# AI Report

**by the European Digital Education Hub's Squad on Artificial Intelligence in Education**

EUROPEAN DIGITAL EDUCATION HUB

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CHAPTER 1

# Teachers' Competences

# Teachers' Competences

Demands on the teaching professions are continually evolving, necessitating the development of an increasingly sophisticated set of competences. In particular, the speed at which digital technologies are developing creates a strong impetus for educators to enhance their digital competence. The realisation of the potential educational benefits of artificial intelligence (AI), and digital data more generally, calls for the active and meaningful engagement of teachers and school leaders. This in turn requires the development of the necessary AI and data literacy to appreciate the full potential of such systems, while being aware of their drawbacks and limitations. **What teachers should be aware of, understand, and be able to do and what kind of attitudes could support them were questions to which the European Digital Education Hub's (EDEH) squad on artificial intelligence in education searched for answers.** We are starting with the presentation of several documents that cover teachers' competences in the area of digital technology, data and artificial intelligence. Competences are presented in three segments, although **there are overlaps** in competences for teaching *for, with* and *about* AI.

*Teaching for AI* entails competences for all citizens, including teachers and learners, to engage confidently, critically and safely with AI systems to provide them with the necessary knowledge, skills and attitudes to live in a world surrounded and shaped by AI.

*Teaching with AI* focuses on how AI systems can be used for educational goals, including using pedagogical judgement on when to use them, but also knowledge about the functioning of underlying algorithms, pedagogical models and data.

*Teaching about AI* is the more technical part, focused on training students in the fundamentals of AI. It is usually part of AI literacy which should comprise both the technological and the human dimensions of AI organised according to the student's age. Knowledge about AI basics is key for preparing students for the labour market, independently of their future careers.

# Competences for Teaching *for* AI

AI policies and systems should aim to protect children, provide equitably for their needs and rights, and empower them to participate in an AI world by contributing to the development and use of AI. This is what UNICEF states in [Policy guidance on AI for Children (2021)](#). Building on this foundation are nine requirements for child-centred AI: 1. Support children's development and well-being; 2. Ensure inclusion of and for children; 3. Prioritise fairness and non-discrimination for children; 4. Protect children's data and privacy; 5. Ensure safety for children; 6. Provide transparency, explainability and accountability for children; 7. Empower governments and businesses with knowledge of AI and children's rights; 8. Prepare children for present and future developments in AI; 9. Create an enabling environment for child-centred AI. These requirements are highly pertinent to the educational context and could be used to guide the deployment of future AI-driven applications in education, keeping in mind the empowerment of children as well as the establishment of safe environments for children to experiment with new technology.

In 2022, the European Commission published **DigComp 2.2:** [The Digital Competence Framework for Citizens](#) (DigComp 2.2) with new examples of knowledge, skills and attitudes for confident, critical and responsible use of digital technologies for learning, at work, and for participation in society. DigComp is an EU-wide tool to improve citizens' digital competence, help policy-makers formulate policies that support digital competence building, and plan education and training initiatives to improve the digital competence of specific target groups. Besides general digital skills already present in previous versions of DigComp the new version introduces more than 30 examples related to interacting with AI systems and also an appendix (page 77-82) describing 73 examples that can support citizens when interacting with AI systems. These include for example: What do AI systems do and what do they not do? How do AI systems work? What are the challenges and ethics of AI? Below are several examples cited from [DigComp 2.2](#) that could be reflected in teachers' competences too (using the original numbering system of the DigComp 2.2 document).

## Information and data literacy

4. Aware that search engines, social media and content platforms often use AI algorithms to generate responses that are adapted to the individual user (e.g. users continue to see similar results or content). This is often referred to as "*personalisation*".

5. Aware that AI algorithms work in ways that are usually not visible or easily understood by users. This is often referred to as "*black box*" decision-making as it may be impossible to trace back how and why an algorithm makes specific suggestions or predictions.

14. Weighs the benefits and disadvantages of using AI-driven search engines (e.g. while they might help users find the desired information, they may compromise privacy and personal data, or subject the user to commercial interests).

22. Aware that the data, on which AI depends, may include biases. If so, these biases can become automated and worsened using AI. For example, search results about occupation may include stereotypes about male or female jobs (e.g. male bus drivers, female salespersons).

27. Able to recognise that some AI algorithms may reinforce existing views in digital environments by creating "*echo chambers*" or "*filter bubbles*" (e.g. if a social media stream favours a particular political ideology, additional recommendations can reinforce that ideology without exposing it to opposing arguments).
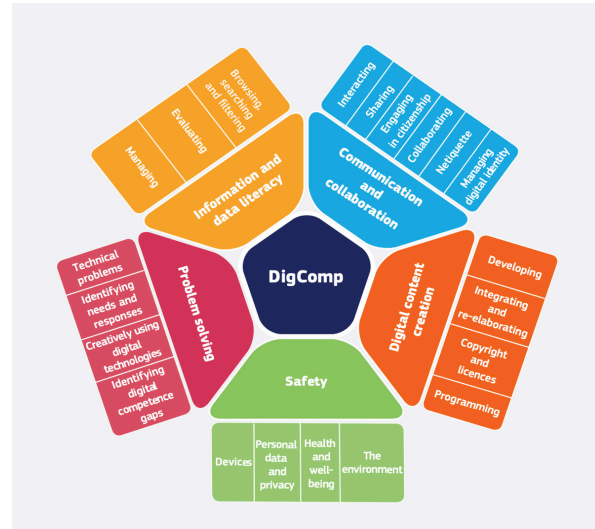


*Figure 1: Competence areas in DigComp;*
*Source: DigComp at Work Implementation Guide, page 9;*
*Available here: https://publications.jrc.ec.europa.eu/repository/handle/JRC120645*

## Communication and collaboration

50. Knows how to identify signs that indicate whether one is communicating with a human or an AI-based conversational agent (e.g. when using text- or voice-based chatbots).

56. Aware that everything that one shares publicly online (e.g., images, videos, sounds) can be used to train AI systems. For example, commercial software companies who develop AI facial recognition systems can use personal images shared online (e.g. family photographs) to train and improve the software's capability to automatically recognise those persons in other images, which might not be desirable (e.g., might be a breach of privacy).

70. Recognises that while the application of AI systems in many domains is usually uncontroversial (e.g., AI that helps avert climate change), AI that directly interacts with humans and takes decisions about their life can often be controversial (e.g. CV-sorting software for recruitment procedures, scoring of exams that may determine access to education).

105. Aware that AI systems collect and process multiple types of user data (e.g. personal data, behavioural data and contextual data) to create user profiles which are then used, for example, to predict what the user might want to see or do next (e.g. offer advertisements, recommendations, services).

113. Knows how to modify user configurations (e.g. in apps, software, digital platforms) to enable, prevent or moderate the AI system tracking, collecting or analysing data (e.g., not allowing the mobile phone to track the user's location).

117. Identifies both the positive and negative implications of the use of data (e.g. collection, encoding and processing), but especially personal data, by AI-driven digital technologies such as apps and online services.

