



Analysis of Current Trends in Al Integration in Education

Literature Review

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Introduction

Artificial Intelligence (AI) is swiftly revolutionising education through the introduction of innovative technologies and approaches that improve teaching and learning experiences. Personalised learning systems adjust to the specific needs of individual students, offering tailored experiences that address each student's strengths and shortcomings. Intelligent tutoring systems provide immediate feedback and assistance, facilitating students' comprehension of intricate concepts and enhancing their skills. Moreover, AI-powered administrative tools optimise school operations, enhancing the efficiency of duties such as scheduling, grading, and attendance monitoring. Artificial intelligence is utilised to create sophisticated instructional materials, like interactive simulations and virtual laboratories, which enhance comprehension and engagement among learners. As artificial intelligence advances, its function in education is anticipated to broaden, providing novel options for both instructors and students.

The incorporation of AI in education poses numerous ethical dilemmas. Privacy and data security are significant issues, as AI systems frequently gather and analyse enormous quantities of personal data from students. Protecting this data from unauthorised access is essential for preserving confidence and ensuring student privacy. Bias and fairness are critical concerns, as AI tools may unintentionally reinforce prejudices inherent in their training data. This may result in disparate treatment of students according to race, gender, or socioeconomic background. Moreover, openness and accountability in AI decision-making processes are essential for educators and students to comprehend the rationale behind AI systems' findings. It is crucial to properly address these ethical problems to fully leverage AI's potential while ensuring equal and inclusive educational settings.

In the age of AI, professional development for teachers is more important than ever. Artificial intelligence is reshaping education by redefining traditional teacher roles, instructional





















strategies, and student interactions. Effective integration of AI in education depends significantly on teachers' ability to adapt and grow professionally. To integrate AI in the classroom safely, responsibly, and effectively, teachers need structured and continuous professional development that enhances digital competencies and AI literacy skills. This development should also address pedagogical integration and ethical considerations. By equipping teachers with the knowledge and skills needed to engage with AI technologies, we can ensure that they are prepared to leverage these tools to enhance student learning and create more dynamic and effective educational environments.

Artificial intelligence is an excellent tool, but it should remain a tool in the hands of teachers or students who are learning. Like any tool, if used critically and purposefully, it yields useful results. However, if the approach is not meaningful, the effects can be completely opposite.

Al in education should not be a replacement for the human factor – it is a tool that, when used responsibly, can enhance learning experiences, increase teacher agency, and reduce inequalities. The future of AI in schools depends on strong leadership, informed practice, and a commitment to fairness and transparency.















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Current trends of Al integration in Education

Artificial Intelligence (AI) is rapidly transforming the educational landscape, introducing innovative tools and methodologies that enhance both teaching and learning experiences. Some of the current trends in AI integration in education are personalised learning systems that adapt to individual student needs, intelligent tutoring systems that provide real-time feedback, and AI-driven administrative tools that streamline school operations. Additionally, AI is being used to develop advanced educational content, such as interactive simulations and virtual labs, which may foster deeper understanding and engagement. As AI continues to evolve, its role in education is expected to expand, offering new opportunities for educators and students alike to achieve their full potential.

However, the integration of AI in education also presents several ethical challenges. Privacy and data security are major concerns, as AI systems often collect and analyse vast amounts of personal data from students. Ensuring this data is protected from unauthorised access is crucial. Bias and fairness are also significant issues, as AI tools can inadvertently perpetuate prejudices present in their training data. These factors can lead to unequal treatment of students based on race, gender, or socioeconomic status. Additionally, transparency and accountability in AI decision-making processes are vital for educators and students to understand how AI systems arrive at their conclusions. Addressing these ethical challenges thoughtfully is essential to harness the full potential of AI while maintaining equitable and inclusive educational environments.

Artificial Intelligence and Education

Artificial intelligence is often lauded as a remedy for numerous fundamental issues in education, such as the scarcity of qualified educators, student underperformance, and the widening achievement gap between affluent and disadvantaged learners, although robust evidence supporting this claim is rarely presented. Such evidence necessitates the















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examination of various factors: the objectives of employing AI in education, its applications, the users (individuals, institutions, or industry), its implementation, the levels of engagement (ranging from individual learners to entire classrooms, collaborative networks, and national or transnational contexts), its functionality, among others. While the borders are not fixed, the relationships between AI and education have been categorised into four classifications: Learning with AI, Utilising AI to understand learning, Learning about AI, and Preparing for AI (Holmes et al. 2019).

- Learning with AI involves using AI-driven tools in teaching and learning, including intelligent tutoring systems, dialogue-based tutoring, exploratory learning environments, automatic writing evaluation, chatbots, and AI for learners with disabilities, administrative systems, and teachers, with few examples except smart curation of learning materials.
- Using AI to learn about learners and learning AI is used to analyse data about learners and learning, aiming to inform practices, support admissions, and plan programmes. This field, known as learning analytics or educational data mining, uses similar techniques to learning with AI tools.
- Learning about AI is the technological dimension of AI literacy, referring to the development of AI knowledge and skills among learners and teachers, covering techniques, technologies, statistics, and coding, from primary education to tertiary education (Miao & Holmes 2021).
- Preparing for AI is the human dimension of AI literacy; it involves understanding potential impacts on citizens, including ethics, data biases, surveillance, and job implications (Holmes et al., 2022).

Al has the potential to deliver significant benefits in education, such as providing personalised learning experiences, streamlining administrative tasks, and assisting in research projects. Many European universities are using Al tools to offer adaptive courseware, manage student

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enrolment, advising, and admissions, and support large-scale data analysis in research. Additionally, AI can enhance formative feedback, help teachers create lesson plans, and assist with administrative functions in schools (European Commission, 2023).

Educators are increasingly exploring AI tools to enhance teaching and learning. AI-powered services such as voice assistants, grammar correction tools, and automated trip planning are becoming common in everyday life. Educators see opportunities to use AI for personalised learning, supporting students with disabilities, and improving lesson planning. However, they are also aware of risks such as data privacy, security, and potential biases in AI-generated recommendations (Cardona et al., 2023).

Al education seeks to impart knowledge, skills, and concepts pertinent to the foundational principles of artificial intelligence. As artificial intelligence becomes more ubiquitous in our daily lives, educational institutions and instructors have begun to acknowledge the significance of Al instruction in K-12 settings (Lee & Kwon, 2024).

The findings in the article "A systematic review of AI education in K-12 classrooms from 2018 to 2023" indicated that K-12 AI education encompassed fundamental AI ideas, various AI applications, and ethical considerations pertaining to AI. To promote significant learning experiences, educators often used experiential activities and project-based learning. The results corroborated the advantages of AI education in improving students' AI literacy, problem-solving abilities, and ethical considerations about AI's social implications. Moreover, it cultivated drive, favourable attitudes towards AI, and a fascination with technology, while igniting career ambitions (Lee & Kwon, 2024).

The U.S. Department of Education emphasises three primary reasons why artificial intelligence should be addressed in education as soon as possible.

• Firstly, artificial intelligence has the potential to assist in the achievement of educational goals on a larger scale and at a lower cost. These goals include addressing

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school dropouts and improving teaching positions. By leveraging AI, educational institutions can enhance the adaptivity of learning resources to better meet students' strengths and needs, thereby facilitating more personalised and effective learning experiences.

- Secondly, AI presents new concerns at the system level, such as increased monitoring and algorithmic discrimination, which need to be managed with caution. The integration of AI in education could lead to greater surveillance of students and teachers, raising significant privacy and ethical issues. Additionally, there is a risk that AI systems may perpetuate or even exacerbate existing biases, leading to unfair treatment of certain groups of students.
- Lastly, automated instructional decisions have the potential to result in unforeseen repercussions. For instance, if AI systems adjust the pace of learning based on insufficient data analysis, this could inadvertently widen achievement gaps. It is crucial to ensure that AI-driven decisions are based on comprehensive and accurate data to avoid unintended negative consequences on student outcomes (Cardona et al., 2023).

