



AIRED
AI reshapes education

WP2 State of the art in the use of AI for training – Mapping AI Practices & Risks, European regulations on the use of AI

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Mapping AI Contributions Across Training Practices and Classifying Accompanying Risks

The primary goal of this task is to systematically identify all current and potential practices in which artificial intelligence (AI) contributes to the field of training. This is achieved through the construction of a dynamic table that cross-references professional roles and educational tasks, thereby offering a comprehensive and multimodal panorama of AI integration. The table not only highlights existing areas of AI use but also brings to light the blind spots—combinations where AI is underutilized or entirely absent. By surfacing these gaps, the matrix serves as a strategic tool to inspire innovation, foster inclusive practices, and guide future development of AI-supported education and training across various sectors.

Core Analytical Framework

Educational Sectors: Schools, Higher Education, and Corporate Training

To comprehensively assess the impact of AI on education, it is essential to examine its integration across three pivotal sectors:

1. **Primary and Secondary Education (K–12)**
2. **Higher Education**
3. **Corporate Training and Adult Learning**

These sectors collectively encompass the continuum of lifelong learning, each playing a distinct role in equipping individuals with the necessary skills and knowledge to navigate an increasingly digital world. The European Union (EU) has underscored the significance of digital transformation and AI integration within these educational domains, as evidenced by various policy initiatives and strategic frameworks.

1. Primary and Secondary Education (K–12)

In the foundational stages of education, integrating digital technologies and AI is crucial for fostering digital literacy and preparing students for future societal and professional landscapes. The EU's Digital Education Action Plan (2021–2027) emphasizes the need to enhance digital capacities within school education systems, advocating for the development of high-quality digital education content and the promotion of digital literacy among educators and learners (European Commission, 2020). Additionally, the European Commission has published ethical guidelines to assist educators in understanding and responsibly implementing AI and data usage in teaching, aiming to demystify AI concepts and address ethical considerations in the classroom (European Commission, 2022).

2. Higher Education

Higher education institutions serve as incubators for advanced knowledge and innovation, making them critical arenas for AI integration. The Digital Education Action Plan outlines strategic priorities to support higher education in adapting to digital transformation, including fostering digital skills among students and staff, and promoting the development and use of digital technologies in teaching and learning (European Commission, 2020). By embedding AI into curricula and research, universities can cultivate a workforce adept at leveraging AI technologies across various sectors.

3. Corporate Training and Adult Learning

The rapid evolution of the digital economy necessitates continuous upskilling and reskilling of the workforce to remain competitive and adaptable. Vocational education and training (VET) systems are pivotal in this context, as they are tasked with equipping individuals with the digital competencies required in modern workplaces. The European Centre for the Development of Vocational Training (Cedefop) highlights the importance of adapting VET to embrace digitalization and AI, ensuring that training programs are responsive to technological advancements and the changing demands of the labor market (Cedefop, 2023).

Educational Stakeholder Professions

The following professions were carefully selected for inclusion in the analysis matrix because recent EU-level policies and research identify them as essential stakeholders in educational transformation, particularly concerning digitalization and the integration of AI in educational contexts. These professions are integral to the development, implementation, and integration of AI across educational systems and training environments.

1. Teachers in Primary and Secondary Schools

Teachers at primary and secondary school levels are consistently emphasized in EU policy documents as crucial agents for implementing digital education strategies and leveraging AI for learning enhancement. The European Council explicitly states teachers' indispensable roles as drivers of innovation, highlighting their necessity in education reform and the adoption of AI-enabled practices (Council of the European Union, 2020). Furthermore, the European Commission's ethical guidelines on AI specifically target teachers, positioning them as central stakeholders in guiding students ethically and effectively through digital and AI-enhanced environments (European Commission, 2022).

2. Trainers (Designers and Facilitators of Training Sessions)

Vocational and corporate trainers who design and deliver training programs are recognized by the CEDEFOP as critical for modernizing training systems, ensuring they remain agile, inclusive, and responsive to technological advances, such as AI. Trainers thus represent essential actors responsible for enabling lifelong learning and upskilling in digital competencies within corporate and vocational education settings (CEDEFOP, 2022; Council of the European Union, 2020).

3. Teacher-Researchers in Universities and Business Schools (Academic Teaching Staff)

Academic teaching staff who engage in research activities in universities and business schools are acknowledged as vital stakeholders in European higher education's digital transformation. University faculty members significantly influence the successful adoption of innovative educational technologies and pedagogical strategies, including AI. EU-level discussions and research confirm that teacher-researchers are pivotal in shaping digital educational environments in higher education institutions (European Commission, 2020; Redecker & Punie, 2017).

4. Instructional Designers

Instructional designers, as part of interdisciplinary teams, are recognized in EU policy as key contributors to the development of effective digital education ecosystems. The Digital Education Action Plan (2021–2027) emphasizes their role in supporting the integration of digital pedagogy and designing inclusive, high-quality learning experiences across all educational levels. Their expertise is crucial in addressing technological gaps and ensuring that educators are equipped with pedagogically sound and accessible digital content. The European Commission also identifies a need for capacity building in this area, highlighting instructional designers as essential actors in advancing institutional digital strategies and fostering educational innovation (European Commission, 2020).

5. Corporate Coaches

Corporate coaches, responsible for professional skill development within organizations, are highlighted by EU policy as fundamental stakeholders in workplace training and lifelong learning initiatives. They play crucial roles in integrating AI-driven tools into workplace learning contexts, significantly contributing to employee adaptability in digitally transforming workplaces (CEDEFOP, 2022; Council of the European Union, 2020).

6. Special Education Teachers

The EU explicitly recognizes special education teachers as essential stakeholders who must be actively involved in digital education strategies. Special education professionals are crucial for ensuring that digitalization and AI adoption are inclusive, thereby preventing digital exclusion among learners with special needs. European educational frameworks emphasize the necessity of empowering special education teachers with digital competencies and innovative teaching methodologies to leverage AI for inclusive education (Redecker & Punie, 2017; European Agency for Special Needs and Inclusive Education, 2022).

7. Educational Digital Professions

Professionals specifically dedicated to digital education, including e-learning managers and educational technologists, are acknowledged by EU initiatives such as the European Digital Education Hub. Their expertise is indispensable for implementing advanced digital education policies, AI tools, and innovative educational methodologies across diverse educational environments (European Commission, 2020; Redecker & Punie, 2017).

8. Technical Digital Learning Professions (e.g., 2D/3D Content Specialists)

Technical specialists responsible for developing digital educational content, such as multimedia developers and AR/VR specialists, are recognized as essential contributors within the EU's digital education policy context. EU consultations and projects explicitly involve these professionals as key stakeholders due to their critical role in creating immersive, AI-enhanced learning environments and digital educational resources (European Commission, 2020; Redecker & Punie, 2017).

9. Minor Students (Children in K-12)

Minor students in primary and secondary education are directly impacted by the integration of AI into the learning environment. While they may not always actively choose or control the tools used in their education, they are primary recipients of AI-supported teaching practices, such as personalized learning platforms, automated feedback, or AI-assisted assessment in areas ranging from mathematics to physical education. EU initiatives stress the importance of protecting learners' rights and well-being in AI-enhanced settings, highlighting children as a vulnerable group whose experiences must inform ethical and inclusive education strategies (European Commission, 2022).

10. Post-Secondary Students (Higher Education)

Students in higher education are key stakeholders in the evolution of AI-supported teaching and learning practices. As users of AI-powered tools for assessment, course planning, feedback, and even academic advising, these learners are increasingly affected by the pedagogical and ethical implications of AI integration in universities. The European Students' Union emphasizes that students must be involved in decision-making about AI usage in education to ensure transparency, fairness, and accountability, especially when AI technologies influence academic outcomes (European Students' Union, 2024).