## Digital content creation

119. Knows that AI systems can be used to automatically create digital content (e.g. texts, news, essays, tweets, music, images) using existing digital content as its source. Such content may be difficult to distinguish from human creations.

134. Knows how to incorporate AI edited/manipulated digital content in one's own work (e.g. incorporate AI generated melodies in one's own musical composition). This use of AI can be controversial as it raises questions about the role of AI in artworks, and for example, who should be credited.

## Safety

187. Weighs the benefits and risks before allowing third parties to process personal data (e.g. recognises that a voice assistant on a smartphone, that is used to give commands to a robot vacuum cleaner, could give third parties - companies, governments, cybercriminals - access to the data).

216. Considers the ethical consequences of AI systems throughout their life cycle: they include both the environmental impact (environmental consequences of the production of digital devices and services) and societal impact, e.g. platformisation of work and algorithmic management that may repress workers' privacy or rights; the use of low-cost labour for labelling images to train AI systems.

## Problem solving

221. Aware that AI is a product of human intelligence and decision-making (i.e. humans choose, clean and encode the data, they design the algorithms, train the models, and curate and apply human values to the outputs) and therefore does not exist independently of humans.

231. Aware that AI-driven speech-based technology enables the use of spoken commands that can enhance the accessibility of digital tools and devices (e.g. for those with mobility or visual limitations, limited cognition, language or learning difficulties), however, languages spoken by smaller populations are often not available, or perform worse, due to commercial prioritisation.

233. Knows how and when to use machine translation solutions (e.g. Google Translate, DeepL) and simultaneous interpretation apps (e.g. iTranslate) to get a rough understanding of a document or conversation. However, also knows that when the content requires an accurate translation (e.g., in healthcare, commerce or diplomacy), a more precise translation may be needed.

246. Open to engage in collaborative processes to co-design and co-create new products and services based on AI systems to support and enhance citizens' participation in society.

255. Has a disposition to keep learning, to educate oneself and stay informed about AI (e.g. to understand how AI algorithms work; to understand how automatic decision-making can be biased; to distinguish between realistic and unrealistic AI; and to understand the difference between Artificial Narrow Intelligence, i.e. today's AI capable of narrow tasks such as game playing, and Artificial General Intelligence, i.e. AI that surpasses human intelligence, which still remains science fiction).

Image source: Maskot I Westend61

# Competences for Teaching *with* AI

In deliberating these matters, the ***Emerging Competences for Ethical use of AI and data*** section of the European Commission's [Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators](#) (2022) provides a useful starting point. It suggests potential indicators of emerging teachers' and school leaders' competences for the ethical use of AI and data in teaching and learning. These indicators have been organised according to the six areas identified in the European framework for the [Digital Competence of Educators](#) (DigCompEdu), an existing framework that supports the development of educator-specific digital competences in Europe. We are quoting emerging competences for the ethical use of AI and data as they are written in the [Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators](#).

## Area 1: Professional engagement

Is able to critically describe positive and negative impacts of AI and data use in education

- Takes an active part in continuous professional learning on AI and learning analytics and their ethical use.

Able to give examples of AI systems and describe their relevance.

- Knows how the ethical impact of AI systems is assessed in the school.
- Knows how to initiate and promote strategies across the school and its wider community that promote ethical and responsible use of AI and data.

Understand the basics of AI and learning analytics

- Aware that AI algorithms work in ways that are usually not visible or easily understood by users.
- Able to interact and give feedback to the AI system to influence what it next recommends.
- Aware that sensors used in many digital technologies and applications generate large amounts of data, including personal data, that can be used to train an AI system.
- Aware of EU AI ethics guidelines and self-assessment instruments.

## Area 2: Digital resources

Data governance

- Aware of the various forms of personal data used in education and training.
- Aware of responsibilities in maintaining data security and privacy.
- Knows that the processing of personal data is subject to national and EU regulation including General Data Protection Regulation (GDPR).
- Knows that processing of personal data usually cannot be based on user consent in compulsory education.
- Knows who has access to student data, how access is monitored, and how long data are retained.
- Knows that all EU citizens have the right to not be subject to fully automated decision making.
- Able to give examples of sensitive data, including biometric data.
- Able to weigh the benefits and risks before allowing third parties to process personal data especially when using AI systems.

AI governance

- Knows that AI systems are subject to national and EU regulation (notably AI Act to be adopted).
- Able to explain the risk-based approach of the AI Act (to be adopted).
- Knows the high-risk AI use cases in education and the associated requirements under the proposed AI Act.
- Knows how to incorporate AI edited/manipulated digital content in one's own work and how that work should be credited.
- Able to explain key principles of data quality in AI systems.

## Area 3: Teaching and learning

Models of learning

- Knows that AI systems implement designer's understanding of what learning is and how learning can be measured; can explain key pedagogic assumptions that underpin a given digital learning system.

Objectives of education

- Knows how a given digital system addresses the different social objectives of education (qualification, socialisation, subjectification).

Human agency

- Able to consider the AI system impact on teacher autonomy, professional development, and educational innovation.
- Considers the sources of unacceptable bias in data-driven AI.

Fairness

- Considers risks related to emotional dependency and student self-image when using interactive AI systems and learning analytics.

Humanity

- Able to consider the impact of AI and data use on the student community.
- Confident in discussing the ethical and legal aspects of AI, and how they influence technology use.

Participates in the development of learning practices that use AI and data

- •Can explain how ethical principles and values are considered and negotiated in co-design and co-creation of learning practices that use AI and data (linked to learning design).

## Area 4: Assessment

Personal differences

- Aware that students react in different ways to automated feedback.

Algorithmic bias

- Considers the sources of unacceptable bias in AI systems and how it can be mitigated.

Cognitive focus

- Aware that AI systems assess student progress based on pre-defined domain-specific models of knowledge.
- Aware that most AI systems do not assess collaboration, social competences, or creativity.

New ways to misuse technology

- Aware of common ways to manipulate AI-based assessment.

## Area 5: Empowering learners

AI addressing learners' diverse learning needs

- Knows the different ways personalised learning systems can adapt their behaviour (content, learning path, pedagogical approach).
- Able to explain how a given system can benefit all students, independent of their cognitive, cultural, economic, or physical differences.
- Aware that digital learning systems treat different student groups differently.
- Able to consider impact on the development of student self-efficiency, self-image, mindset, and cognitive and affective self-regulation skills.

Justified choice

- Knows that AI and data use may benefit some learners more than others.
- Able to explain what evidence has been used to justify the deployment of a given AI system in the classroom.
- Recognises the need for constant monitoring of the outcomes of AI use and to learn from unexpected outcomes.

## Area 6: Facilitating learners' digital competence

AI and Learning Analytics ethics

- Able to use AI projects and deployments to help students learn about ethics of AI and data use in education and training.

Educator-specific digital competences are captured also in the DigCompEdu Framework (2017) which aims to describe digital competences to effectively and responsibly use, create and share digital resources for learning, focusing also on the potential of digital technologies for learner-centred teaching and learning strategies. Based on that framework the free self-reflection tool for primary and secondary school teachers **SELFIE FOR TEACHERS** was launched in October 2021  which includes competences relating to AI and some relevant questions for educators to reflect upon the use of AI tools in education.