Cardona (2023) and Lee & Kwon (2024) in the articles "Artificial Intelligence and the Future of Teaching and Learning" and "A systematic review of AI education in K-12 classrooms from 2018 to 2023" highlight several examples of the potential use of AI in education.

Learning with AI: AI can enhance adaptivity in learning by providing personalised support based on students' strengths and needs. Intelligent Tutoring Systems are an example of AI models that offer step-by-step feedback to students. However, AI models must be expanded to include social, motivational, and other aspects of learning, moving from deficit-based to asset-oriented approaches.

Teaching with AI: AI can improve teaching jobs by reducing administrative burdens and providing personalised recommendations for students. Teachers should remain central in











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instructional loops, making decisions based on AI-generated insights. Professional development is crucial to help teachers effectively use AI tools.

Al education: Various topics may be covered in K-12 Al education, including fundamental Al concepts, branches and applications of AI, and ethical considerations. Fundamental Al concepts include the introduction to AI, its definition, history, applications, and limitations. Branches and applications of AI encompass machine learning, neural networks, deep learning, and robotics. Ethical considerations involve discussions on AI ethics, societal impact, and the future of work in AI.

Ethical and Social Considerations

While AI offers numerous benefits, it also presents challenges such as increased surveillance and algorithmic discrimination. These risks need to be managed carefully to avoid unintended consequences, such as widening achievement gaps if AI systems adjust learning pace based on insufficient data. The Council of Europe advocates for responsible, fair, accountable, ethical, and transparent use of AI in education to mitigate these risks (Holmes, 2022).

In 2022, the European Commission published the "Ethical guidelines on the use of AI and data in teaching and learning" (European Commission, 2022). The purpose is to help educators understand the potential that AI and data usage applications can have in education and to increase their awareness of the potential risks so that they can engage positively, critically, and ethically with AI systems and exploit their full potential.

The ethical use of AI and data in teaching, learning, and assessment is based on four key considerations: human agency, fairness, humanity, and justified choice.

• **Human agency** is the capacity of an individual to contribute to society. This is the foundation of autonomy, self-determination, and responsibility.

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- **Fairness** refers to all members of a social organisation being treated fairly, including equity, inclusion, non-discrimination, and an equitable distribution of rights and responsibilities.
- **Humanity** as consideration for the people, their identity, integrity, and dignity, comprise humanity. For a meaningful human connection, we must consider the wellbeing, safety, social cohesion, meaningful contact, and respect required. It is fundamental to the human-centred approach to AI.
- Justified choice refers to the use of knowledge, facts, and data to justify necessary or appropriate collective decisions made by multiple school stakeholders. It necessitates openness and is founded on participatory and collaborative decision-making models, as well as explainability.

The Ethical guidelines on the use of AI and data in teaching and learning (European Commission, 2022) include guiding questions based on the key requirements for trustworthy AI systems of which the purpose is to facilitate a constructive dialogue on the ethical use of AI in education and training. It could aid the school or educator in formulating pertinent queries and engaging in a productive dialogue with AI system providers or the responsible public bodies.

The European Digital Education Hub's Squad on artificial intelligence in education (European Commission, 2023) also emphasises the need to balance AI's benefits with potential risks, ensuring human supervision and serving human values. The issues linked to the ethics of AI, the right to privacy, data protection, gender inequality or human rights are also present in the education sector, where the population is often more vulnerable, notably due to a young age and a lack of understanding. Therefore, it is highly important to put in place and implement legal safeguards and technical norms for the ethical use of AI in education to ensure that its use does not violate the rights of students, teachers and other people in the educational





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sphere. This duty must be mainly the responsibility of the countries; other actors, including schools and teachers as well as tech companies, have an important role to play.

Regulations

The European Parliament resolution on artificial intelligence in education, culture, and the audiovisual sector advocates for the inclusion of education within the regulatory framework for high-risk AI systems due to the notably sensitive nature of data concerning pupils, students, and other learners (European Parliament, 2021). This resolution's general observations emphasise that the application of AI in education raises ethical concerns regarding data usage, learners' rights, data accessibility, and the safeguarding of personal information, thereby jeopardising fundamental rights. This concern includes the potential for developing stereotypical models of learners' profiles and behaviours, which could result in discrimination or the amplification of detrimental pedagogical practices. The education section acknowledges that AI presents numerous possibilities and opportunities, while also highlighting potential issues. It emphasises the need to enhance digital skills, the essential role of educators, and the necessity of allocating increased public funding to AI research in universities.

The Resolution (European Parliament, 2021) highlights the significance of enhancing digital skills and attaining a high level of media, digital, and information literacy at the Union level as a requirement for utilising AI in education. Stresses the necessity of ensuring widespread digital and AI literacy throughout the Union, especially by creating training programmes for teachers.

35. Stresses that the learning benefits of using AI in education will depend not only on AI itself, but on how teachers use AI in the digital learning environment to meet the needs of pupils, students and teachers; points out, therefore, the need for AI programmers to involve teaching communities in the development, deployment and

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use of AI technologies where possible, creating a nexus environment to form connections and cooperation between AI programmers, developers, companies, schools, teachers and other public and private stakeholders in order to create AI technologies that are suitable for real-life educational environments, reflect the age and developmental readiness of each learner and meet the highest ethical standards; highlights that educational institutions should only deploy trustworthy, ethical, human-centred technologies which are auditable at every stage of their lifecycle by public authorities and civil society; emphasises the advantages of free and open-source solutions in this regard; calls for schools and other educational establishments to be provided with the financial and logistical support as well as the expertise required to introduce solutions for the learning of the future.

Artificial Intelligence Act (AI Act; European Parliament, 2024), emphasises the significance of utilising AI systems to update education systems, improve educational standards in both offline and online settings, and expand access to digital education for a broader range of people. Nevertheless, the use of AI systems in the field of education, namely for making judgements related to admissions, evaluations, and selecting suitable educational levels, raises ethical concerns. These AI systems should be categorised as high-risk because of their capacity to influence an individual's educational and professional path, so affecting their ability to secure their means of living. Inadequately designed and utilised AI systems can intrude upon privacy, infringing upon the right to education, perpetuating prejudice, and fortifying longstanding prejudices against particular groups, such as women, specific age cohorts, individuals with disabilities, or those of specific racial, ethnic, or sexual orientations.

There are several aspects of AI Act that have a direct impact on education:

- recognition of prohibited AI practices (Recital 44, Article 5)
- recognition of high-risk AI systems (Recital 56, Article 6, Annex III)
- recognition of AI practices that may not be high-risk (Recital 53, Article 6(3))

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- AI literacy (Recital 91, Articles 3 and 4) •
- human oversight, impact assessment (Recital 73, Articles 14 and 27)
- Al generated content, DeepFake and transparency obligations (Articles 3(60), 50 and • 86)

The AI Act addresses the risks of AI, ensuring that Europeans can trust what AI has to offer, also pointing out some potential risks of AI in education. While most AI systems pose limited to no risk and can contribute to solving many societal challenges, certain AI systems create risks that need to be addressed to avoid undesirable outcomes.

(56) The deployment of AI systems in education is important to promote high-quality digital education and training and to allow all learners and teachers to acquire and share the necessary digital skills and competences, including media literacy, and critical thinking, to take an active part in the economy, society, and in democratic processes. However, AI systems used in education or vocational training, in particular for determining access or admission, for assigning persons to educational and vocational training institutions or programmes at all levels, for evaluating learning outcomes of persons, for assessing the appropriate level of education for an individual and materially influencing the level of education and training that individuals will receive or will be able to access or for monitoring and detecting prohibited behaviour of students during tests should be **classified as high-risk AI systems**, since they may determine the educational and professional course of a person's life and therefore may affect that person's ability to secure a livelihood. When improperly designed and used, such systems may be particularly intrusive and may violate the right to education and training as well as the right not to be discriminated against and perpetuate historical patterns of discrimination, for example against women, certain age groups, persons with disabilities, or persons of certain racial or ethnic origins or sexual orientation.