11. Adult Students (Corporate Training)

Adult learners in corporate or vocational training contexts are also subject to AI-supported instructional environments, from adaptive learning modules to AI-driven performance monitoring. These learners often engage with AI as part of reskilling or upskilling initiatives, but they may also encounter ethical challenges related to data privacy, algorithmic evaluation, and transparency. EU policy frameworks stress that inclusive, learner-centered approaches are necessary to ensure that adult students benefit from AI-enhanced training environments without facing new barriers or biases (European Commission, 2020).

Educational Tasks/Activities in the Digital and AI-Enhanced Educational Context

The integration of AI and digital technologies into educational environments has necessitated a reevaluation of teaching methods and instructional activities. As part of this transformation, it is essential to understand how various educational tasks contribute to enhancing the learning experience and aligning it with the demands of a rapidly changing digital landscape. This section justifies the selection of key educational tasks and activities, drawing on

EU-level policies, reports, and educational frameworks to demonstrate their importance in supporting effective learning environments, particularly in the context of digital education and AI integration.

1. Research

Academic research is fundamental to the advancement of knowledge and the development of innovative solutions within higher education institutions. The integration of AI into research practices offers significant opportunities to enhance research efficiency, data analysis, and the dissemination of findings. But there are important principles such as reliability, honesty, respect, and accountability in the use of AI tools, ensuring that research integrity is maintained while leveraging technological advancements. By adhering to these principles, researchers can harness AI's potential to accelerate discovery and foster innovation, contributing to the development of more effective and ethical research practices in higher education institutions (European Commission, 2025).

2. Curriculum Design

Curriculum design is a crucial task for ensuring that learning objectives are effectively defined and that content is structured to meet both pedagogical goals and the evolving demands of the digital age. The design of curricula that integrate digital skills is pivotal for fostering students' readiness for the future workforce. EU initiatives emphasize the importance of flexible and adaptable curricula that not only address subject-specific content but also embed digital competencies across disciplines (European Commission, 2020). This approach helps students develop the skills needed to navigate a digital world, enhancing both their employability and their ability to interact with emerging technologies like AI.

3. Supervision

Supervision of learners is essential for maintaining academic standards and ensuring that educational objectives are being met. It involves monitoring learners' progress, offering guidance, and providing support to ensure that each student achieves their potential (Redecker & Punie, 2017). In higher education, this includes the supervision of Bachelor's and Master's theses, a formative process that introduces students to independent research and plays a critical role in shaping future academic pathways. As such, thesis supervision represents not only an educational task but also an early-stage investment in the next generation of researchers. The supervision of doctoral candidates is recognized as a cornerstone of institutional responsibility in European higher education (Hasgall et al., 2019). In the context of digital education, supervision becomes more complex as educators must manage students' interactions with digital platforms and AI-based learning tools (European Commission, 2020). As AI systems become more prevalent in academic research workflows, discussions around their role in thesis and dissertation supervision become increasingly important, not only to support efficiency but to uphold academic integrity and critical thinking.

4. Projects

Project-based learning has gained increasing recognition as a powerful pedagogical method that enables students to apply theoretical knowledge to practical, real-world tasks. This approach fosters critical thinking, problem-solving, and collaboration, skills essential in today's digital economy, for instance, in higher education (Van Slyke et al., 2023). The EU also emphasizes project-based learning in its VET strategies, particularly in contexts where learners are required to integrate digital technologies into their work. Projects, whether in academic, vocational, or corporate settings, serve as a bridge between theory and practice, encouraging students to work collaboratively and creatively while developing digital competencies (CEDEFOP, 2023).

5. Design the Course

Course design is a pivotal step in the creation of an educational experience that is both coherent and aligned with desired learning outcomes. It involves planning instructional activities, selecting appropriate learning resources, and choosing teaching strategies that support the achievement of educational goals. With the increasing use of digital technologies in education, course design must adapt to include not only traditional teaching methods but also digital tools and resources that enhance learning. The EU encourages the design of courses that integrate digital skills, ensuring that learners develop the necessary competencies to succeed in an increasingly digital world (European Commission, 2020).

6. Develop the Course

Developing a course involves the actual production and assembly of instructional materials, including interactive components, learning resources, and assessments. The development process is essential for ensuring that courses are engaging, accessible, and aligned with educational objectives. As digital tools become more integrated into education, course development must include the creation of digital learning materials that can support flexible, personalized learning experiences (Redecker & Punie, 2017).

7. Prepare the Classes

Preparing for classes involves organizing the content and resources needed for effective lesson delivery. This task requires careful planning to ensure that the learning experience is coherent and engaging for students. In the digital age, preparation for classes must also account for the integration of digital resources, including learning management systems (LMS) and other online platforms that facilitate both face-to-face and remote learning. The EU underscores the importance of preparing both physical and virtual learning environments to accommodate diverse learning styles and ensure that digital tools are utilized effectively to enhance the educational experience (European Commission, 2020).

8. Face-to-face and Online Delivery

The delivery of lessons, whether in traditional face-to-face classrooms or through online platforms, is a core function of education. The EU promotes blended learning approaches that combine both face-to-face and online delivery methods, enhancing flexibility and

accessibility. Blended learning not only improves student engagement but also allows for the integration of digital tools and AI to support personalized learning. The EU's Digital Education Action Plan (European Commission, 2020) highlights the role of educators in creating dynamic learning environments that foster interaction and collaboration, both in physical classrooms and through digital platforms.

9. Ongoing Assessment

Ongoing assessment is essential for providing continuous feedback on students' progress, helping to inform instructional adjustments, and improving learning outcomes. This process is particularly important in digital education, where AI tools can provide real-time data on student performance. Ongoing assessment is a valuable tool for identifying learning gaps and providing timely interventions (European Commission, 2020; Van Slyke et al., 2023). Digital technologies, such as AI-powered learning analytics, enable educators to assess students more efficiently, offering tailored feedback and support based on individual progress.

10. Assessment

Assessment in education is critical for measuring the effectiveness of teaching and determining whether learning objectives have been met. While traditional assessment methods such as exams and assignments remain prevalent, there is a growing recognition of the need to incorporate digital tools and AI in assessment strategies. AI-driven assessment platforms can provide more personalized, adaptive evaluations that cater to the specific learning needs of students. The EU encourages the development of new assessment models that integrate digital technologies to improve the accuracy and efficiency of evaluations (Redecker & Punie, 2017).

11. Digital Learning

Digital learning encompasses the use of technology to facilitate, enhance, and personalize the learning experience. The EU's Digital Education Action Plan (European Commission, 2020) stresses the importance of leveraging digital platforms to create flexible learning environments that support a wide range of teaching and learning activities. Digital learning enables educators to provide students with interactive and engaging content, while also offering opportunities for remote learning and collaboration. In this context, AI technologies can be used to enhance the learning process by providing personalized learning pathways and real-time feedback.

12. Homework

Homework plays a crucial role in reinforcing learning, allowing students to practice skills and deepen their understanding of content outside the classroom. With the integration of digital tools, homework assignments can become more interactive and engaging, offering students access to online resources and platforms that support independent learning (Redecker & Punie, 2017). The EU advocates for the use of digital technologies in homework to make

learning more flexible and accessible, ensuring that students can work at their own pace and receive immediate feedback on their performance (European Commission, 2020).