In 2020, UNESCO organised the first International Forum on AI – AI and the Futures of Education 'Developing Competencies for the AI Era. To support its member states in harnessing the benefits and mitigating the risks of using AI in education, UNESCO is implementing an initiative on Artificial Intelligence and the Futures of Learning. The project revolves around three strands of work:  a report with recommendations on AI-enabled futures of learning; guidance on ethical principles on the use of AI in education; a guiding framework on AI competencies for school students. Through its projects, UNESCO affirms that the deployment of AI technologies in education should be purposed to enhance human capabilities and to protect human rights for effective human-machine collaboration in life, learning and work, and for sustainable development. An UNESCO series of **consultation on AI competency frameworks for teachers** is dedicated to the development of a framework on AI competencies for teachers to guide the planning of the national and institutional frameworks, standards or training programmes. Among the findings from that consultation are the following:

- The main areas of AI competency for teachers are AI literacy, AI and pedagogy, ethics of AI, the use of AI for continuous professional development, and the ability to foster AI competencies for students. It is important that AI literacy and competencies incorporate both the technological and human dimensions of AI.

- Competences need to address: what AI tools exist for teachers, the influence of AI on education, how AI changes the relationship between teachers and learners, ethical and human-centred issues, AI awareness and social responsibility (covering what AI is, what it can do and needs to do, typical applications of AI, the impact of AI, including the ethical impact on humans and society). It was also suggested to be careful that the AI competencies and curriculum for teachers avoid perpetuating AI myths and hyperbole and the need for experiential activities to promote AI understanding and application.
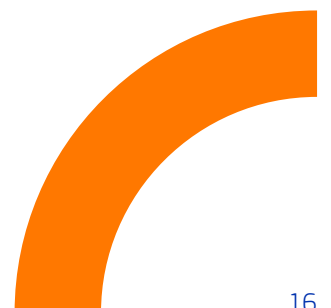
# Competences for Teaching *about* AI

The Council of Europe report "Artificial Intelligence and Education - A Critical View Through the Lens of Human Rights, Democracy, and the Rule of Law" recommends that all citizens should be supported and encouraged to achieve a certain level of AI literacy. They should have the knowledge, skills and values centred on the development, implementation and use of AI technologies. AI literacy should encompass both the technical and human dimensions of AI, including how it works and its impact on people's lives, such as their cognitive abilities, privacy, and agency. Without understanding the impact of AI on people, teaching about what AI does is incomplete.

Members of the EDEH squad also pointed out that **Teachers' competences need to be based upon students' competences and needs** and suggested a few examples of that approach. The proposal is to start with skills students need to achieve in primary, secondary or tertiary levels of education, bearing in mind that students could be both users and developers of artificial intelligence applications.
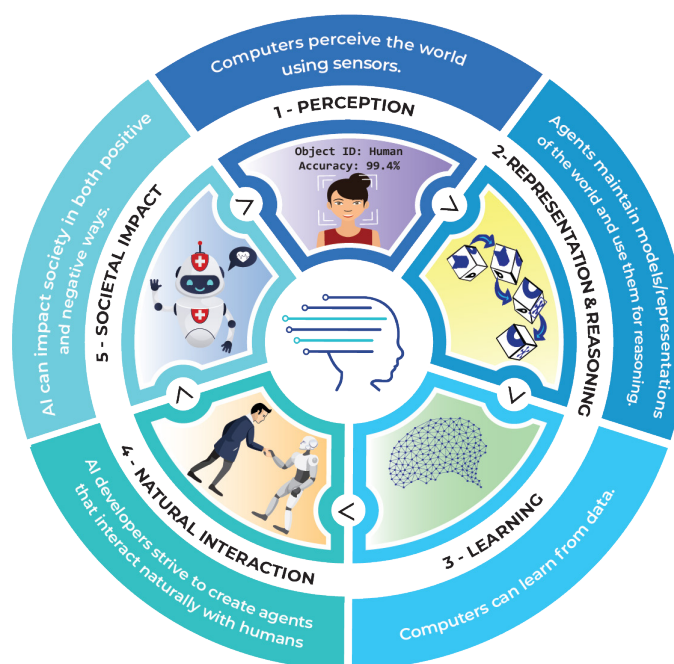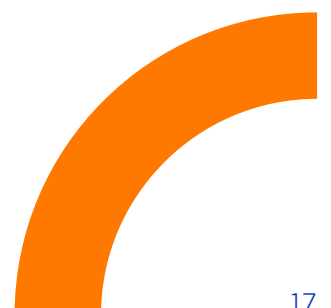


*Figure 2: AI4K12 Grade Band Progression Charts;*
*Source: "Grade Band Progression Charts" by AI4K12 Initiative licensed under CC BY-NC-SA 4.0*

One of the projects that could be used as a resource for envisioning teachers' competences based on students' competences is **AI4K12 Five Big Ideas for AI education**. Core ideas mentioned in that initiative provide a comprehensive overview of the AI field, tailored to the understanding of school-aged children:

- Perception: Computers perceive the world through sensors that gather information from their surroundings.
- Representation and Reasoning: AI agents create and maintain internal models of the world, which they use to make decisions and solve problems.
- Learning: Machines can learn from data and improve their performance over time.
- Natural Interaction: Intelligent agents require a broad range of knowledge to interact naturally with humans, including language, social skills, and emotional intelligence.
- Societal Impact: AI has the potential to impact society in both positive and negative ways, and it is important to consider the ethical implications of its use.

Project AI4K12 Five Big Ideas for AI education also listed some competences for K-12 students (students from kindergarten till grade 12, aged 5 – 18):

**Grades K–2 (age 5 to 8):** Identify common AI applications encountered in their daily lives; Discuss whether common uses of AI technology are a good or bad thing.

**Grades 3–5 (age 9 to 11):** Explore how behaviour is influenced by bias and how it affects decision-making; Describe ways that AI systems can be designed for inclusivity.

**Grades 6–8 (age 12 to 14):** Explain potential sources of bias in AI decision-making; Understand trade-offs in the design of AI systems and how decisions can have unintended consequences in the function of a system.

**Grades 9–12 (age 15 to 18):** Critically explore the positive and negative impacts of an AI system; Design an AI system to address social issues (or explain how AI could be used to address a social issue).

To support K-12 students, the AI4K12 Five Big Ideas for AI education  associated guidelines recommends to use transparent AI demonstrations that help students see what is happening inside the black box, so they can understand that it is nothing magical Teachers should help students build mental models of what is happening under the hood in AI applications. Additionally, students should be encouraged to develop AI applications using AI services. The use of these guidelines can help students better understand and engage with AI technology.

To equip students with AI-related competences, the EDEH squad proposed **multiple domains** that are pertinent to enhancing the skill set of educators. These areas aim to develop teachers' competences in AI and include the following suggestions:

**Basic digital skills**

- Content creation
- Cloud usage
- Data analysis and representation
- Collaboration and communication tools

**Computational thinking**

- Design thinking
- Problem-solving
- Block-based programming
- Text-based programming

**Mathematics**

- Fundamentals of statistics
- Fundamentals of probability

**Existing applications of AI**

- To provide a realistic view of AI
- To be updated on the real usage of AI
- Ethics behind real cases
- Legal issues and data privacy

**Specific AI topics**

- Perception and actuation
- Representation and reasoning
- Machine learning
- Collective intelligence

# Recommendations by the Squad

Different competences are needed for teachers, school leaders, IT support personnel and other professionals in education. This can mean varying levels of knowledge, skills and attitudes related to teaching *for, with* and *about* AI.