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Article 5 Prohibited AI practices

(a)... AI system that deploys **subliminal techniques** beyond a person's consciousness or purposefully manipulative or deceptive techniques,...

(b) ... AI system that exploits any of the **vulnerabilities of a natural person** or a specific group of persons due to their age, disability or a specific social or economic situation... (c) the placing on the market, the putting into service or the use of AI systems for the **evaluation or classification** of natural persons or groups of persons over a certain period of time based on their social behaviour or known, inferred or predicted personal or personality characteristics, with the social score leading to either or both of the following:

(i) detrimental or unfavourable treatment of certain natural persons or groups of persons in social contexts that are unrelated to the contexts in which the data was originally generated or collected;

(ii) detrimental or unfavourable treatment of certain natural persons or groups of persons that is unjustified or disproportionate to their social behaviour or its gravity;

(f) ... AI systems to **infer emotions** of a natural person in the areas of workplace and education institutions, ...

(g)... of **biometric categorisation systems** that categorise individually natural persons based on their biometric data to deduce or infer their race, political opinions, trade union membership, religious or philosophical beliefs, sex life or sexual orientation...

ANNEX III High-risk AI systems referred to in Article 6(2)

3. Education and vocational training:

(a) AI systems intended to be used to **determine access or admission** or to assign natural persons to educational and vocational training institutions at all levels;

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(b) AI systems intended to be used to **evaluate learning outcomes**, including when those outcomes are used to steer the learning process of natural persons in educational and vocational training institutions at all levels;

(c) AI systems intended to be used for the purpose of **assessing the appropriate level of education** that an individual will receive or will be able to access, in the context of or within educational and vocational training institutions at all levels;

(d) AI systems intended to be used **for monitoring and detecting prohibited behaviour** of students during tests in the context of or within educational and vocational training institutions at all levels.

4. Employment, workers' management and access to self-employment:

(a) AI systems intended to be used for the **recruitment or selection** of natural persons, in particular to place targeted job advertisements, to analyse and filter job applications, and to evaluate candidates;

(b) AI systems intended to be used to make decisions affecting terms of work-related relationships, the promotion or termination of work-related contractual relationships, to allocate tasks based on individual behaviour or personal traits or characteristics or to monitor and evaluate the performance and behaviour of persons in such relationships.

Brief information from participating countries

The Council of Europe has been actively examining the impact of AI on human rights, democracy, and the rule of law. A survey conducted in 2022 aimed to gather data from member states to understand the connections between AI and education. The survey highlighted the need for dedicated AI policies and strategies in education to ensure respect for fundamental values, rather than relying solely on general AI frameworks. Most respondent

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member states have a general AI policy or are working on one, emphasising the importance of AI literacy, ethical considerations, and personalised learning (Holmes et al., 2022).

According to the comprehensive 2022 UNESCO report "K-12 AI curricula: a mapping of government-endorsed AI curricula", only a limited number of government-endorsed AI curricula had been developed and implemented by 2021 when mapping was conducted. The UNESCO report emphasises that further research is needed to determine the extent to which K–12 curriculum reform will include the development and implementation of AI curricula.

Here we are sharing just few information from every country participating in the <u>EducationalAl project</u>. **More information will be presented in Comprehensive report which** follows.

Austria

The Austrian strategy on Artificial Intelligence was adopted in 2021 and covers the period up until 2030. It recommends that AI competencies must be integrated into education and training in schools, instructional practices, and universities. Artificial intelligence can assist learners and instructors in enhancing the efficacy and engagement of the educational experience. Artificial Intelligence will render some information and competencies, currently emphasised in academic education, outdated. A conversation is necessary regarding how the educational system should adapt to the changes brought about by AI (Federal Ministry for Digital and Economic Affairs, 2021).

In the Digitalisation report "Mission Possible AI as an enabler for Austria's regions" (2023), the Federal Ministry of Education, Science and Research described AI package for Austria's schools which aims to support schools in the integration of artificial intelligence. A The AI package for Austria's schools includes: International perspectives for AI in the school system, Integrating AI into school development, Focus on AI in teacher training, Generative AI as a teaching and learning tool, Pilot school project to evaluate AI learning software. It promotes

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the use of AI technologies in schools to improve teaching and learning processes and prepare schools for the challenges of digitisation. The initiative is complemented by scientific support from the University of Graz, which will make recommendations based on the evaluation results.

Croatia

The article "Personalized Learning in the Croatian National Education System" examines the incorporation of AI-driven personalised learning into the e-Class Register, emphasising how customised educational programs can address individual student requirements, enhance engagement, and promote goal setting. The article also explores the possibility of virtual teaching assistants to aid students and educators through personalised recommendations and progress evaluations. The results demonstrate that AI-driven solutions can revolutionise conventional educational methods by increasing student engagement, optimising administrative functions, and providing interactive learning experiences. This research emphasises the potential for wider implementation of AI technologies in education and identifies future prospects for enhancing personalised learning in digital classrooms (Šabić et al., 2024).

Application of Artificial Intelligence-Based Digital Technologies in Education – BrAIn project aims to contribute to the quality and duration of the time students spend in the educational process through the integration of digital technologies. This aims to establish a personalised approach to learning and teaching, as well as the development of curricula and digital educational content in emerging digital technologies (CARNet, 2023).

Finland

The Finnish National Agency for Education and the Ministry of Education and Culture published the material "Artificial Intelligence in Early Childhood Education and Training – Legislation and Recommendations" in March 2025. The aim of the material is to support

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providers of early childhood education and training in integrating artificial intelligence into teaching and learning. The content consists of two parts: obligations and recommendations, as well as background materials that support these guidelines.

The goal of the material is to assist organizers of early education, teaching, and training in developing expertise related to artificial intelligence and to promote responsible, safe, and innovative use of AI. "Artificial Intelligence in Early Childhood Education and Training – Legislation and Recommendations" is an evolving guide, as AI technologies develop rapidly and their potential applications in various sectors of society continue to expand.

The obligations and recommendations cover a wide range of themes related to the use of AI in early childhood education, schools, and teaching. These themes include AI systems and services, data protection, cybersecurity, and copyright. Additionally, the recommendations address the pedagogical justification for using AI, transparency, adherence to ethical principles together with learners, and consideration of AI's potential biases and errors (Finnish National Agency for Education, 2025).

The University of Eastern is leading Finland's Generation AI project, which aims to enhance children's understanding of artificial intelligence through hands-on activities and collaborative app design. The aim of the project is to bring together technology developers, schools, authorities, businesses, and non-governmental organizations. It enhances children's and youth's ability to face the global societal impacts of technology and produces pedagogical tools for teachers to use in the transformation of learning.

The project, involving over 200 Finnish 4th and 7th graders, demonstrated significant improvements in children's conceptual understanding of AI, algorithmic bias, and ethical considerations. Workshops facilitated by new educational technologies allowed children to create and test AI apps, fostering critical thinking and creativity. The findings underscore the importance of integrating AI education into school curricula to prepare children for a future increasingly influenced by AI technologies (University of Eastern Finland, 2024).







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University of Eastern Finland's Generation AI project aims to enhance children's understanding of artificial intelligence through hands-on activities and collaborative app design. The project, involving over 200 Finnish 4th and 7th graders, demonstrated significant Latvia

The Artificial Intelligence Centre Law, adopted in its final reading by the Saeima, establishes the creation of an artificial intelligence technology ecosystem and its legal framework for cooperation between the public and private sectors and universities, supporting the responsible use and development of artificial intelligence technologies.

The law provides for the creation of the Artificial Intelligence Centre, which will bring together representatives from the government, research, and digital sectors to promote mutual partnerships, the implementation and development of innovations, and the advancement of artificial intelligence initiatives in areas with high potential, in line with national interests and the country's competitiveness (Labs of Latvia, 2025).

The "Idea Day" conference created an opportunity for teachers to explore new approaches and tools for using AI in education. The conference provided a comprehensive programme addressing the opportunities and difficulties posed by artificial intelligence in the educational sector. The Latvian Information and Communications Technology Association, as the Code4Europe project coordinator in Latvia, facilitated a conference in collaboration with Riga Business School to enhance teachers' proficiency in utilising artificial intelligence technologies (Riga Business School, 2025).