The MATRIX

Educational sector	Roles	Research	Curriculum design	Supervision	Projects	Design the course	Develop the course	Prepare the classes	Face to face and online Delivery	Ongoing assessment	Assessment	Digital Learning	Homework
K-12	Teachers in primary, secondary schools.				X	X	X	X	X	X	X		
	Teachers working with students with special educational needs, such as learning disabilities.				X	X	X	X	X	X	X		
	Lerner in k-12 (child)				X				X	X	X	X	X
Higher education	Teacher-researchers working in universities and higher education establishments.	X	X	X	X	X	X	X	X	X	X		
	Lerner in higher education (student)	X		X	X				X	X	X	X	X
Corporate training and adult learning	Trainers who design and run training sessions in companies or training centers. Private academy.					X	X	X	X	X	X		
	Professional coaches, corporate training facilitators, skills development workshop and seminar facilitators		X	X	X	X		X	X	X	X		
	Lerner in corporate training (adult)			X	X				X	X	X	X	X
Cross-sector roles	Instructional designers responsible for creating educational content and training programs using innovative educational methods.	X	X			X	X	X					
	Digital learning professions : educational engineers, project managers		X		X	X		X	X	X	X		
	Digital learning technical professions: 2d and 3d graphic designers, integrators, it developers, videographers, tutors working in e-learning environments.						X	X					

Analyzing the Tasks per Educational Sector

AI in K-12 Educational Tasks and Activities

1. Projects

Project-based learning (PBL) is particularly well-suited for addressing complex, multifaceted tasks that require critical thinking, collaboration, and iterative problem-solving. AI tools are especially effective in supporting PBL environments. According to Yim and Su (2025), PBL is the most common pedagogical strategy in complex topics like AI in education, as it allows students to engage deeply with real-world challenges. For instance, learners might build machine learning models to analyze voting data (VoteStratesML) or develop classifiers for image recognition tasks. These activities not only deepen cognitive understanding but also cultivate ethical reasoning, teamwork, and creativity. Through such projects, students take on roles like AI developers, testers, and end-users, fostering engagement through authentic, interdisciplinary learning experiences.

2. Design the Course

AI, particularly Generative AI (GenAI), is increasingly used by teachers to assist in course design. Trendowski (2025) outlines the PROMPT model—a structured approach to generating lesson plans using GenAI platforms like ChatGPT. The model emphasizes defining clear objectives, student context, and measurable outcomes to ensure pedagogical relevance. For instance, a PE teacher might request a differentiated volleyball unit aligned with national standards, including warm-ups, drills, and assessments. Teachers are advised to iterate and refine AI-generated outputs using professional judgment and evidence-based practices.

3. Develop the Course

Developing instructional content is another area where GenAI offers substantial efficiency gains. Cheah et al. (2025) report that teachers use GenAI tools to create worksheets, slides, quiz banks, and multimodal learning resources. Teachers particularly value the ability to quickly produce differentiated materials for mixed-ability classrooms. However, the study also notes that integration into teaching practices is still limited, with most applications confined to preparation phases. Continued professional development is needed to help educators translate these efficiencies into improved student outcomes.

4. Prepare the Classes

AI supports lesson preparation by automating repetitive tasks and generating tailored instructional content. Teachers use AI to adapt reading materials, create discussion prompts, and align classroom activities with curriculum standards. Cheah et al. (2025) describe widespread teacher use of AI for preparing materials, including communication tools like parent newsletters or classroom behavior contracts. While this support boosts productivity,

challenges persist in ensuring the pedagogical appropriateness of AI-generated content and its seamless integration into teaching routines.

5. Face-to-Face and Online Delivery

AI enhances both in-person and online instruction by supporting real-time interaction, personalization, and differentiated pacing. Zhang et al. (2024) document how GenAI-based chatbots can act as co-facilitators and as tutors, answering student queries, providing elaborative feedback, and offering alternative explanations. These systems can simulate expert dialogues or create interactive learning experiences in blended or remote settings. However, the authors caution that successful integration requires careful alignment with teacher competencies and student needs to avoid over-reliance or misuse.

6. Ongoing Assessment

AI facilitates continuous, formative assessment by delivering immediate feedback and enabling teachers with real-time insights into students' progress and engagement. Intelligent agents and adaptive learning platforms offer automated tracking of performance and behavior, alerting teachers to potential learning difficulties. Yim and Su (2025) describe how tools such as Scratch, PopBots, and Google's Teachable Machine allow teachers to track learning pathways and adapt instruction accordingly. Importantly, Kim and Kwon (2024) note that while formative evaluation in AI-integrated learning is increasing, most current studies rely heavily on self-report surveys, indicating a need for more diverse and rigorous qualitative and mixed-method assessment strategies. They also emphasize the value of project-based evaluations and learner analytics for capturing ongoing cognitive development and engagement patterns in K–12 contexts. Therefore, caution is necessary because effective use of AI for supervision requires teacher oversight, pedagogical training, and attention to privacy and data ethics.

7. Assessment

AI plays a growing role in summative assessment, offering scalable and efficient approaches such as automated essay grading, adaptive testing, and conversational assessment via AI chatbots. Zhang et al. (2024) emphasize the potential of GenAI to personalize and enhance the validity of student assessments while reducing teacher workload. Complementing this, Kim and Kwon (2024) found that evaluation practices in K-12 AI education still predominantly target machine learning concepts and are often summative in nature, focusing on immediate post-intervention knowledge gains. They call for broader, longitudinal, and contextualized assessment models that reflect not only cognitive outcomes but also ethical reasoning and soft skill development, which are essential in AI education.

8. Digital Learning

AI is integral to modern digital learning ecosystems. Casal-Otero et al. (2023) argue that AI should be embedded within core disciplinary subjects, such as using machine learning in mathematics or ethical debates on AI in social studies, without needing to create standalone

AI courses. They advocate a modular, interdisciplinary, and competency-based model where AI literacy is co-designed with teachers to ensure alignment with pedagogical contexts and learners' developmental levels. Core competencies include understanding AI concepts, applications, and ethical implications. Successful integration depends on supporting teacher involvement and tailoring content to students' cognitive and technological readiness.

Platforms like Scratch, Python, and Machine Learning for Kids enable students to develop AI projects that enhance computational thinking and digital literacy. Yim and Su (2025) stress that digital learning with AI tools supports inclusivity by accommodating diverse learning styles through multimodal content and adaptive features. When aligned with developmental psychology principles, these platforms offer intuitive, exploratory environments that bridge abstract AI concepts with tangible learning experiences.

9. Homework

AI provides real-time support for homework, helping students complete assignments and deepen their understanding. Cheah et al. (2025) note that some teachers use GenAI to scaffold homework tasks, offering hints, generating examples, or rephrasing explanations without giving direct answers. This approach preserves academic integrity while promoting autonomy and self-directed learning. Nevertheless, concerns around over-reliance and unequal access underscore the need for careful instructional framing and support structures at home.

AI in Higher Education Tasks and Activities

1. Research

In higher education, generative AI has emerged as a valuable support tool in the research process, particularly during the early stages of literature review, rather than as a replacement for scholarly judgment. Pan et al. (2023) emphasize that while tools like ChatGPT, Bing AI, Elicit, and Scite can assist researchers in mapping existing literature, generating summaries, and identifying thematic clusters, they should be viewed as complements to traditional methods, not substitutes. These AI systems can enhance awareness and efficiency in scoping the research landscape, but their limitations, such as hallucinations and a lack of transparency, require that human researchers remain central in critically evaluating and contextualizing outputs. Generative AI, then, plays a supportive role in helping researchers engage with complexity, refine ideas, and improve the clarity of academic writing, while the intellectual responsibility for synthesis and theoretical contribution remains firmly with the researcher (Pan et al., 2023).

Furthermore, AI technologies play an important role in supporting empirical research. They enable systematic investigation through automated data analysis, behavior tracking, and performance prediction. For instance, Yim and Su (2025) highlight that intelligent tools such as Google's Teachable Machine and LearningML support empirical data collection for understanding students' interactions, learning behaviors, and conceptual mastery. Researchers have also employed AI to explore pedagogical impacts through outcome-based studies,

documenting gains in students' cognitive, affective, and behavioral dimensions (Yim & Su, 2025). These AI-supported evaluations are crucial in designing interventions that are sensitive to students' needs and responsive to emerging educational paradigms.