There are significant differences in competences for those who will teach *about* AI (the techniques and the technologies) and those who will just use AI as support for teaching and learning processes, but all teachers need to know what impact AI has on people and have competences to teach *for* and *with* AI.

All competences need to be described contextually and with existing subject-specific examples.

# How to Support Teachers to Use AI in Teaching

# How to Support Teachers to Use AI in Teaching

Artificial intelligence (AI) technology has already moved from an emergent to a more advanced stage where people are trying to explore its affordances and discover new innovative usages. It became extremely clear that AI technology is here to stay, and teachers cannot ignore it anymore. How should offerings to educators be positioned, and which problems are we going to solve through AI usage? We will try to model the 5 Whys technique on how AI is making an impact on education, teaching and learning. The below sets of questions refer first to education in general and then to the teaching/learning process:

**1) Why is AI making an impact on education, teaching and learning?**
AI is making an impact on education, both for teachers and for students as it enables new forms of personalisation and learning through individual feedback and coaching. While there are concerns over academic integrity, there is also hope that AI will enable teachers to provide more personalised learning experiences for their students.

**2) Why is personalisation important in education?**
Every student is different in their abilities, interests and circumstances of learning. It is important to tailor learning experiences for each individual student. This task is incredibly difficult in large classes, when a teacher cannot provide real-time feedback for every student.

**3) Why is real-time feedback valuable in education?**
Real-time feedback helps students identify their strengths and weaknesses, adjust their learning strategies, and improve their performance. It allows them to focus on achieving educational outcomes most effectively.

**4) Why is enhancing educational outcomes important?**

Education provides students with the knowledge and skills they need to succeed in their personal and professional lives. Educational outcomes are designed in a way that improves students' future prospects and contributes to societal well-being.

**5) Why is societal well-being important?**

Providing students with high-quality education can help create a more just and equitable society, where everyone has the opportunity to reach their full potential regardless of their background or circumstances.

**1) Why should teachers use AI in the classroom?**

AI allows to provide real-time feedback and personalise learning experiences for students and can also support teachers in improving their learning designs for classes.

**2) Why is it important to personalise learning experiences for students?**

Personalisation allows to create individual learning paths and achieve educational outcomes most effectively. But for this, teachers need big amounts of data, as well as time to support multiple students.

**3) Why is it beneficial for teachers to have access to real-time data and insights?**

When teachers have real-time data and insights, they can adapt their teaching strategies to be most effective for a given student or a group of students.
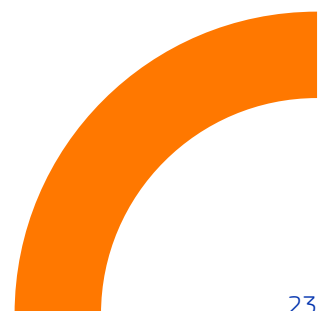
**4) Why can AI help teachers save time and reduce workload?**

AI can assist with tasks such as grading, data analysis, and providing feedback, allowing teachers to focus on teaching and providing personalised support to their students.

**5) Why is it beneficial for teachers to stay up-to-date with technological advancements in education?**

Teachers can improve their skills and knowledge, making them more competitive and effective in their roles. It can also increase job satisfaction and motivation by providing opportunities for professional growth and development.

In the article "AI in education: added value or not?" Digisprong mentions some practical ideas and dilemmas about AI use in education. For example, educational applications driven by artificial intelligence can divide students into level groups, automatically correct exercises, and help beginner students with reading difficulties. But that also means teachers need to keep an eye on the results from AI to make sure the quality of the teaching process remains high. More examples can be found in the Chapter 3 of this report.

Although AI is evolving rapidly, its abilities are still limited. Teachers' pedagogical and educational role remains important. Digisprong mentions several tasks which AI cannot perform well yet, like monitoring and giving feedback on higher thinking skills or collaboration, and it does not consider students' thought processes or intermediate steps. Today, most AI tools for education can only provide feedback on skill sets for which there are clearly defined "right or wrong" answers such as reading, writing, coding, and mathematics.

# How Could Teachers be Supported?

## How could AI support teachers?

AI can support teachers in their everyday practice, for example in:

- **Enabling personalised learning.** Using AI, teachers can create personalised learning materials for students regarding their strengths and weaknesses, students' pace and ability (e.g. gifted students or twice exceptional).

- **Offering feedback.** AI can help teachers provide immediate feedback to students. This can be useful or not as research shows (Sumeracki, 2022) but this is up to the teachers to decide.

- **Focusing on certain tasks.** AI can allow teachers to focus more on tasks like student engagement, student observation, formative assessment, etc.

- **Monitoring the class.** AI can be used to monitor the class and through frequent testing give a data-driven overview to the teacher about the students' content learning.

- **Having an overview of the learning process.** If AI is used for frequent testing, it could provide a great overview of the learning process of students or classes.

- **Teacher training.** In teacher training or preparation of substitute teachers for students of different age groups AI can, for instance, provide quick examples of pieces of text and adapt them to a given age level so the teacher can practice grading or correcting assessments for that target group of students. AI-based text tools could be used as instruments to train writing and creativity skills and critical thinking.

- **Planning learning.** AI-based apps can support teachers in the process of creating courses, course modules, units, or lessons.

## How could AI support educational institutions?

AI, used at an institutional level, can support teachers in their everyday practice, for example in:

- **Interpreting testing data.** If hypothetically, the whole school does frequent testing with adaptive learning applications, maybe AI can be useful to create learning groups that are based on students' abilities and not anymore based on the biological age/class grade.

- **Personalised training models for groups of students and teachers.**

- **Predictive analysis of student achievement.** Providing early warning of students at risk of failing to reach the required learning standards of their grade level and providing

suggestions for support.

- **Support in academic writing of institutions official documents.**
- Recommending learning materials to support the teacher in their own professional development.

## How could teachers be supported to teach with AI?

### Teacher level

Teachers who want to teach with AI could be supported by:

- European School Education Platform & eTwinning communities
- European Digital Education Hub
- EU Teacher Academies
- Peer-to-peer connections
- possibility of virtual exchanges
- blended intensive programmes
- Projects such as AI for teachers
- Requirement (e.g., in procurement processes) to include teacher support materials and training opportunities in AI tools for schools

### Institutional level

In order to support teachers in using AI in their daily professional life, institutions could:

- Allocate more time for professional development and planning.
- Give teachers access to applications dedicated to class management using AI.
- Implement AI at the organisational level. If, for example, educational institutions use AI for assessment and monitoring then they could consider leveraging the use of student achievement data in new ways, for example by supporting the creation of learning groups based on abilities or students' interest rather than age groups with the help of AI-driven organisational tools. It is important that educators would be part of planning such activities.
- Offering managerial-level support for integrating AI in a reflective and critical way to improve performance on certain tasks. Educational leaders and managers should reflect on: What is the support needed from the managerial level? What should principals do? How should they set goals? How should they organise shared learning of teachers in single schools? How can this be integrated into pedagogical programs? What are the pitfalls, risks as well as ethical and law-related considerations?

