Zadroga, A. (2025). Sztuczna inteligencja w edukacji akademickiej: perspektywa moralno-społeczna. *Społeczeństwo, 169*(1), 106–118. https://doi.org/10.58324/s.443

50. Želvytė, V., & Statkuvienė, D. (2024). Dirbtinio intelekto galimybės ir grėsmės aukštajame moksle. *Verslas, technologijos, biomedicina: inovacijų įžvalgos, 1*(15), 563–575.

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