In recognition of these emerging practices and related ethical concerns, the European Commission has recently issued guidelines on the responsible use of generative AI in research, underscoring the growing relevance of this topic for academic integrity and innovation in higher education (European Commission, 2025).

2. Curriculum Design

AI integration in curriculum design within higher education is grounded in its ability to suggest, structure, and scaffold learning content, not to autonomously create entire programs. Empirical research shows that AI can support faculty in developing personalized and adaptive learning pathways, especially in rapidly evolving disciplines like business, IT, and engineering (Abbasi, Wu, & Luo, 2025). These technologies assist educators in identifying student needs, improving instructional content, and fostering critical thinking. Rather than replacing human-led curricular planning, AI functions as a collaborative tool that enhances flexibility, supports real-time feedback, and promotes learner engagement. This shift reflects a broader move from static, expert-defined curricula to more dynamic, learner-informed design processes. Furthermore, Hönigsberg et al. (2025) emphasize the importance of embedding AI literacy into the curriculum itself, helping students understand both disciplinary knowledge and how to responsibly engage with AI tools. This dual literacy supports adaptive, future-ready course structures where students learn *with* and *about* AI.

3. Supervision

The supervision of students engaged in thesis projects, particularly at the Master's and early doctoral stages, plays a crucial role in shaping future academic pathways. Dai et al. (2023) document how postgraduate students are integrating generative AI, such as ChatGPT, into their daily research practices. These tools are used to scaffold early-stage academic tasks like summarizing literature, debugging code, or generating feedback, thereby allowing students to prepare more effectively for supervisory meetings. The AI support enables supervisors to shift their focus toward higher-order mentoring, such as conceptual framing, methodological design, and theoretical refinement. As a result, students benefit from faster progress and deeper engagement with their research. Importantly, the study emphasizes that AI tools should act as epistemic partners, not as replacements, within a blended supervisory model. The findings also suggest that these developments enhance, rather than diminish, the social and intellectual depth of supervision, particularly when supervisors can use their freed-up time to offer more personalized and meaningful feedback.

4. Projects

Project-based learning in higher education benefits from GenAI's capacity to support creativity, structure, and iteration. Students increasingly use tools like ChatGPT to generate initial ideas, prototype responses, or conduct simulated analyses in disciplines ranging from

information systems to media studies. Van Slyke et al. (2023) observe that students in higher education use ChatGPT as a tutor, study partner, and even ghostwriter. The tool is reportedly applied to tasks such as troubleshooting code and generating written content, reflecting its emerging role in supporting academic work. Sundberg and Holmström (2024) advocate for the use of code-free AI platforms to democratize machine learning education across domains, thereby supporting AI-driven project work. Integrating AI tools into project-based learning allows students to experiment with human-AI collaboration, reflecting broader shifts in knowledge and creative work. As Benbya et al. (2024) note, generative AI is transforming how individuals interact with technology in co-creative roles, raising important questions about agency, ethics, and the division of labor in collaborative tasks. However, Van Slyke et al. stress that the educational value of projects depends on intentional design that guides students to reflect on the AI's contribution, identify biases, and revise AI-generated content. This critical integration ensures that students engage not only in using AI, but also in questioning and evaluating its output—an essential skill in today's professional environments.

5. Design the Course

Course design processes in higher education are increasingly supported by GenAI through tools that suggest instructional objectives, map assessments to learning goals, and organize module progression. Hönigsberg et al. (2025) highlight how AI tools can serve as “co-designers” during early planning phases. Educators can prompt GenAI to offer frameworks for lesson sequencing or suggestions for blended learning activities, which are then refined through professional judgment. Importantly, these AI outputs should be viewed as drafts, not definitive designs. Educators maintain responsibility for aligning AI-generated materials with accreditation standards, institutional goals, and the specific needs of their student cohorts.

Moreover, Chang et al. (2023) emphasize that AI chatbots, such as ChatGPT, can function as pedagogical agents that scaffold learning through goal setting, feedback, and personalization. These tools can assist educators and learners in structuring content sequences and aligning them with targeted learning outcomes, particularly when embedded within self-regulated learning frameworks. Sundberg and Holmström (2024) also support this notion, demonstrating that intuitive and accessible AI tools can contribute to inclusive design by catering to diverse technical backgrounds. While not intended to replace instructional planning, AI can serve as a “learning facilitator” by helping define academic goals, reflect on progress, and receive adaptive guidance throughout the learning process.

Hence, GenAI's greatest strength in course design is its ability to rapidly iterate, allowing instructors to test and improve curricular logic efficiently.

6. Develop the Course

AI supports the development of course content by enabling instructors to create diverse educational resources, such as formative quizzes, explainer videos, interactive activities, and

reading guides, more efficiently. Zhang et al. (2024) emphasize that GenAI's ability to generate structured, readable, and modular content has been particularly useful in large-enrollment courses and online education, where scaling quality is a constant challenge. GenAI can be used to create multiple versions of the same content to serve students with different language proficiencies or learning preferences. Dwivedi et al. (2023) point to an increasing expectation among students for educational technologies that can tailor learning materials to their unique goals, learning styles, and personal progress. However, there are concerns around content verification and ensuring that generated materials maintain academic rigor, especially when dealing with complex or evolving subject matter. Faculty are encouraged to use GenAI as a starting point and refine outputs through critical editing and peer feedback.

7. Prepare the Classes

Preparing for individual class sessions can be time-intensive, especially when instructors aim to personalize instruction. Baig and Yadegaridehkordi (2024) note that educators are using GenAI to draft class outlines, generate examples tailored to local contexts, and write case study prompts. These applications are seen as valuable time-savers that free instructors to focus on student engagement during delivery. Schlimbach et al. (2024) further underline that AI tools can be used to suggest relevant teaching strategies based on evolving learner needs, supporting better alignment of class activities with student readiness. However, instructors must carefully vet AI-generated content for factual accuracy, disciplinary appropriateness, and cultural sensitivity. Faculty also benefit from using GenAI for “ideation prompts,” where the tool generates multiple ways of explaining a concept, helping the instructor choose the most pedagogically effective path.

8. Face-to-Face and Online Delivery

GenAI can support live and asynchronous delivery by enhancing interactivity and responsiveness in the learning environment. Hönigsberg et al. (2025) describe how AI tools can take on flexible roles during instruction, acting as knowledge consultants, discussion facilitators, or clarification agents depending on learner input. These systems have proven especially helpful in large lectures and online forums, where individualized attention is harder to scale. Strzelecki and ElArabawy (2024) reinforce this by arguing that flexible AI roles are necessary for serving diverse student populations and learning contexts. Instructors can also use AI to provide pre-scripted responses, generate summaries of previous discussions, or facilitate student brainstorming. Despite these benefits, Hönigsberg et al. (2025) stress the importance of maintaining a clear instructor presence, as students value human responsiveness, especially when discussing complex, controversial, or values-driven topics.

9. Ongoing Assessment

Formative assessment is one of the strongest use cases for AI in higher education. Bond et al. (2024) report that adaptive learning environments powered by AI can generate personalized

feedback in real time, helping students identify misconceptions and practice targeted improvements. These systems also allow educators to gather continuous performance data, which informs decisions on pacing, intervention, and support. However, Bond et al. urge caution around data ethics, algorithmic bias, and the need for transparent systems that explain how assessments are generated. Effective use of AI in formative assessment involves careful calibration and teacher oversight, ensuring that students receive fair and actionable feedback.

10. Assessment (like an exam)

The role of AI in summative assessment is under significant debate. Farrelly and Baker (2023) discuss growing concerns about using AI-detection tools and auto-grading systems in high-stakes evaluations. They highlight that false positives from AI detectors can disproportionately affect international and multilingual students, and caution against relying on opaque algorithms for academic judgments. Institutions are encouraged to develop clear policies that balance innovation with academic integrity, ensuring students are not unfairly penalized or misjudged due to flawed detection models or unverified AI outputs.