Lithuania

The Lithuanian Artificial Intelligence Strategy, titled "A Vision of the Future," was released in April 2019 and formulated by the Ministry of Economy and Innovation in collaboration with professionals from the commercial sector, public sector, and academia. The Artificial









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Intelligence Strategy outlines the current status and future strategic vision of the Republic of Lithuania concerning artificial intelligence. The strategy recommends education reform to cultivate the competencies requisite for a future integrated with AI from the inception of education, improving curricula to emphasise technical competencies vital for a future integrated with artificial intelligence and promoting STEM education.

Lecturers at Vilnius University's Faculty of Law, utilised the latest AI technologies while teaching an intensive course on data protection law in English for international master's and Erasmus students. They created their AI knowledge twins, which they successfully integrated into the learning process (Vilnius University's Faculty of Law, 2025).

North Macedonia

Despite the initiation of efforts by the Macedonian Fund for Innovation and Technology Development (FTID) and the government in 2021 to formulate a National Strategy for AI, progress has been hindered by hurdles like inadequate data, human resources, and technical capabilities (Radonjanin et.al, 2024).

In 2023, North Macedonia's government launched ADA, its first AI-based digital assistant in the public sector. ADA will offer companies information on the conditions for investing in the country and on the available State aid. Users will have access to a 24-hour service that allows for instant communication and prompt personalised recommendations, enhancing the overall customer experience. It will also help reduce costs associated with customer service (Interoperable Europe, 2024).

Norway

In the report "Learning: Lost in the Shuffle?" Expert Group of the Norwegian Ministry of Education and Research observes that remaining stagnant also has risks, especially in the realm of technology. Advancements in artificial intelligence have fostered an environment conducive to inquiry, discovery, and innovation within the education sector, while















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simultaneously necessitating the formulation of critical questions. Experts emphasised enabling encounters with learning analytics within secure and acceptable frameworks while acknowledging that enhancing and evolving teaching practices through new technologies inherently entails some risk (NOU, 2023).

In "Long-term plan for research and higher education 2023–2032" Norwegian Ministry of Education and Research points out that despite Norwegian public sector being one of the most digitised globally, there remains potential for enhancement. Numerous public sector entities are currently employing artificial intelligence-based solutions to deliver more targeted and user-centric services, enhance the societal benefits of their activities, streamline operations and workflows, and mitigate risks. The utilisation of artificial intelligence is likely to escalate in the future, necessitating Norway to cultivate a greater number of individuals proficient in artificial intelligence and machine learning, among other domains. Staying abreast of these advancements is challenging, especially for numerous small firms, necessitating both specialised and adaptable educational programmes in this domain (Meld. St. 5 (2022–2023).

Romania

Romania has been making significant strides in developing its AI ecosystem, though somewhat behind other EU member states. Romania's National AI Strategy 2024–2027: The Ministry of Research, Innovation, and Digitalization (MCID) has published the national AI strategy, focusing on digital transformation and AI integration across various sectors, including education. This strategy aligns with the European Union's broader AI initiatives, particularly focusing on developing AI competencies, infrastructure, and ethical standards (Ministry of Research, Innovation, and Digitalisation, 2024).

The Romanian AI ecosystem has been growing through several initiatives (The Recursive, 2024a):

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- 1. Strategic initiatives and research infrastructure
 - Romanian Artificial Intelligence Hub (HRIA): Launched in March 2025, HRIA is a €65.25 million, five-year project coordinated by Politehnica University of Bucharest. It brings together six top Romanian universities and seven innovative SMEs to create a robust research ecosystem for AI, focusing on both fundamental and applied advancements (The Recursive, 2025a).
 - AI Research Institute in Cluj-Napoca: In May 2024, construction began on Romania's first AI research institute at the Technical University of Cluj-Napoca (UTCN). This institute, with an investment exceeding 105 million lei, aims to develop technological solutions, collaborate internationally, and train top specialists in AI.
- 2. Emerging AI startup ecosystem
 - First, significant private sector development led by companies like UiPath (originally a Romanian startup) has contributed significantly to Romania's AI capabilities, particularly in Robotic Process Automation (RPA) and machine learning applications.
 - Growth and Funding: As of late 2024, Romania's AI startup ecosystem has shown significant growth, with notable funding rounds such as FintechOS securing €55.2 million. The country hosts approximately 146 AI product companies, employing around 49,100 professionals in the AI sector (The Recursive, 2024b).
 - Notable Startups:
 - Parol: A healthtech startup that raised €1.2 million in early 2025. Parol's AI solution streamlines healthcare workflows by generating real-time medical records from doctor-patient conversations.







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- Bible Chat: A faithtech startup that secured €13.41 million in February 2025.
 Bible Chat provides a digital space for Christian communities and individuals seeking peace and emotional balance through religion (The Recursive, 2025b).
- Cluj Innovation Park and other regional innovation hubs have created specialized AI incubators focusing on healthcare, agriculture, and industrial applications.
- 3. Implications for AI Integration in Education
 - Educational Collaborations: The establishment of research hubs like HRIA and the AI Research Institute in Cluj-Napoca presents opportunities for integrating AI into educational curricula, fostering research collaborations, and developing AI literacy programs (Digi Economic, 2024).
 - Startup Innovations: The rise of AI startups in Romania indicates a growing ecosystem that can contribute to educational tools and platforms, enhancing the learning experience through AI-driven solutions.

Spain

The new education law in Spain (LOMLOE) includes contents of AI at different levels, from primary school to high school, mainly related to technology subjects. At the elementary levels (upper primary school, ages 10-12), the emphasis is on cultivating computational thinking and fundamental digital competencies, including computer use. AI principles are not explicitly taught at this level; rather, educators might integrate activities that promote technical thinking broadly. Transitioning to secondary school, for students aged 12 to 14, the objective is to enhance the primary school curriculum by incorporating block-based programming together with foundational instruction in mathematics, logic, and informatics. At the upper secondary school level (ages 14-16), educators may utilise specific AI resources within their disciplines or develop specialised AI courses. The approach should focus on "teaching for AI," enabling students to engage without necessitating extensive programming skills or prior knowledge.







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In secondary and vocational education, the focus transitions to a more technical "teaching about AI" methodology. Students are required to develop AI-driven solutions and acquire knowledge in data science and machine learning (European Commission, 2023).

Finally, at the University level, the impact of generative artificial intelligence in Spanish universities has also been discussed (Cruz Argudo et al., 2024), analysing its impact in teaching, and highlighting its opportunities and challenges. Among key features, the capability of creating new content from natural language descriptions is specifically addressed due to its potential to transform the current educational model by enabling more personalized, collaborative, and accessible teaching. Al can improve interaction between students and teachers by providing automatic responses, generating educational materials, and optimizing repetitive tasks, allowing professors to focus more on active teaching and designing learning experiences.

However, the translation into higher education also presents challenges, such as the need to ensure the accuracy of results, address potential biases, and protect privacy and intellectual property. Additionally, ethical implications must be considered to prevent misuse of the technology. The document concludes with recommendations on how to take advantage of GAI's opportunities while managing these challenges, emphasizing the importance of proper training and critical use of available tools.

The Guide on the Use of AI in Education, released by the Spanish Ministry of Education, Vocational Education and Training and Sport, serves as a crucial tool for the ethical and effective integration of AI into the educational sector. It provides practical examples, ethical considerations, and a glossary of AI-related terms (INTEF, 2024)

The Spanish government released its National AI strategy in December 2020 (Spain, 2020) with the objective to develop a policy framework defining the various actions that the

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governmental administrations will undertake to facilitate the development and deployment of AI in the economy and society. This strategy adopts a multidisciplinary approach to address economic, social, environmental, public management and governance challenges, and it includes perspectives for a wide range of sectors and disciplines. It seeks to boost the growth of AI in the Spanish economy in the coming years with concrete AI-directed policies at the national level while ensuring a smooth alignment with EU policy.

