- Provide incentives to teachers to upskill themselves, e.g., credits, certification and promotion.
- Organise open discussions and reflections with all educational stakeholders on legal/ethical questions regarding technology usage in education.

**National level**

- Guidance on teacher competences to teach with, for and about AI. This could be included in the national recommendations for each curriculum (You may find more in Chapter 1 of this report.
- Integrated learning scenarios: AI could be used as a tool to create more transdisciplinary approaches or to promote moments of vertical teaching or mixed classes. If given access to data and trained properly, it could be a tool to generate an overview of which content is taught in which class, which would make AI a useful tool to help teachers create integrated learning scenarios (like for integrated STEM teaching).
- Provide incentives to teachers to upskill themselves, e.g., credits, certification, promotion.
- AI, coding and statistics should be part of initial teacher education. At university level, educational leaders and program coordinators should start building teachers'

training curricula by answering questions such as what the challenges for teachers of the future are, how AI will affect their jobs, and how they can use AI. This kind of training based on a future oriented perspective would be highly recommendable for initial teachers training.
- Offer professional development on AI in national catalogues for teachers trainings, e.g. the ones developed in North Macedonia, Serbia or Croatia

**European level**

- European programmes to support AI use in education, like Erasmus+
- Recommendations and guidelines to encourage AI use in education, like the Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators

# How Could Teachers Start with AI in Education?

The TPACK framework highlights that the effective incorporation of technology to enhance student learning relies on three fundamental elements: content, pedagogy, and technology. To achieve a valuable teaching and learning experience, educators must possess thorough knowledge of the subject they teach, a strong grasp of effective teaching methodologies, and a good understanding of the technology they can use or abstain from using. In 2018, Punya Mishra's website upgraded the TPACK diagram, and included the context domain to emphasise the limitations and different circumstances teachers face while teaching. Besides these elements, it is important to note that integrating technology in classroom activities also requires some understanding of the cognitive process of learning.

## Knowledge about the content

Educators can begin by utilising AI to expand their understanding of subject-related content. There are various AI applications that can offer descriptions of particular concepts, clarify them, and provide teachers with tailored explanations appropriate for their students' age level. Furthermore, AI-powered search engines can enhance the search experience by assisting teachers in finding information more quickly and efficiently.

## Knowledge about underlying pedagogical models of educational applications

From the educational science point of view, caution regarding the underlying pedagogical models of educational applications and services is needed. For teachers, before using any AI-driven educational applications with students, it is essential to reflect on which theoretical constructs the pedagogical decisions are based on and how traceable these decisions are. Practical questions such as "Do I agree with the grades this system is automatically giving?" or "Is this AI-driven system shaping or producing the kind of learning practices I want my students to perform and pursue later?" can be useful (SURF 2022).

Secondly, the intended learning outcomes and educational goals of AI-driven educational applications and services require scrutiny. Before integrating any new technology in education teachers should ask themselves why they shall use it, what the intended learning outcomes and educational goals of AI-driven educational applications are. For example, if the goal is to develop learner agency and reflection skills, AI-driven educational technologies, which support critical thinking and independent

working, could be integrated. Some AI tools rely on specific schema or curriculum alignment, and teachers and schools should ensure that those are appropriate for the educational context in which they are situated (e.g., some may be aligned to US curriculum standards).

Eventually, it will be important for teachers to consider "which parts of the teaching tasks or learning processes could be substituted, enhanced and transformed through automatisation, algorithms and machines" (Vuorikari et al, 2020).

## Understanding of the technology

When educators opt for a new technology to incorporate into their classroom, they must be conscious of its potential benefits and drawbacks to determine if it will hinder or augment the learning experience. By employing frameworks such as the SECTIONS model proposed by Bates for evaluating digital media, teachers can become more critical and adapt the tech tool to their specific context.

## Understanding of the teaching context

Creating a conducive environment is crucial for a successful learning experience. Teachers need to recognise the strengths and limitations of the learning environment and evaluate whether AI technology is suitable for their context before designing their course. For instance, having a group of tech-savvy students but no internet and appropriate device access in the learning space would make the use of AI technology in the learning process impossible. Therefore, having an accurate and practical assessment of the available physical and human resources is indispensable for integrating technology into any educational process.

## Knowledge about the cognitive processes

Learning with different tools activates different cognitive processes and thus teachers need to be aware of the ones that are related to AI integration.

As with all teaching activities, having an understanding of the cognitive learning process is crucial to select the appropriate pedagogical approach and technology to effectively support and enhance the learning activity.

With AI "[o]ur whole relationship with knowledge and skills has changed. The nature of work will also change so how we learn will changed." ('Donald Clark Plan B', 2023) "We have moved from Human Teachers and Human Learners, as a dyad to AI Teachers and AI Learners as a tetrad." ('Donald Clark Plan B', 2023)

With AI, teachers can engage their students in a more interactive and personalised manner, while simultaneously enhancing their own teaching methods. One of the key cognitive processes that AI

can aid in is attention. As previously discussed, AI-powered tools can help teachers maintain students' engagement level high by delivering personalised content, offering instant feedback, and providing adaptive learning experiences that are customised to each student's unique needs. Additionally, AI-supported learning can be beneficial in enhancing students' learning strategies.

Dual coding (Dual Coding) is an important strategy in learning. It refers to the concept of utilising multiple forms of stimuli to assist learners in encoding information more efficiently, thus making it easier to recall later. Visual and verbal stimuli are the two primary types of stimuli used in the classroom

for this purpose. As AI apps can generate, for example, visual stimuli from verbal ones, they can be concurrently used to support students in better perceiving and processing information.

Retrieval practice (Retrieval Practice) is another cognitive process that can be strengthened using AI. Intelligent tutoring systems and other AI-powered tools can help students practice retrieving information, which improves memory consolidation and long-term retention. They can be useful tools for spaced repetition techniques (Spaced Practice) by integrating moments of reviewing material at gradually increasing intervals.

AI has several other ways to support students in learning, including exploring examples and linking them to the study topics. This will help them understand how the example is relevant to the concepts taught. Additionally, AI can generate different examples on the same topic that students can use to establish connections between them and enhance their problem-solving skills.

AI can help increase student motivation by providing personalised learning experiences, immediate feedback, and a sense of autonomy in their learning journey. By leveraging these cognitive processes, AI can play a vital role in supporting and enhancing learning outcomes in the classroom.

Finally, keeping in mind that metacognition is a critical cognitive process that can promote self-awareness and improve learning outcomes, AI-powered tools can help students become more aware of their learning strategies, strengths, and weaknesses, providing guidance on how to improve their learning outcomes.