11. Digital Learning

AI significantly expands the potential for flexible, personalized digital learning experiences. Hönigsberg et al. (2025) explain that students use GenAI tools to fill knowledge gaps, simulate problem-solving approaches, and engage in scaffolded practice across multiple domains. This helps learners progress at their own pace, particularly in self-directed or asynchronous environments. GenAI also supports learners who face barriers related to language, accessibility, or prior educational experience by generating adaptive explanations, summaries, or alternative representations of concepts. However, the authors remind educators to teach students how to critically evaluate AI responses to foster autonomy and deepen conceptual understanding.

12. Homework

Baig and Yadegaridehkordi (2024) document that students in higher education are actively using ChatGPT for a wide range of academic purposes, including content creation, study assistance, and collaborative tasks. Specifically, they highlight its use in supporting communication, offering feedback, enhancing writing, and generating academic materials. These uses demonstrate that students perceive GenAI not only as an information retrieval tool but also as a multifunctional academic companion. While the authors do not detail specific behaviors such as outlining or clarifying assignment instructions, the reported applications imply that students are engaging with AI tools in ways that assist with both the ideational and executional stages of learning tasks. This supports a broader view of GenAI as an accessible academic aid that scaffolds student learning through on-demand, conversational interactions, which are particularly beneficial in self-directed or asynchronous learning environments. (Baig & Yadegaridehkordi, 2024).

AI in Corporate Training and Adult Learning Tasks and Activities

1. Projects

Generative AI tools are increasingly integrated into workplace learning environments, where they enhance collaborative and project-based activities by supporting ideation, content generation, and asynchronous coordination. Callari and Puppione (2025) show how tools like Microsoft 365 Copilot facilitate co-creation of documents, presentations, and data outputs, helping employees iterate and learn in real-time. These AI-enhanced workflows contribute to dynamic team interactions, foster informal learning, and promote experiential engagement with complex, real-world tasks—key aspects of effective learning in corporate settings. Similarly, Windelband (2023) emphasizes that intelligent assistance systems embedded in work processes support situated learning by guiding employees through complex tasks and adapting to their evolving competence levels. This illustrates how generative AI is naturally aligning with project-based approaches, where learning emerges through doing, collaboration, and iterative problem-solving.

2. Design the Course

In VET, AI can support course design by generating modular learning units aligned with job profiles and certification requirements. Trainers can use AI to propose content structures, learning goals, and instructional formats that fit sector-specific needs, such as courses on negotiation strategies or safety protocols. With access to learner performance data and real-time workplace demands, AI helps design relevant, adaptive programs. This enables training that aligns with both learner profiles and evolving industry standards across technical and soft skill domains.

3. Develop the Course

AI technologies support the development of corporate training materials by enabling the creation of modular, adaptive, and context-rich content. Intelligent assistance systems, as described by Windelband (2023), are particularly effective in translating complex workplace tasks into structured learning experiences. These systems can generate task-specific guidance, simulate technical processes, and adapt instructional content based on learners' evolving skill levels. Trainers can use such AI capabilities to design scenario-based learning modules that reflect authentic challenges encountered on the job. For example, generative tools like Microsoft Copilot—originally used by employees to draft reports or co-develop presentations (Callari and Puppione, 2025), can be repurposed by trainers to create realistic training cases or interactive exercises that closely mirror day-to-day workflows. This allows for highly relevant, just-in-time learning that enhances both engagement and applicability.

4. Prepare the Classes

For face-to-face VET training, especially in management or soft skills—AI tools assist instructors in planning sessions tailored to diverse learners. AI can automate content

summaries, suggest examples or scenarios based on learner levels, and adapt class materials from previous sessions. Trainers can use AI to prepare variations of exercises for different group sizes or contexts. This streamlines prep time and ensures instructional materials remain context-aware and engaging. It also supports trainers in delivering sessions that are flexible and highly targeted.

5. Face-to-Face and Online Delivery

AI enhances VET delivery across in-person, blended, and online formats by enabling personalization and real-time learner support. Trainers can use AI tools during sessions to provide feedback, adapt activities on the fly, or answer learner questions via chatbots. In online settings, AI supports self-paced learning while tracking engagement. In face-to-face sessions, it helps instructors adjust delivery by flagging comprehension gaps. These tools enrich engagement, maintain instructional flow, and make learning more interactive, accessible, and outcome-oriented for vocational learners.

6. Ongoing Assessment

In vocational settings, AI supports continuous assessment through tools that monitor progress, give formative feedback, and track skill acquisition over time. Trainers can use AI to assess hands-on performance, presentations, or peer collaboration in real-time. AI-driven analytics also help detect learning gaps and recommend next steps. For example, a trainer in a technical course can use AI to flag repetitive errors in simulations and offer corrective tasks. This enables more responsive, individualized instruction and reduces the time spent on manual evaluations.

7. Assessment

High-stakes final assessments are a cornerstone of VET programs, especially for certifications like ITIL, PRINCE2, or SCRUM. Despite this, AI remains underused in formal summative evaluations. There is significant potential for AI to assist in exam creation, adaptive testing, or automated grading of standardized tasks. However, the field is currently underdeveloped and lacks regulatory clarity. To preserve integrity, final assessments must balance automation with human oversight. This remains a critical gap in the responsible use of AI in vocational certification contexts.

8. Digital Learning

AI significantly enhances digital learning in corporate and vocational contexts by enabling adaptive, context-sensitive, and workplace-integrated instruction. Windelband (2023) highlights how AI-driven assistance systems and intelligent learning environments can provide real-time feedback, personalize learning paths, and support learners in authentic, task-based scenarios. These systems are often embedded directly into digital tools or technical equipment, allowing employees to learn while working, solve complex problems, and reflect on their performance. Furthermore, the integration of technologies such as virtual and augmented reality, combined with AI, creates immersive learning experiences that

support both skill acquisition and situational awareness. This shift toward intelligent, embedded learning environments promotes greater autonomy, just-in-time learning, and the continuous development of practical competencies in line with evolving workplace demands.

Risk Classification

Risk Classification Framework for AI Integration in Education and Training

To responsibly adopt AI across educational environments, it is essential to classify and evaluate the risks associated with its use. These risks span ethical, pedagogical, technical, and social dimensions, and vary in their severity and likelihood across different educational sectors—K-12, higher education, and corporate/adult learning.

The risk levels presented below are adapted from the European Union’s Artificial Intelligence Act (2024), which establishes a four-tiered classification based on potential harm to safety, fundamental rights, and well-being. While the EU AI Act applies across all sectors, this framework contextualizes the categories specifically for education, where unique considerations—such as the vulnerability of learners, developmental appropriateness, the centrality of teacher-student relationships, and the critical role of fairness and academic integrity—necessitate a more pedagogically grounded interpretation. These education-specific impact levels range from I0 (low/negligible risk) to I4 (major and unacceptable risk) and are designed to guide policy, institutional safeguards, and responsible AI implementation.

Impact Levels

I0 – Low or Negligible Risk

Definition: Risks that are either highly improbable or carry minimal consequences if realized. They do not compromise learning quality, data protection, or stakeholder well-being.

Justification:

- Examples include the use of AI to generate preliminary lesson ideas or content drafts that are always reviewed and modified by educators.
- These applications operate under direct human oversight and pose minimal ethical or operational challenges.
- Corresponds to the EU AI Act’s “Minimal or No Risk” category.

I2 – Moderate Risk

Definition: Risks that may have a noticeable impact on learning outcomes, equity, or data integrity, but are generally manageable through institutional safeguards or educator intervention.

Justification:

- These include risks of bias in AI-assisted formative assessments or limited explainability of adaptive feedback systems.
- While these tools enhance learning efficiency, misalignment with pedagogy or learner profiles may result in diminished outcomes if not addressed.
- Reflects the EU AI Act’s “Limited Risk” category, with educational emphasis on teacher mediation and transparency.