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Professional Development of Teachers in the Age of AI

Artificial intelligence (AI) is reshaping education by redefining traditional teacher roles, instructional strategies and student interactions. Effective integration of AI in education depends significantly on teachers' ability to adapt and grow professionally. In order to integrate AI in the classroom in a safe, responsible and effective way, teachers need structured and continuous professional development that not only enhances digital competencies and AI literacy skills but also addresses pedagogical integration and ethical considerations. This literature review synthesises contemporary frameworks and research studies exploring professional development approaches for teachers to effectively engage with AI technologies in educational settings.

Status of research on teacher professional development

in the field of AI

Research on professional development related to AI integration reveals substantial gaps between existing programmes and teachers' actual needs. For instance, Tan et al. (2024) conducted a systematic review of research between 2015 and 2024 to explore the integration of AI in teaching and teacher professional development. Analysing 95 empirical articles, the authors identified a research imbalance: most studies (65%) focused on AI applications in classroom teaching, such as **conversational AI**, **AI-driven learning systems, and analytics**, while significantly fewer (35%) examined AI's role in teacher professional development. The authors emphasised that despite AI's potential to support teacher training, a substantial gap exists between available professional development programmes and actual teacher needs. The review highlighted an urgent requirement for future research on AI-enhanced professional development, especially addressing technological competencies and ethical considerations.





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The "Artificial Intelligence and Learning Analytics in Teacher Education: A Systematic Review" by Salas-Pilco et al. (2022) explores the integration of AI and Learning Analytics (LA) into teacher education, synthesising insights from 30 empirical studies published between 2017 and 2021. The review identifies several key themes, including **pre-service and in-service teachers' behaviours, digital competencies, perceptions of AI and learning analytics, self-regulation, engagement and educational data analysis.** Results highlight that behavioural data (e.g., access and interaction patterns) and discourse data (e.g., text, audio-video discussions) were prominently used, employing AI techniques like machine learning and natural language processing, as well as learning analytics dashboards. However, the review also raises concerns about ethical practices, as few studies explicitly mentioned ethical clearance or data privacy considerations. The authors conclude that despite substantial potential for enhancing teacher training, the educational community needs stronger ethical frameworks, clear guidelines, and continuous professional development programmes to fully benefit from AI and LA technologies.

Conceptual and Policy Frameworks

The UNESCO AI Competency Framework for Teachers (UNESCO, 2024) emphasises a holistic approach to professional development and highlights continuous lifelong learning through structured progression levels: **Acquire, Deepen, and Create**. This model prioritises developing human-centred mindsets, ethical AI practices, foundational knowledge, AI pedagogy and leveraging AI for professional growth. Similarly, the European Schoolnet report by Cukurova et al. (2024) emphasises the importance of aligning teacher training with frameworks like DigCompEdu and UNESCO's AI competencies, reinforcing the need for ethical literacy, technological proficiency and pedagogical innovation.







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Bridging Theory and Practice

Bridging theory and practice is crucial for professional development in the field of AI, as it ensures educators can effectively translate complex theoretical AI concepts into meaningful classroom applications. Teachers often encounter a gap between theoretical understandings of AI technologies and their practical pedagogical integration, which can limit their confidence and effectiveness in using AI to enhance student learning. Effective professional development programmes, therefore, must intentionally integrate theoretical AI foundations, ethical considerations and data literacy with experiential learning opportunities, including practical use cases, pedagogical modelling and reflective practice. By aligning theoretical knowledge with practical classroom strategies, educators can develop the necessary competencies, confidence and critical skills to responsibly and effectively harness AI's full educational potential.

In this context, Nyaaba (2024) examines the **transformative potential of Generative AI** (GenAI) and argues that GenAI can effectively reduce the heavy emphasis on content delivery and standardised testing by supporting content knowledge acquisition, thus enabling educators to focus more on pedagogical modelling and performance-based assessments. This shift addresses persistent institutional challenges such as resistance to pedagogical change, inadequate training of teacher educators, resource constraints, and overreliance on traditional lecture-based methods. However, the author also advises caution regarding GenAI's potential risks, including weakening critical thinking and creativity if misused. Consequently, the study advocates for **structured**, **scaffolded professional development programmes** emphasising ethical considerations, AI literacy and practical skills for the responsible integration of GenAI into teacher education curricula.

Noakes et al. (2024) examine the outcomes and insights from 28 exploratory projects funded by the Gates Foundation, aimed at investigating how AI could ethically and equitably transform K-12 education. The projects revealed critical findings regarding the practical and















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ethical deployment of AI technologies in educational contexts. Major successes included **AI's effectiveness in categorising datasets, translating languages, and clustering data**. However, significant challenges were noted in generating accurate math problems, diagnosing student misconceptions, and reliably evaluating AI-generated outputs. The authors highlighted the **essential role of transparency, collaboration and co-design** involving educators, students, and communities to ensure that AI tools are equitable and genuinely address user needs. Ethical considerations such as data privacy, bias detection and transparency in data use emerged as critical themes. The report emphasised the importance of intentionally using AI for specific, clearly defined tasks and advocated for ongoing professional development in AI literacy to empower educators to integrate AI effectively into their teaching practices.

Teacher Professional Vision and Experiential Learning

The rapid advancements of artificial intelligence significantly impact teaching, learning and assessment practices, which necessitates a profound evolution in teacher professional development. Developing teachers' professional vision through experiential learning is a critical yet underutilised strategy. Cukurova et al. (2024) and Tammets and Ley (2023) argue persuasively that professional development (PD) programs should involve active teacher participation in AI design and implementation. By emphasising professional vision, educators become more adept at integrating technology seamlessly and responsibly, thus improving student outcomes significantly. Cukurova et al. (2024) pose that this transformation demands not only new competencies but also reshaping teachers' roles and pedagogical strategies, which leads to three key implications of AI on teacher professional development:

1. Supporting Teaching and Learning with AI:

Professional development must equip teachers with skills to effectively integrate AI tools, such as adaptive learning systems and intelligent tutoring, into teaching. This includes the ability to critically evaluate these tools, personalise educational experiences and use AI to

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reduce administrative burdens, thereby allowing more time for pedagogically meaningful activities.

2. Educating Teachers about AI:

It is crucial for professional development programmes to include comprehensive education about AI itself in order to cover its foundational concepts, applications and ethical implications. Teachers should be empowered to use AI ethically and effectively, to understand its potential and limitations and to identify pedagogical benefits and pitfalls. This education should foster continuous learning, collaboration and the development of critical, selfregulated learning skills among teachers.

3. Innovating Education for an AI-driven World:

Teacher training should also encourage innovation in educational methods, shifting from outcome-focused to process-oriented teaching and preparing students for a future in which AI is pervasive. Key areas such as metacognition, emotional intelligence and social skills must become integral to curricula alongside traditional subjects.

Complementing this, Tammets and Ley (2023) propose a conceptual model emphasising the integration of AI technologies specifically into teacher professional learning. Their approach underlines **teacher professional vision – the** ability of teachers to notice critical classroom elements and engage in **knowledge-based reasoning** (interpretation and prediction). They argue that AI tools should not merely assist or replace teaching tasks but significantly enhance teachers' decision-making, adaptive teaching practices and alignment with their pedagogical competencies.

Tammets and Ley (2023) advocate for a **human-centred**, **researcher-teacher partnership** approach, whereby teachers are actively involved in the design and use of AI-enhanced learning analytics tools. This process involves iterative experiential learning phases – concrete experiences, **reflective observation**, abstract conceptualisation and active experimentation

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- through which teachers co-develop AI solutions tailored to pedagogical contexts, leading to deeper professional knowledge and adaptive skills. An illustrative case from their study involves mathematics teachers who collaboratively designed learning analytics dashboards to enhance their students' problem-solving skills. This co-design process facilitated teachers' professional vision by guiding them to identify meaningful learning cues and integrate pedagogical knowledge into real-time instructional decisions.