# Recommendations by the Squad

- Create an online course for school management on integrating AI at the school level to support education.
- Define "human-AI interface interaction skill".
- Make recommendations for including "teaching with AI" in initial teacher education.
- Propose several professional development pathways for teachers to get acquainted with AI.
- Teachers who are wondering how to get started with AI could access this flowchart and find guidance depending on the choices they make.

## START

**Are you a teacher who has digital skills?**

**YES** ——————————————————— **NO**

**Great! Do you have knowledge about AI?**

**Great time to get started with Chapter 1**

**YES** ——————————————————— **NO**

**Wonderful! Whom do you want to teach AI to?**

**That is ok. Start with Chapters 1 and 2.**

**Peer teachers or adults**
Amazing! Start with Chapters 1, 2, 3, 4, 5, 6 and 7.

**Secondary students**
Super! Start with Chapters 3, 4 and 7.

**Primary students**
Awesome! Start with Chapters 3, 4 and 7.
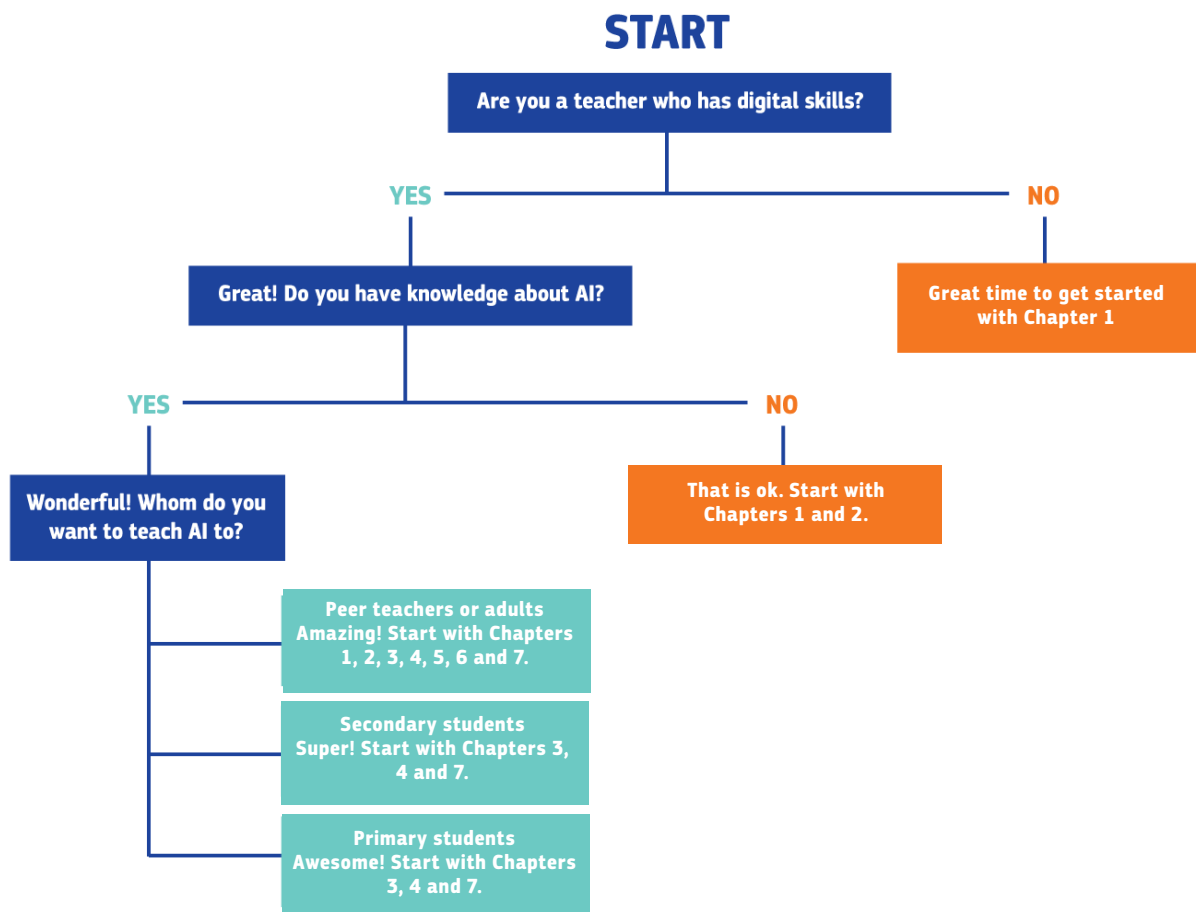
# Use Scenarios & Practical Examples of AI Use in Education

# Introduction and Report Organisation

This chapter presents a set of use scenarios based on existing resources that teachers can use as inspiration to create their own, with the aim of introducing artificial intelligence (AI) at different **pre-university levels,** and with different goals. The Artificial Intelligence Education field (AIEd) is very active, with new resources and tools arising continuously. Those included in this document have already been tested with students and selected by experts in the field, but they must be taken just as practical examples to guide and inspire teachers' creativity.

The use scenarios have been organised in three main categories, according to the three main approaches followed in AIEd:

Teaching *for* AI entails competences for all citizens, including teachers and learners, to engage confidently, critically, and safely with AI systems to provide them with the necessary knowledge, skills and attitudes to live in a world surrounded and shaped by AI.

Teaching *about* AI is the more technical part, focused on training students in the fundamentals of AI. It is usually part of AI literacy which should comprise both the technological and the human dimensions of AI organised according to the student's age. Knowledge about AI basics is key for preparing students for the labour market, independently of their future careers.

Teaching *with* AI focuses on the application of AI-based tools for educational goals. These types of tools provide autonomous support to students in different aspects of learning, facilitating teachers' work. Moreover, they can also support teachers and institutions in management and supervisory tasks. The main goal in this category is not to understand the technology behind these tools , but to take advantage of the potential of AI to enhance teaching and learning.

While the third category is quite clear, the difference between the first and second could be confusing for teachers. Teaching *for* AI implies training students in all the AI topics from an AI **user perspective**, rather than an AI **developer perspective**, which will be covered in the Teaching about AI section. We could differentiate these two perspectives with the following key ideas:

- In terms of **curriculum**, teaching *about* AI should be included as specific subjects or courses (or part of them) with a detailed program covering the main AI topics (perception, actuation, reasoning, representation, learning, impact, etc.). **The learning outcomes are more technical and specific,** so before learning about AI, students should receive background training in maths, programming, and other technical knowledge required to properly understand the AI topics from a developer perspective. Teaching *for* AI could be organised in a more transversal manner through embedding it in different courses and areas (e.g., language, history, natural sciences, mathematics, arts). The learning material could be organised as small activities within different subjects (not only technical), or as specific subjects where the AI topics are delivered without relying on deep technical aspects (like programming). Learning for AI does not require a specific background in maths or programming.
- In terms of **methodology**, in teaching *about* AI, students develop simple AI-based solutions by programming them, while in teaching *for* AI, they can focus on analysing existing AI-based applications or tools by using them, understanding the way they work and their impact.
- In terms of **specialisation**, teaching *for* AI is necessary for all students, independently of their area (humanities, science, engineering, arts). Teaching *about* AI could be targeted to technical paths, thinking about those students interested in working as "AI engineers". Hence, **teaching *for* AI is a pre-requisite for educators and learners before moving to teaching about AI.**

The following 3 sections contain selected use scenarios in these categories that exemplify their differences and opportunities at classes.