I3 – High Risk

Definition: Risks that pose substantial challenges to educational integrity, learner privacy, equity, or academic standards. They often require active mitigation, policy enforcement, and technical controls.

Justification:

- Examples include over-reliance on AI for supervision or the use of opaque algorithms for grading.
- These risks can directly affect fairness, data rights, and the learner-teacher relationship, especially in high-stakes contexts or vulnerable populations.
- Aligns with the EU AI Act’s “High Risk” designation, acknowledging the critical role of education in personal and professional development.

I4 – Major and Unacceptable Risk

Definition: Risks that fundamentally threaten the ethical, legal, or pedagogical foundations of education. These must be avoided or discontinued unless comprehensive, multi-layered controls are in place.

Justification:

- This level applies to uses of AI that enable surveillance without consent, promote discriminatory outcomes, or outsource critical instructional decisions (e.g., auto-grading high-stakes exams without human verification).
- Such practices can lead to loss of trust, regulatory violations, and systemic inequities that are unacceptable in educational institutions.
- Directly reflects the EU AI Act’s “Unacceptable Risk” category, contextualized for educational ethics and child/student protection norms.

Risk Mapping of AI Use in Core Educational Tasks and Activities

The following section offers a cross-sectoral aggregation of identified AI-related risks in education, organized according to 12 core pedagogical tasks. Each risk is assigned an impact level (I0–I4) based on severity and mapped using insights from four national reports produced as part of the AIRED project (AIRED France, Spain, Ireland, and Haikara). These insights are intended to guide European educational stakeholders in prioritizing safeguards and interventions.

1. Research

Risk Level: I2 – Moderate Risk

Abstracted Risk: Use of generative AI to aid educational research raises concerns around source integrity, factual accuracy, and inadvertent plagiarism. The opaque nature of AI outputs may lead to reliance on unverifiable or biased content.

Example: Generative AI was used by Master’s students for ideation in business research, which improved efficiency but introduced a risk of uncritical acceptance of AI-generated claims (Hönigsberg & Mallek, 2025).

2. Curriculum Design

Risk Level: I3 – High Risk

Abstracted Risk: Outsourcing curriculum design to AI may lead to standardized, culturally narrow or decontextualized outcomes. Without expert oversight, AI-generated frameworks may ignore learner diversity, pedagogical coherence, or social inclusion goals.

Example: One report notes that AI-generated training outlines often lacked field sensitivity and context-specific nuance, especially in regulatory or legal subjects (Beleme, 2025).

3. Supervision

Risk Level: I4 – Moderate Risk to Major and Unacceptable Risk

Abstracted Risk: AI tools used to monitor learner behavior, emotional state, or engagement via facial recognition or biometric data pose serious ethical and privacy risks, particularly in K–12 settings.

Example: Concerns were raised about the use of facial analysis tools to monitor student engagement, potentially misinterpreting culturally normative behavior as disinterest (Alonso & Arrieta, 2025).

On the other hand, AI can also support human supervisors in their tasks—for example, by helping generate more detailed feedback or by promoting consistency in evaluations across diverse supervisors through the use of standardized AI-generated assessments (Hönigsberg & Mallek, 2025).

4. Projects

Risk Level: I2 – Moderate Risk

Abstracted Risk: AI co-creation tools in collaborative projects can enhance ideation but also lead to over-reliance, reducing student agency and masking individual contributions.

Example: At ICN Business School, students used ChatGPT to generate business ideas, improving productivity but occasionally submitting unverified or superficial content (Hönigsberg & Mallek, 2025).

5. Design the Course

Risk Level: I2 – Moderate Risk

Abstracted Risk: Using AI in course design accelerates workflow but risks homogenization of pedagogical approaches and reliance on templated content unless guided by human expertise.

Example: Corporate trainers found that AI-assisted course design often resulted in “impoverished training plans” lacking critical reflection or innovation (Beleme, 2025).

6. Develop the Course

Risk Level: I2 – Moderate Risk to High Risk

Abstracted Risk: Fully delegating course development (including content writing, quiz generation, and visuals) to AI often results in factual errors, generic phrasing, and reduced educational quality.

Example: French educators reported that generative content lacked academic rigor, disqualifying materials in learners’ eyes due to poor quality and repetitiveness (Beleme, 2025).

7. Prepare the Classes

Risk Level: I1 – Low Risk

Abstracted Risk: AI can effectively support teachers in organizing classes and preparing materials if used as a supplementary tool. Risks are minimal when outputs are critically reviewed.

Example: In Ireland, primary teachers used GenAI to assist in lesson planning, finding it helpful for routine tasks but raising concerns about subtle content bias (Szproch, O’Brien, & Kummer, 2025).

8. Face-to-Face and Online Delivery

Risk Level: I2 – Moderate Risk

Abstracted Risk: AI in live delivery contexts (e.g., automated chatbots, teaching companions) can increase accessibility but may disrupt human interaction, cause emotional disconnection, or be misinterpreted as sentient.

Example: French pre-primary trials of humanoid robots (NAO) demonstrated benefits but also highlighted children's emotional attachment to AI and occasional distress (Hönigsberg & Mallek, 2025).

9. Ongoing Assessment

Risk Level: I3 – High Risk

Abstracted Risk: Continuous monitoring of learner performance using AI-powered analytics can introduce bias, especially when behavior is misread, and may promote data-driven teaching over human judgment.

Example: In Spain, adaptive tools adjusting difficulty levels based on prior answers risked overwhelming or under-challenging learners with non-standard learning trajectories (Alonso & Arrieta, 2025).

10. Assessment

Risk Level: I3 – High Risk

Abstracted Risk: Automating summative assessments using AI can lack transparency and fairness, especially when AI decisions are unreviewed or insufficiently explained.

Example: In France, misuse of AI in high-stakes evaluations raised concern over fairness and trust, leading universities like Sciences Po to prohibit AI use in formal assessments (Hönigsberg & Mallek, 2025).

11. Digital Learning

Risk Level: I2 – Moderate Risk

Abstracted Risk: AI-enhanced platforms support scalable learning but introduce access inequities, digital dependency, and potential vendor lock-in that threaten autonomy and pedagogical flexibility.

Example: The Irish report highlighted that limited AI resources in Irish-speaking schools may exacerbate linguistic inequality in digital environments (Szproch, O'Brien, & Kummer, 2025).

12. Homeworks

Risk Level: I3 – Moderate Risk to High Risk

Abstracted Risk: Use of GenAI to complete homework undermines academic integrity and reduces opportunities for skill development, particularly in formative education stages.

Example: Spanish university research linked frequent ChatGPT use with increased plagiarism, especially among students with low intrinsic motivation (Alonso & Arrieta, 2025).

Regulating AI in Education: European Legal Frameworks

Across the European Union, AI is framed simultaneously as a driver of educational innovation and a source of significant risk. Recent policy stresses two imperatives: (i) safeguarding fundamental rights when AI is deployed in learning environments and (ii) ensuring that European learners, teachers and researchers acquire AI literacy. These dual aims underpin the EU's layered regulatory architecture, which now couples a binding risk-based statute (the AI Act) with a suite of soft-law instruments and strategic programs that steer Member States toward trustworthy, inclusive and innovation-friendly AI adoption in education.

1. Key Legal and Policy Instruments

EU AI Act (Regulation (EU) 2024/1689)

The EU's AI Act – published June 2024, entering into force Aug 1, 2024, classifies AI systems used in education (for admissions, student evaluation, etc.) as “*high-risk*” applications (European Parliament & Council, 2024). Once its provisions apply (mostly by Aug 2026), providers and users of educational AI will face strict obligations: data governance, transparency to users, human oversight, accuracy and safety requirements. The Act outright bans certain practices (e.g. social scoring, or real-time biometric ID in public spaces) starting Feb 2025 (Chambers & Partners, 2025), which effectively prohibits invasive AI student surveillance (like live facial recognition in schools). It also mandates AI literacy initiatives – requiring organizations to ensure employees (including educators) have adequate AI knowledge. EU Member States must designate national AI supervisory authorities to enforce these rules. Several European countries are now aligning national laws with the EU AI Act or introducing complementary measures ahead of 2026.