Ravi et al. (2023) in the MIT RAICA study provide empirical insights into the challenges and transformative potential of implementing AI literacy modules in middle-school settings. Teachers reported enhanced awareness and critical understanding of AI, though they also noted practical challenges, including technical difficulties and inadequate support systems. The study underscores **the necessity of comprehensive, ongoing support to manage AI curricula effectively, particularly in interdisciplinary contexts**.

Similarly, Ding et al. (2024) explored case-based professional development programmes involving different case structures (well-structured, moderately structured and ill-structured). Teachers showed significant improvements in AI literacy, particularly when engaging with ill-structured cases that prompted collaborative problem-solving, critical reflection and creative pedagogical solutions. This result underscores **the value of integrating practical, authentic case studies into professional development**.

Velander et al. (2023) highlight substantial gaps in teachers' AI-related TPACK (Technological, Pedagogical and Content Knowledge), emphasising **misconceptions and emotional concerns** surrounding AI integration. Their study argues for robust PD programmes explicitly addressing teachers' misconceptions, ethical considerations and foundational AI literacy.

Complementing this perspective, Rütti-Joy et al. (2024) outline multi-level institutional strategies (micro, meso, macro) essential for successful AI integration. They advocate embedding AI literacy and ethical knowledge deeply into teacher education programmes,















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supported by institutional frameworks ensuring equity, accountability and professional agency.



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Examples of Artificial Intelligence Use

by Teachers and Students

The integration of artificial intelligence (AI) in education represents not just a technological advancement but a **profound transformation of pedagogy, teacher–student relationships, and the role of schools in the digital age**. According to a UNESCO report (2021), educational systems are increasingly facing challenges related to personalisation, inclusivity, and efficiency, and AI is emerging as a potential response to these demands. Research conducted in the European Union confirms that AI is already impacting teaching, learning, assessment, and administration but also raises new ethical and professional questions (European Commission, 2022; Holmes et al., 2022).

The use of AI in education should be viewed from an interdisciplinary perspective – not merely as a technical innovation but as a social change with implications for equity, safety, access to knowledge and 21st century skills.

Application of AI by Teachers

In the Handbook "Artificial Intelligence in Education" (Kralj et al., 2024), authors describe several examples of possible use of AI by teachers:

- Creation of educational content and teaching materials
- Assessment & Evaluation of students' work
- Supporting adaptation of teaching resources
- Analysis of teacher work as support better teaching

Authors also warn teachers about the risk of overreliance on artificial intelligence. Artificial intelligence is an exceptional tool; however, it should remain merely a tool deployed by professionals or students in the process of learning. Like any instrument, when employed

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critically and purposefully, it produces beneficial outcomes. Nonetheless, if the approach is not meaningful, the effects can be completely opposite.

Some of the risks of over-reliance on artificial intelligence include:

- Storing and sharing large amounts of data about both students and teachers
- Believing that all information exchanged with artificial intelligence systems is confidential and will not be shared with others
- Violating laws and breaching privacy
- Using results that may cause discrimination and further spread biases and prejudices
- Limiting students' opportunities through automatic content and learning path adjustments
- Misconceptions and material errors in teaching content
- Lack of originality in ideas and methodological approaches
- "Numbing" cognitive centres of the brain and synapses
- Settling for the minimum
- Reducing the potential for creativity
- Losing independence
- Misinterpretations of student progress tracking and evaluation results
- Incorrect predictions by artificial intelligence systems
- Lack of critical thinking, creating the belief that everything artificial intelligence suggests is good or even better than what teachers can devise (Kralj et al., 2024).

Automation and reduction of administrative burden

One of the most common ways teachers encounter AI is through tools for **automating routine and administrative tasks**. AI platforms enable the creation of customised teaching materials, worksheets, quizzes, and individualised learning plans in seconds. An analysis from the UK Parliament (Tobin, 2023) shows that teachers using such tools to automate administrative





















tasks, such as creating lesson plans and worksheets, can reduce the time spent on these activities, allowing them to focus more on interacting with students and significantly **improving their motivation and capacity for innovation**.

In the United States, a survey by EdWeek Research Centre (Langreo, 2025) showed that 64% of teachers had used some form of AI to prepare instructional content or give feedback to students. Similarly, a study of the U.S. Department of Education (2023) discusses the potential of AI in education, including its role in formative assessment. It emphasises that AI systems can provide timely feedback to students, reducing the time needed for assessment and allowing teachers to focus more on teaching.

Personalization of instruction

A major advantage of AI lies in its ability to process large amounts of data and adapt content to individual needs. AI systems use learning analytics to detect patterns, identify learning gaps, and offer customised content. The European Commission (2022, p. 27) emphasises that personalised learning must be accompanied by pedagogical oversight, as algorithmic recommendations can be biased if based on incomplete or skewed data.

Assessment and diagnostics

Al-powered systems are increasingly being used for diagnostic and formative assessment. Al tools may facilitate the automatic assessment of essays, open responses, and problem-solving tasks. In addition to saving teachers time, these tools **help detect plagiarism and common errors** across large student groups (Luckin, 2018).

Application of AI by Students

In the Handbook "Artificial Intelligence in Education" (Kralj et al., 2024) authors describe several examples of possible use of AI by students balancing it with potential risks:

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• AI chatbot and emotional intelligence















- AI assistants and critical assessment
- Artistic creativity using AI and intellectual property
- Deepfakes artificially generated or manipulated

Overreliance on artificial intelligence applications as assistance and/or replacements for performing everyday school tasks may result in the evasion of cognitive effort, diminished critical thinking, and insufficient development of problem-solving skills. While AI technologies provide convenience and assistance, they should complement rather than replace traditional methods of learning and creation. Overreliance on artificial intelligence systems for academic and daily tasks may hinder the development of essential skills, like research, analysis, and communication. For this reason, it is important that teachers and students together determine and find a balance, using the tools as aids while simultaneously encouraging active participation and independent learning (Kralj et al., 2024).

Adaptive systems and personalized learning

Students widely use AI-driven platforms for independent study, especially in mathematics, languages and STEM. Adaptive learning systems analyse accuracy, time on task, and problem-solving strategies, then dynamically adjust content and difficulty.

Generative AI in writing and research

Generative AI tools may assist students in drafting essays, summaries and arguments. While helpful, they present risks if used to complete assignments without understanding the material. A study conducted in Australia (Gruenhagen et al., 2004) found that more than a third of students had used AI tools for homework. It recommends embedding AI literacy into the curriculum to help students assess reliability and ethical usage.

Supporting students with learning difficulties

Al also plays a critical role in inclusive education. Al systems which help students with reading disabilities and speech-to-text Al for dyslexia are increasingly used. European Schoolnet

















(Symeonidou, 2025) highlights the potential of artificial intelligence (AI) and social robots to improve accessibility and inclusiveness in education.

Challenges, Ethical Issues, and Pedagogical Implications

Algorithmic bias and transparency

One of the key concerns is bias in algorithms. AI systems may unintentionally favour certain behaviours or learning strategies, putting marginalised students at a disadvantage. As Luckin (2018) note, training algorithms on non-diverse datasets can produce systemic inequities, especially in automated essay scoring.

The European Commission's guidelines (2022, pp. 26–27) stress the importance of algorithmic transparency and the right of students and teachers to understand how AI systems make decisions.

Data privacy and security

Collecting and processing sensitive student data poses serious risks unless governed by clear legal and technical safeguards. The European guidelines (2022) recommend strict data minimisation and students' right to delete their data upon leaving the education system.

Pedagogical risks: superficial learning and dependency

Al can contribute to passive learning if students rely on immediate answers rather than active cognitive engagement. Holmes et al. (2022) warn against "technological determinism", where algorithmic logic replaces critical thinking, potentially undermining the development of metacognition.













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Recommendations for Responsible and Effective

Al Integration in Education

Successful integration of artificial intelligence in education requires not only technical readiness but also strategic planning, ethical awareness, and stakeholder engagement. Based on the European Commission's ethical guidelines (2022, pp. 26–27), the following key steps are recommended for schools intending to adopt AI and data-driven technologies:

- 1. Review existing AI systems and data usage
- 2. Initiate clear policies and procedures
- 3. Pilot the AI system
- 4. Collaborate with AI providers
- 5. Monitor AI system performance and assess risks
- 6. Raise awareness and engage the community

Alongside these steps, several broader principles remain fundamental:

- develop AI literacy among students and teachers
- ensure pedagogical alignment
- prioritize ethical safeguards
- promote equitable access.