# Teaching *for* AI

In this section we describe projects and learning scenarios that provide activities for teachers to engage students in activities that improve knowledge, skills, and attitudes towards how AI systems are used in today's society, and focus on underlined:[everyday applications] that are driven by AI. To teach for AI use in everyday life, the focus is two-fold:

- to introduce some basic principles to keep in mind when interacting with **common AI applications,** such as virtual assistants and recommendation systems, to mitigate risks related to safety, personal data, privacy and well-being;
- to become aware of **how AI is used in various parts of our society**, e.g., autonomous vehicles, medicine, industry, agriculture, and creating realistic expectations about what AI systems do and do not do.

This is a key topic, and students should be aware of the limits of AI from a formal perspective, mainly understanding the differences with human intelligence.

When creating lesson plans to teach *for* AI, areas that are part of the DigComp framework can become helpful. Especially **understanding AI's impact** on information, data and media literacy is crucial due to disinformation on social media platforms and other new forms of automated AI -generated content that exists on the internet.

AI literacy and digital citizenship are essential topics to cover and should include examples for responsible use of AI and data-driven technologies, with a critical mindset to be aware about the potential biases and limitations of such systems. Here, an important goal is to help people navigate ethical questions related to digital practices – like the question of human autonomy which underpins many of the EU values.

At a certain student age, the inclusion of **legal topics** such as personal data protection (GDPR) and privacy, ethical considerations in data collection, storage, and usage, and bias and fairness in AI algorithms will be important.

It could also be useful to include examples about **AI applications in tools and services,** including using AI-powered tools for productivity, communication, and entertainment, integrating AI services into custom applications using application programming interfaces (APIs), and evaluating AI services for data privacy and security concerns. Similarly, introducing students to methods of exploratory data analysis through descriptive statistics and data distributions, data visualisation techniques and tools such as bar charts, pie charts, and scatter plots, and making data-driven decisions based on analysis and visualisations could be useful as well.

Teaching *for* AI can also include aspects such as understanding the nature of different types of data (structured, unstructured, and semi-structured), data formats (text, images, audio, and video), and data sources (public datasets, APIs, and web scraping), and more technical concepts of AI such as machine learning and deep learning.

## Use scenario 1: Bias on AI algorithms

**Idea:**

- Explaining to students the bias that can be introduced in machine learning if data are not properly selected and analysed, and how it can have a relevant impact on automatic decision systems.
- *Why:* to introduce them to the impact of AI.
- *How:* by means of a developing and analysing simple decision systems.

**Target level:** upper primary school and secondary school (ages 8 to 18).

**Topic:** machine learning

**Possible resources:**

*Name:* **A fresh squeeze on data**

- **Target level:** ages 8-10
- **Link:** https://freshsqueezekids.com
- **Description:** This lesson is intended to provide student awareness of bias and their relationship with data. As a demonstration, this lesson allows the teacher and the students to explore and experiment with data bias. The teacher will explain why data is important, how to collect data, what is bias and its relationship with data. The lesson will conclude by asking students to imagine practical, real-life implications of data bias.

*Name:* **AI + ethics curriculum for middle school**

- **Target level:** ages 10-14
- **Link:** https://docs.google.com/document/d/1e9wx9oBg7CROs5O7YnYHVmX7H7pnITfoDxNdrSGkp60/
- **Description:** On page 29 of this pdf file, there is a detailed activity with the required materials. Students will have to use an online programming tool (teachable machine), which does not require any previous experience on programming.
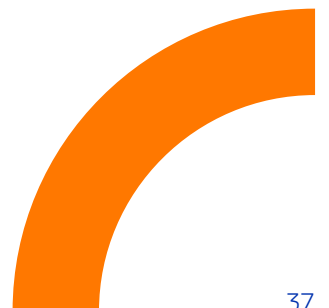
*Name:* **Our AI code of ethics**

- **Target level:** ages 10-14
- **Link:** https://studio.code.org/s/ai-ethics-2021/lessons/1
- **Description:** This lesson belongs to the code.org initiative, and it builds on prior activities involving research and finding sources to justify an argument. In small groups, students conduct research using articles and videos that expose ethical pitfalls in an AI area of their choice. Afterward, each group develops at least one solution-oriented principle that addresses their chosen area. These principles are then assembled into a class-wide "Our AI Code of Ethics" resource (e.g., a slide presentation, document, or webpage) for AI creators and legislators everywhere.

*Name:* **Build a bot**

- **Target level:** ages 14-18
- **Link:** https://dschool.stanford.edu/resources/build-your-own-bot
- **Description:** This facilitation guide includes a set of activities for children, families, and parents to experiment with the potential and peril of AI assistants. In this document there are three workshops with facilitator guides, slide decks, worksheets, and other materials. These have all been designed as unplugged activities and do not require a computer.

## Use scenario 2: Computational thinking and algorithms

**Idea:**

- What is an algorithm? How does it work? How is it related to AI?
- *Why:* to introduce students in the fundamentals of problem solving by means of computer programs.
- *How:* by creating simple algorithms with and without AI.

**Target level:** lower secondary school (ages 10 to 14)

**Topic:** design thinking, problem solving, algorithms

### Possible resources:

*Name:* **Algorithmic literacy**

- **Link:** https://algorithmliteracy.org
- **Description:** Digital2030 (an experience by Digital Moment), the Canadian Commission for UNESCO (CCUNESCO) and UNESCO have partnered up to launch the Algorithm Literacy & Data Project to raise awareness and educate children about the presence of algorithms and how they influence our digital experiences — in other words, get algorithm literate. The goal is to empower children to exercise critical thinking in how they engage online, and to become proactive, creative users and makers rather than passive consumers.

*Name:* **AI + ethics curriculum for middle school**

- **Link:** https://docs.google.com/document/d/1e9wx9oBg7CR0s5O7YnYHVmX7H7pnITfoDxNdrSGkp60/
- **Description:** On page 16 of this pdf file, there is a detailed activity with the required materials. Students will have to create an algorithm to make the "best" peanut butter and jelly sandwich. Students then explore what it means to be "best" and see how their opinions are reflected in their algorithms.
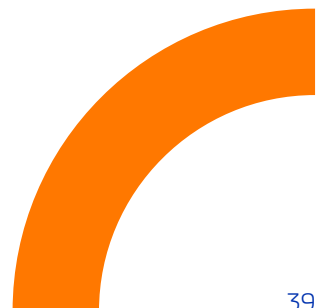
## Use scenario 3: Data privacy and AI

**Idea:**

- What data are AI systems collecting about us? How can we keep our online data private?
- *Why:* because AI changes the way some of our most basic human rights need to be protected and adapted.
- *How:* getting students to experiment with AI systems that collect personal data and reflect on what privacy means in the context of AI.