Council of Europe Convention on AI (2024)

In May 2024, the Council of Europe adopted the world's first AI treaty (opened for signature in 2024) aimed at ensuring AI systems respect human rights, democracy and the rule of law (Vie publique, 2025). Once ratified, this convention will require European states to implement legal safeguards (transparency, oversight, non-discrimination, etc.) for AI – including in education – consistent with its principles (Inclusive Digital Education, 2022). Though not yet in force, it signals a supranational baseline that complements EU law.

Table 1 summarizes binding European regulations and legislative drafts that govern the use of artificial intelligence in educational contexts.

Table 1 AI-Specific Regulations Relevant to Education in Europe

Country / Level	Instrument	Status	Education-Relevant Elements
EU (supranational) (European Parliament, 2024)	Regulation (EU) 2024/1689 “AI Act”	In force (1 Aug 2024) → high-risk rules apply 2 Aug 2026	- AI systems for admissions, grading, proctoring etc. classified <i>high-risk</i> → CE-conformity, data-quality, transparency, human oversight. - Bans “emotion-recognition” or social-scoring of pupils (Feb 2025). - Art. 4 obliges institutions to provide AI-literacy training for staff.
Council of Europe (pan-European treaty) (Cooper & Choi, 2024)	Framework Convention on AI, Human Rights, Democracy & Rule of Law	Open for signature (5 Sept 2024)	Requires signatories to assess and mitigate AI risks in all public-sector uses, including schools, and to guarantee remedies for individuals affected by AI decisions.
Spain (White & Case, 2025)	Royal Decree 729/2023 – Statute of the Spanish Agency for AI Supervision (AESIA)	In force (Aug 2023)	Creates Europe’s first AI supervisory authority; mandate covers EdTech audits, promotes training on <i>trustworthy AI</i> , and will enforce EU AI Act in schools and universities.
	<i>Draft</i> “Bill on the Good Use and Governance of AI” (approved 11 Mar 2025)	Parliamentary draft	Supplements EU AI Act; proposes fines for unlabeled AI content, child-protection rules (e.g., deepfake labelling), and domestic sanction regime.
Italy	<i>Draft</i> National AI Act – Disegno di legge n. 1146/2024 (Council of Ministers, 23 Apr 2024)	Senate committee stage	Would set up national AI authority, align with EU Act, and mandate AI-literacy in school curricula & teacher training.
Germany	<i>Draft</i> KI-Marktüberwachungsgesetz (KIMÜG) – AI Market-Surveillance Act (4 Dec 2024)	Draft	Implements EU AI Act; designates Bundesnetzagentur as AI market-surveillance body for all high-risk sectors, incl. education technology.
Ireland	<i>Draft</i> Regulation of Artificial Intelligence Bill (announced 18 Feb 2025)	Draft	Will transpose EU AI Act; Government indicates obligations on schools for staff

			AI-literacy and risk assessments of high-risk EdTech.
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Figure 1 illustrates the distribution of national AI-specific regulations relevant to education across Europe. Countries are color-coded by legal status: from binding national laws and agency statutes to draft bills aligned with the EU AI Act, as well as jurisdictions with no AI-specific education law to date.

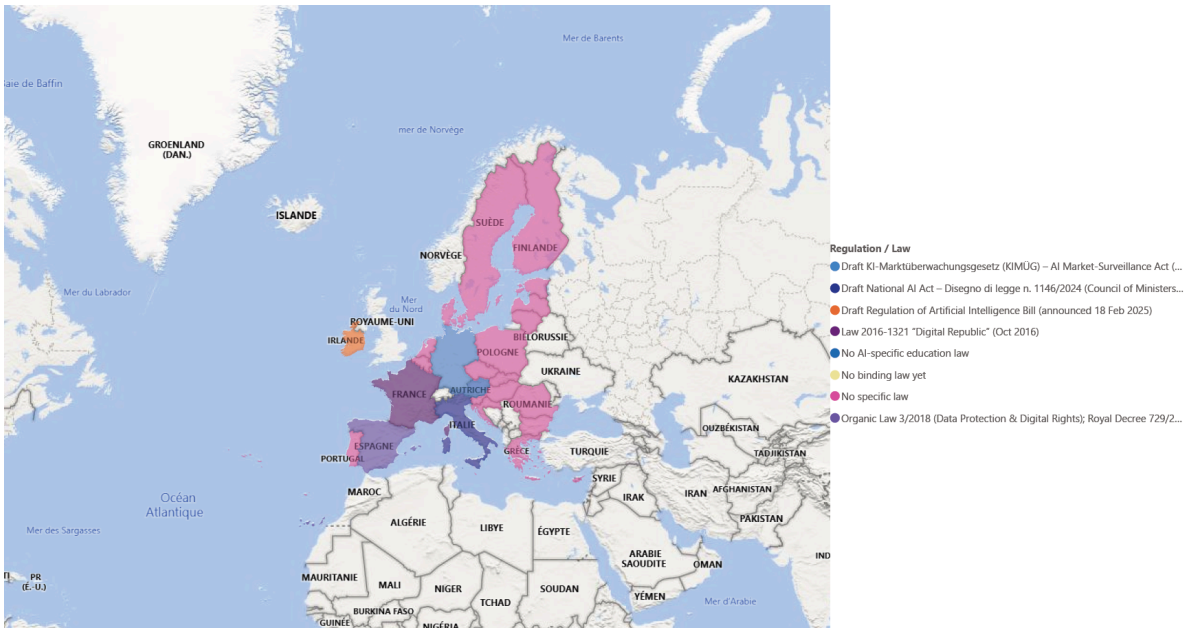


Figure 1 National AI-specific regulations relevant to education across Europe

2. Analysis: Trends, Gaps, and Divergence from EU Framework

Widespread Reliance on General Laws

As Figure 1 illustrates, most European countries currently have no education-specific AI laws in force. Instead, they rely on general binding frameworks – chiefly data protection laws (GDPR implementations) and existing education or anti-discrimination statutes – to indirectly regulate AI in schools (Livingstone & Shekhawat, 2024). For example, GDPR-based rules in all EU countries require transparency and a legal basis for processing student data, effectively constraining AI tools that handle personal data. Many states also enforce human-rights and equality laws that would forbid AI systems from discriminatory or harmful impacts on students. However, these general laws do not always explicitly mention “AI”, leaving potential gaps in clarity and enforcement specific to AI’s novel risks (e.g. algorithmic bias in grading, or opacity in AI tutoring systems). Until the EU AI Act fully applies, there is a regulatory vacuum in many countries regarding AI in education, filled only by soft guidelines or case-by-case interpretations of existing law.

Early Adopters and Specific Measures

A few countries stand out for having binding provisions tailored to AI/algorithms in education.