Al in education should not be a replacement for the human factor – it is a tool that, when used responsibly, can enhance learning experiences, increase teacher agency, and reduce inequalities. The future of AI in schools depends on strong leadership, informed practice, and a commitment to fairness and transparency.

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Conclusion

In conclusion, the integration of AI in education may revolutionise the way we teach and learn. Current trends such as personalised learning systems, intelligent tutoring systems, AI-driven administrative tools, and advanced educational content have the potential to enhance educational experiences and make learning more efficient and engaging. As AI technology continues to advance, its impact on education is expected to grow, providing even more opportunities for innovation and improvement.

The AI Act, a regulatory framework aimed at ensuring the safe and ethical use of AI, will also impact AI integration in education. By setting standards for transparency, accountability, and fairness, the AI Act will help mitigate risks associated with privacy, bias, and data security. This legislation will guide the use of AI in education, ensuring that AI tools are developed and implemented responsibly, fostering trust and confidence among educators, students, and parents. Addressing AI ethical challenges thoughtfully is crucial to harnessing the full potential of AI while maintaining equitable and inclusive educational environments.

The comprehensive integration of AI into education depends upon meticulously structured, ethical and practically oriented professional development programmes. Teachers must be viewed not merely as passive users but as empowered, knowledgeable stakeholders actively shaping AI's educational future. To successfully integrate AI into education, professional development programmes must address technological proficiency, pedagogical innovation, AI literacy and institutional support comprehensively. Future professional development initiatives must emphasise continuous learning, ethical mindfulness and collaborative pedagogical innovation to ensure equitable, effective, and responsible AI deployment in education.

Artificial intelligence presents an opportunity to improve educational systems through personalisation, inclusiveness, and efficiency. However, its implementation must be















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thoughtful, ethically grounded, and pedagogically justified. Teachers and students must be empowered to use AI critically and creatively – not as passive users but as active agents shaping the digital future of learning.

















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References

Cardona, M.A., Rodríguez, R.J., Ishmael, K., U.S. Department of Education, Office of Educational Technology (2023). Artificial intelligence and the future of teaching and learning: Insights and recommendations. U.S. Department of Education.

CARNet (2023). Application of Artificial Intelligence-Based Digital Technologies in Education – BrAIn project <u>https://www.carnet.hr/en/projekt/brain/</u>

Cukurova, M., Kralj, L., Hertz, B., & Saltidou, E. (2024). Professional Development for Teachers in the Age of AI. European Schoolnet.

http://www.eun.org/resources/detail?publicationID=2461

Cruz Argudo, F., García Varea, I., Martínez Carrascal, J.A., Ruiz Martínez, A., Ruiz Martínez, P.M., Sánchez Campos, A., Turró Ribalta, C. (2024). La Inteligencia Artificial Generativa en la docencia universitaria: oportunidades, desafíos y recomendaciones https://www.crue.org/wp-content/uploads/2024/03/Crue-Digitalizacion IA-Generativa.pdf

Digi Economic (2024). România devine Hub digital în estul Europei. Vom avea un Institut de Cercetare în Inteligența Artificială la Cluj

https://www.digi24.ro/digieconomic/digital/romania-devine-hub-digital-in-estul-europeivom-avea-un-institut-de-cercetare-in-inteligenta-artificiala-la-cluj-19419

Ding, A.-C. E., Shi, L., Yang, H., & Choi, I. (2024). Enhancing teacher AI literacy and integration through different types of cases in teacher professional development. Computers and Education Open, 6, 100178.

Education Endowment Foundation. (2023). Using AI in Formative Assessment: UK Case Studies.

https://assets.publishing.service.gov.uk/media/671108a18a62ffa8df77b2bf/Use Cases for Generative AI in Education - Technical report October 2024.pdf







European Commission: European Education and Culture Executive Agency (2023). AI report – By the European Digital Education Hub's Squad on artificial intelligence in education, Publications Office of the European Union <u>https://data.europa.eu/doi/10.2797/828281</u>

European Commission: Directorate-General for Education, Youth, Sport and Culture, (2022). Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators, Publications Office of the European Union <u>https://data.europa.eu/doi/10.2766/153756</u>

European Parliament resolution of 19 May 2021 on artificial intelligence in education, culture and the audiovisual sector, 2021, <u>https://www.europarl.europa.eu/doceo/document/TA-9-</u>2021-0238 EN.html

European Parliament (2024). Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act) <u>https://eur-lex.europa.eu/eli/reg/2024/1689/oj</u>

Federal Ministry for Digital and Economic Affairs (2021). AIM AT 2030 Artificial Intelligence Mission Austria 2030 <u>https://www.digitalaustria.gv.at/eng/strategy/strategy-AI-AIM-AT-</u> 2030.html

Federal Ministry for Digital and Economic Affairs (2023). Digitalisation Report Mission Possible
AI as an enabler for Austria's regions <u>https://www.digitalaustria.gv.at/dam/jcr:f30ae163-</u>
<u>9435-4a6b-8edb-4ceba5606f72/Digitalisation%20Report 4 EN-af.pdf</u>

Finnish National Agency for Education (2025). Tekoäly varhaiskasvatuksessa ja koulutuksessa – lainsäädäntö ja suositukset (Artificial intelligence in early childhood education and training

- legislation and recommendations) <u>https://www.oph.fi/fi/tekoalysuositukset</u>























Gruenhagen, J. H., Sinclair, P. M., Carroll, J., Baker, P. R. A., Wilson, A., Demant, D., (2024). The rapid rise of generative AI and its implications for academic integrity: Students' perceptions and use of chatbots for assistance with assessments, Computers and Education: Artificial Intelligence, Volume 7 <u>https://doi.org/10.1016/j.caeai.2024.100273</u>.

Heffernan, N., et al. (2023). AI Tutoring Systems: Evidence from Schools in Australia. Australian Educational Researcher, 50(1), 83–102.

Holmes, W., Persson, J., Chounta, I.-A., Wasson, B., & Dimitrova, V. (2022). Artificial intelligence and education: A critical view through the lens of human rights, democracy, and the rule of law. Council of Europe. <u>https://book.coe.int/en/education-policy/11333-artificial-intelligence-and-education-a-critical-view-through-the-lens-of-human-rights-democracy-and-the-rule-of-law.html</u>

Holmes, W., Bialik, M., Fadel, C. (2022a). Artificial Intelligence in Education: Promises and Implications for Teaching and Learning. Center for Curriculum Redesign. <u>https://curriculumredesign.org/wp-content/uploads/AIED-Book-Excerpt-CCR.pdf</u>

Interoperable (2024). North Macedonia Digital Public Administration Factsheet 2024 <u>https://interoperable-europe.ec.europa.eu/sites/default/files/inline-</u> files/NIFO 2024%20DPAF North Macedonia vFINAL.pdf

Kralj, L., Blažić, A., Valečić, H., Janeš, S., Blašković, V., Marinić, N., Slišurić, K., Dasović, D., Majdandžić, V., Rakić, D.(2024). Umjetna inteligencija u obrazovanju, Agencija za elektroničke medije i UNICEF [Artificial Intelligence in Education; Agency for electronic media & UNICEF] <u>https://www.medijskapismenost.hr/wp-content/uploads/2024/04/Umjetna-inteligencija-u-obrazovanju.pdf</u>

Labs of Latvia (2025). National Artificial Intelligence Center will be Established in Latvia <u>https://www.researchlatvia.gov.lv/en/national-artificial-intelligence-center-will-be-</u>established-latvia















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🙀 Vilniaus **Ozo** gimnazija





Langreo, L. (2025). More Teachers Say They're Using AI in Their Lessons. Education Week. <u>https://www.edweek.org/technology/more-teachers-say-theyre-using-ai-in-their-lessons-heres-how/2025/03</u>

Luckin, R., (2018). Machine Learning and Human Intelligence: The Future of Education for the 21st Century. UCL Knowledge Lab.

https://discovery.ucl.ac.uk/10178695/1/Machine%20Learning%20and%20Human%20Intelli gence.pdf

Miao F. and Holmes W. (2021). Al and education: guidance for policy-makers, UNESCO, available at https://unesdoc.unesco.org/ark:/48223/pf0000376709, accessed 25 June 2022.

Ministry of Economy and Innovation Lithuania (2019). The Lithuanian Artificial Intelligence Strategy, "A Vision of the Future,"

https://eimin.lrv.lt/uploads/eimin/documents/files/DI_strategija_ENG(1).pdf

Ministry of Education and Research Norway (2022). Long-term plan for research and higher education 2023–2032, Meld. St. 5 (2022–2023)

https://www.regjeringen.no/contentassets/9531df97616e4d8eabd7a820ba5380a9/engb/pdfs/stm202220230005000engpdfs.pdf

Ministry of Education Romania (2025). Artificial Intelligence, tested in the Romanian educational environment <u>https://www.edu.ro/press_rel_23_2025</u>

Ministry of Research, Innovation, and Digitalization (MCID) of Romania (2024). "Strategia Națională în Domeniul Inteligenței Artificiale 2024-2027" <u>https://www.mcid.gov.ro/wp-content/uploads/2024/07/20240723_SNIA_2024-2027.pdf</u>

Noakes, S., Shell, A., Murillo, A. M., Van Nostrand, P., Ruiz, P., Cornick, S., & Karim, S. (2024). An Ethical and Equitable Vision of AI in Education: Learning Across 28 Exploratory Projects. Digital Promise. <u>https://doi.org/10.51388/20.500.12265/232</u>













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Nyaaba, M. (2024). Transforming Teacher Education in Developing Countries: The Role of Generative AI in Bridging Theory and Practice. [Preprint]. arXiv:2411.10718. https://arxiv.org/abs/2411.10718

Official Norwegian Report (2023). NOU 2023: 19 Learning: Lost in the Shuffle? Use of pupil and student data to enhance learning

https://www.regjeringen.no/contentassets/c0471fcd36e8481a92b627f54a702c7e/engb/pdfs/nou202320230019000engpdfs.pdf

Radonjanin, A., Lazarevska, A., Srbinoski, F., Schönherr (2024). The status and future prospects of AI regulation and development in North Macedonia

https://www.schoenherr.eu/content/the-status-and-future-prospects-of-ai-regulation-anddevelopment-in-north-macedonia

Ravi, P., Broski, A., Stump, G., Abelson, H., Klopfer, E., & Breazeal, C. (2023). Understanding Teacher Perspectives and Experiences After Deployment of AI Literacy Curriculum in Middle-School Classrooms. MIT ICERI2023. <u>https://doi.org/10.48550/arXiv.2312.04839</u>

Riga Business School (2025). Teachers explore new approaches and tools for using AI in teaching at the "Idea Day" conference, <u>https://rbs.lv/blog/2025/03/17/teachers-explore-new-approaches-and-tools-for-using-ai-in-teaching-at-the-idea-day-conference/</u>

Rütti-Joy, O., Winder, G., & Biedermann, H. (2024). Teacher Educator Professionalism in the Age of AI. Artificial Intelligence for Quality Education.

Sabic, I., Puljiz, H. & Smoljo, (2024). A. Personalised Learning in the Croatian National Education System: A Study of AI Implementation in the e-Class Register. *SN COMPUT. SCI.* **5**, 1145 (2024). <u>https://doi.org/10.1007/s42979-024-03515-8</u>

💭 Vilniaus **Ozo** gimnazija

















Salas-Pilco, S.Z., Xiao, K., & Hu, X. (2022). Artificial Intelligence and Learning Analytics in Teacher Education: A Systematic Review. *Education Sciences*, *12*(8), 569. <u>https://doi.org/10.3390/educsci12080569</u>

Sang J. L., Kyungbin K. (2024). A systematic review of AI education in K-12 classrooms from 2018 to 2023: Topics, strategies, and learning outcomes, Computers and Education: Artificial Intelligence, Volume 6, 2024, <u>https://doi.org/10.1016/j.caeai.2024.100211</u>.

Symeonidou, E. (2025). Inclusive Digital Education: The role of social robots. European Schoolnet. <u>http://www.eun.org/documents/411753/12547689/Perspective+n14+Jan+2025-V2.pdf/12d94103-0711-493e-b7ce-e82f088a8fa0</u>

Spanish Ministry of Education, VET and Sports; National Institute of Educational Technologies and Teacher Training (INTEF) (2024). Guide on the Use of AI in Education <u>https://code.intef.es/wp-content/uploads/2024/07/Guidelines-on-the-use-of-AI-in-</u> <u>Education-INTEF_2024.pdf</u>

Spain (2020). ENIA Estrategia Nacional de Inteligencia Artificial. Gobierno de España. <u>https://www.lamoncloa.gob.es/presidente/actividades/Documents/2020/021220-</u> ENIA.pdf

Tammets, K., & Ley, T. (2023). Integrating AI tools in teacher professional learning: a conceptual model and illustrative case. Frontiers in Artificial Intelligence.

https://doi.org/10.3389/frai.2023.1255089

Tan, X., Cheng, G., & Ling, M. H. (2024). Artificial Intelligence in Teaching and Teacher Professional Development: A Systematic Review. Computers and Education: Artificial Intelligence, 8, Article 100355. <u>https://doi.org/10.1016/j.caeai.2024.100355</u>

The Recursive (2024a). Romania's AI Startup Ecosystem: €160M Fresh Capital to Move the Innovation Needle <u>https://therecursive.com/romania-ai-startup-ecosystem/</u>























The Recursive (2024b). Romanian Startup Founded by Journalists Raises €1.2 Million in a Round Led by GapMinder VC <u>https://therecursive.com/romanian-startup-founded-by-journalists-raises-e1-2-million-in-a-round-led-by-gapminder-vc</u>

The Recursive (2025a). Will These Three Initiatives Boost Romania's Innovation Capabilities? <u>https://therecursive.com/will-these-three-initiatives-boost-romania-s-innovation-</u> <u>capabilities/</u>

The Recursive (2025b). Romanian AI Bible Assistant Secured €13.4M Deal https://therecursive.com/romanian-consumer-startup-signs-e13-4m-in-largest-funding-round-yet/

Tobin, J. (2024). Educational technology: Digital innovation and AI in schools. UK Parliament. <u>https://lordslibrary.parliament.uk/educational-technology-digital-innovation-and-ai-in-schools/</u>

UNESCO (2024). AI Competency Framework for Teachers. UNESCO. <u>https://unesdoc.unesco.org/ark:/48223/pf0000391104</u>

University of Eastern Finland (2024). AI education in Finland: Enhancing children's understanding, critical thinking, and creativity through hands-on activities. University of Eastern Finland. <u>https://www.uef.fi/en/article/ai-education-in-finland-enhancing-childrens-understanding-critical-thinking-and-creativity-through</u>

U.S. Department of Education (2023). Artificial Intelligence and the Future of Teaching and Learning <u>https://www.ed.gov/sites/ed/files/documents/ai-report/ai-report.pdf</u>

Velander, J., Taiye, M. A., Otero, N., & Milrad, M. (2023). Artificial Intelligence in K-12 Education: Eliciting and Reflecting on Swedish Teachers' Understanding of AI. Education and Information Technologies, 29, 4085–4105.

💯 Vilniaus **Ozo** gimnazija















Vilnius University's Faculty of Law, (2025). AI Knowledge Twins Created by Law Faculty Professors Attract International Media Attention: Is Lithuania a Role Model for Germany? https://www.tf.vu.lt/news/ai-knowledge-twins-created-by-law-faculty-professors-attractinternational-media-attention-is-lithuania-a-role-model-for-germany/

















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