- France has embedded AI oversight into law: since 2016, any public algorithm affecting individuals (like school or university placement algorithms) must be transparent and explainable (Merigoux et al., 2024). In 2018, France outlawed purely automated university admissions, mandating human decision-making (Ministère de l'enseignement supérieur et de la recherche, 2022). These rules closely mirror the EU AI Act's emphasis on transparency and human oversight for high-risk systems, effectively pioneering those principles nationally.
- Spain similarly legislated digital rights and is raising protections for minors: Article 83 of its 2018 law obliges the education system to instill safe and critical digital tool (White & Case, 2025). Spain also set up AESIA, the first dedicated AI regulator in Europe, signaling strong oversight (the agency will supervise AI in all domains, including EdTech) (White & Case, 2025). Spain's forthcoming law to protect minors online (pending in 2025) goes beyond EU requirements by increasing the age of consent to 16 and targeting AI risks like emotional manipulation (Osborne Clarke, 2025). This indicates a willingness to go above the EU baseline for child safety.
- Italy has legally mandated AI/digital literacy (through its civic education law) and is on the verge of a comprehensive AI Act that includes education/training mandates (FiscalNote, 2024). Though Italy's AI bill is not yet law, its content (e.g. integrating AI curriculum in schools) shows an intent to directly address education – an area the EU AI Act leaves to Member State discretion.
- United Kingdom, though outside the EU, enforces a Children's Code that compels educational digital services to consider children's best interests and data protection design (Atabey, 2025). This effectively regulates many AI-driven education platforms (requiring privacy, transparency, and limitations on profiling minors). The UK's exam authority also functionally bans fully automated grading (Atabey, 2025), aligning with EU-style risk mitigation despite no overarching AI law.

These early measures in France, Spain, Italy, and the UK highlight a trend: where specific risks have materialized (e.g. opaque admission algorithms, ChatGPT's popularity, online proctoring), some national authorities responded with targeted laws or rules to fill the gap.

Common Themes: Transparency, Oversight, Data Privacy

Across the board, the provisions that do exist coalesce around a few key themes, which are also pillars of the EU AI Act:

- **Transparency:** Many countries require that students and parents be informed when AI or algorithms influence decisions. France's laws demand intelligible explanations of any automated decision in education (Merigoux et al., 2024). In Spain and others, data protection law is interpreted to mandate informing data subjects (students) about algorithmic processing of their data. This aligns with the EU AI Act's transparency

obligations for high-risk AI (users must be notified and understand how the system affects them).

- **Human Oversight & Accountability:** Where addressed, laws insist on keeping a human in the loop for critical educational decisions. France's higher-ed admissions reform explicitly re-inserted human examiners to avoid unchecked AI selection (Ministère de l'enseignement supérieur et de la recherche, 2022); the UK's Ofqual similarly insists exam grading cannot be left to AI alone [blogs.lse.ac.uk](https://www.blogslse.ac.uk). Even without explicit laws, GDPR's Article 22 gives individuals the right not to be solely subjected to automated decisions – effectively requiring human review in education contexts like grading or disciplinary actions. This principle will become binding EU-wide under the AI Act (which mandates human oversight for high-risk education AI). National practices are converging on this norm ahead of time.
- **Student Data Protection:** Every EU country, via GDPR implementation, has binding rules on processing children's data. Differences exist (e.g. the age of digital consent varies: 13 in some, up to 16 in others), but all require robust consent or other legal bases for using student data in AI systems. Several nations (Spain's draft law, the UK code) are raising the bar for parental consent and age verification for AI tools used by minors (Osborne Clarke, 2025). Moreover, the emphasis on privacy is tied to broader rights – as noted by the UN and experts, children's right to education is intertwined with their right to privacy in the digital realm (Atabey, 2025). Thus, national regulators (like the Dutch AP (Autoriteit Persoonsgegevens, 2024) stress that invasive AI monitoring in schools can undermine learning and must be curbed. This focus on privacy and data security is fully consistent with the EU AI Act (which references GDPR and requires data governance for AI) and with the Council of Europe's forthcoming AI Convention.
- **Safety & Non-Discrimination** – While few countries have explicit AI safety standards for education yet, general product safety laws and equality laws fill some void. For instance, an AI tutoring tool causing harm could trigger consumer protection rules; an algorithm that unfairly flags minority students could violate anti-discrimination law. Spain's AESIA is tasked with ensuring AI is used ethically and safely, protecting privacy and equality [vidanuevadigital.com](https://www.vidanuevadigital.com). Many countries are waiting for the EU Act's risk-classification to kick in, but there is already consensus that AI in education must not compromise student welfare or perpetuate bias (UNESCO, 2021). The EU AI Act's detailed requirements on accuracy, robustness, and nondiscrimination for high-risk AI will soon give these principles binding force across all Member States.

Gaps and Divergences

Despite these common themes, gaps remain in the current patchwork:

- **Legislative Lag:** Most countries have no binding rules tailored to AI in education yet, which means current protections can be piecemeal. For example, GDPR covers data

privacy but not algorithmic transparency per se (unless it's personal data driven decision-making). Issues like AI-driven curriculum design, or use of AI analytics on educational big data, are largely unregulated until the EU Act applies. National strategies and guidelines (from ministries or DPAs) exist but are not enforceable. This lag could lead to inconsistent handling of AI in the interim (some schools forging ahead with AI tools, others banning them due to uncertainty).

- **Varied Ages of Consent:** Differences in the digital age of consent (e.g. 13 in UK, 14 in Italy, 15 in France, 16 in Germany/soon Spain) mean AI education platforms face uneven obligations – a child-friendly AI app might be legal for a 15-year-old to self-consent to in Italy but not in Spain. These disparities can complicate deployment of AI educational services across Europe. The EU AI Act does not harmonize this aspect (it defers to GDPR), so this divergence will persist unless national laws converge or an EU ePrivacy law addresses it. Spain's move to set 16 as the rule (Osborne Clarke, 2025) may signal a trend towards the maximum protection level.
- **Regulatory Infrastructure:** A few countries (Spain, France to some extent, soon Italy) are establishing dedicated AI regulators or advisory councils. Others plan to vest responsibility in existing bodies (e.g. data protection authorities or consumer agencies). This could lead to varied enforcement focus. For instance, Spain's AESIA is a specialized agency that can deeply inspect AI systems (White & Case, 2025), whereas in a country without such an agency, oversight may fall to a general body with less AI expertise. The EU AI Act requires each Member State to designate a market surveillance authority for AI – how uniformly effective these will be, especially regarding education (which often is managed at regional/local levels), remains to be seen. National commitment varies: Spain already gave AESIA sanctioning powers (White & Case, 2025), while others have not yet identified an AI watchdog.
- **Above and Beyond EU Act:** Some national initiatives may go further than the EU AI Act in certain respects. The EU Act focuses on regulating AI system providers and deployers, but less on embedding AI education into curricula – something Italy's bill addresses by promoting AI literacy in schools (FiscalNote, 2024). Similarly, Spain's child protection law addresses content like lootboxes and deepfakes targeting minors (Osborne Clarke, 2025), which is adjacent to AI regulation (the EU Act doesn't specifically cover deepfake crimes or gambling-like mechanisms – those are tackled in other EU laws or left to national criminal law). These national laws will complement the EU Act by covering ethical and societal dimensions (e.g. requiring education about AI, not just regulation of AI). Conversely, the UK's Age Code is a unique instrument outside EU law that others might emulate to ensure AI design meets children's rights – the EU has no direct equivalent (though the Digital Services Act and forthcoming EU Child Sexual Abuse Regulation address some online harms, and the AI Act will require extra scrutiny for AI affecting children). This shows a divergence where the UK prioritizes a child-rights design approach, whereas the EU

Act takes a product compliance approach. Over time, we might see EU guidance bridging this, or Member States adopting codes of conduct for AI in education as encouraged by the (Alter Consultores Legales, 2025).

While binding national regulations explicitly addressing AI in education are still the exception, the panorama is rapidly evolving. Europe's countries are converging on key safeguards, transparency, human oversight, safety, and data privacy, driven in large part by the impending EU AI Act and shared human-rights values. The current gaps (with many countries lacking specific laws) are likely to be filled in the next 1–2 years through EU-harmonized rules and targeted national measures. Going forward, the challenge will be ensuring these laws keep up with technology (e.g. new generative AI tools in classrooms) and that they are enforced consistently, so that students across Europe enjoy equal protection and benefits from AI-enhanced education. The comparative overview above reveals a strong foundation of common principles, upon which a more detailed and binding regulatory framework is now being built at both national and European levels.

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