**Target level:** lower secondary school (ages 10 to 14)

**Topic:** privacy, digital rights, algorithms, bias

**Possible resources:**

*Name:* **Artificial intelligence and human rights – Lesson 4 – Technology and privacy**

- **Link:** https://www.dayofai.org/curriculum
- **Description:** AI Blueprint Bill of Rights (please register to use lessons for free). Students learn about the increasing use of AI in our everyday lives, and how that use is forcing us to consider how some of our most basic human rights need to be protected and adapted. Students focus on four specific rights: non-discrimination, privacy, transparency and safety, with a targeted lesson on each.

*Name:* **How normal am I?**

- **Link:** https://www.hownormalami.eu/
- **Description:** Interactive documentary about how websites and cameras can collect personal and behavioural data and infer pieces of information such as your age, life expectancy, beauty score, body mass index, concentration level, and others. (Sherpa Horizon 2020 Project).
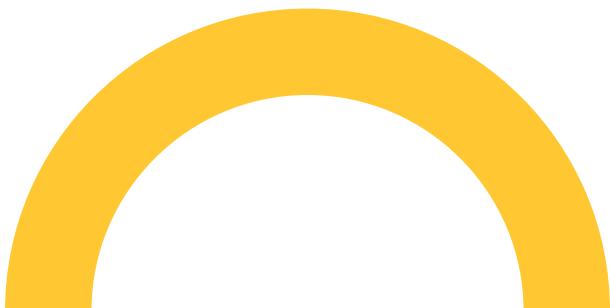
# Teaching *about* AI

In this section we describe projects and learning scenarios for primary and secondary schools (K-12) that provide examples for teaching about AI, to train students in the fundamentals of AI from an AI developer perspective. In most cases, these resources imply that students program a simple AI-based solution, with the aim of gaining the AI basics from the background. It is a more technical approach to AI education. Teaching about AI should cover an introduction to AI, which includes the definition and history as well as the importance and applications of AI in various fields. Four key areas of AI should be covered: perception and actuation, representation and reasoning, learning and the impact of AI. Students should get a clear idea of an AI system as an agent (computational system) that is situated in an environment (real or virtual) which interacts with it in an autonomous fashion (no human supervision required) to reach some design goals. Consequently, the teacher should differentiate AI from machine learning, which is a specific area of AI.

However, it is essential to have an introduction to machine learning, covering supervised, unsupervised, and reinforcement learning, as common machine learning algorithms such as linear regression, decision trees, clustering, and neural networks. It is important to explain different ways of data collection and organisation, including identifying relevant data sources for AI projects, data cleaning and pre-processing techniques. It is also important to introduce students in AI applications like computer vision: object detection, recognition, and segmentation, face recognition, and facial landmarks. Additionally, an overview of robotics and control systems should be provided. The topics should also include generative models, natural language processing (NLP) and its applications. The teacher should cover the social implications and biases of AI, privacy, and data security, AI in decision-making and policy, responsible AI development. Within this scope, it is necessary that educators and learners have a proper background in mathematics, programming, statistics and informatics. Education in this realm requires background knowledge about mathematics, statistics, informatics and programming.

## Use scenario 1: Representation & reasoning in AI

**Idea:**

- Providing students with the fundamentals of representation and reasoning on AI by means of the development of a smartphone application using App Inventor.
- *Why:* to train them about these 2 key topics of AI.
- *How*: by means of developing a smartphone app

**Target level:** high school (ages 15 to 18)

**Topic:** representation and reasoning

**Possible resources:**

*Name:* **AI + Project**

- **Link:** https://drive.google.com/drive/u/1/folders/190-rLvuWvKsNtX7Mb2FOB0SLuZTx404w
- **Description:** The linked folder contains a guide file for teachers so they can implement this activity, as well as the code with the solution. Students will develop an app called "School Path Guide", using a graph representation and a simple probabilistic reasoning algorithm.

*Name:* **Elements of AI – Building AI – Dealing with uncertainty**

- **Link:** https://buildingai.elementsofai.com/Dealing-with-Uncertainty
- **Description:** One of the reasons why modern AI methods actually work in the real world - as opposed to most of the earlier old-fashioned methods in the 1960-1980s - is the ability to deal with uncertainty. This activity shows students how Bayes probability works and how relevant it is for reasoning and problem solving in real AI.

## Use scenario 2: Recommendation systems

**Idea:**

- Learning about "clustering" and using a clustering application to create their own recommendation system.
- *Why:* to understand how the use of clustering and filtering in recommendation systems in social media platforms can speed the spread of misinformation.
- *How:* by developing a basic understanding of what AI is and how it works in recommendation systems – what data it looks at, and how it chooses to filter content for us.

**Target level:** high school (ages 16 to 18)

**Topic:** recommendation, clustering, filter bubbles

**Possible resources:**

*Name:* **Day of AI – AI and social media**

- **Link:** https://www.dayofai.org/curriculum
- **Description:** AI in social media (please register to use lessons for free). Recommendation systems, the foundation of feeds and suggestions across social media platforms, define what we are and are not exposed to online. In this activity, students look at different forms of misinformation, how the use of clustering and filtering in recommendation systems in social media platforms can accelerate the spread of misinformation, and explore the social implications of these filter decisions for us as individuals, and as a society.

## Use scenario 3: Teaching machines to classify

**Idea:**

- What is a classification task in the context of supervised machine learning context and what are the basic building blocks of a classification pipeline?
- *Why:* to recognise the importance of the quality and the quantity of training data and their impact on the accuracy and fairness of classifiers.
- *How:* by the implementation of a three-step procedure to build a classifier, test it, assess its performance in terms of accuracy and fairness and streamline it when possible.

**Target level:** lower secondary school and high school (ages 12 to 18)

**Topic:** classification, machine learning, datasets

**Possible resources:**

*Name:* **EU CodeWeek – Supervised machine learning**

- **Link:** https://codeweek.eu/training/introduction-to-artificial-intelligence-in-the-classroom and Teaching Machines to Classify: Intro to Supervised Machine Learning, for Lower Secondary School
- **Description:** This activity covers essential concepts of machine learning at an introductory level, focusing specifically on the task of classification. It aims to inspire the future generation of innovators to harness the potential of machine learning and AI and understand related advantages and limitations, through simple yet powerful case studies.

*Name:* **AI + Project – Image classification with machine learning**

- **Link:** https://drive.google.com/drive/u/1/folders/1lohSLWg8yRsZQEiM2X2oW6Ne_hDYqI6M
- **Description:** Develop a smartphone app using App Inventor that allows to play a scavenger hunt searching game in school based on machine learning.

Scenarios have been developed with pre-university levels in mind, to be used by teachers in formal or informal education. If we move to higher levels, each speciality would require a different focus of teaching about AI. In general, specific training in AI is recommended. For general citizenship education (adult education, informal education), teaching about and for AI is encouraged, and some remarkable initiatives are already available like ciutadanIA or Elements of AI.
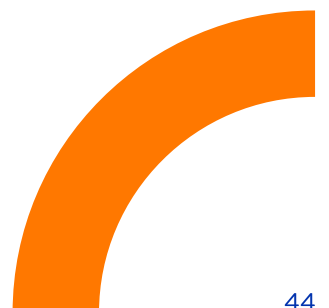
# Teaching *with* AI

In this section we describe use scenarios for learning/teaching with the use of AI-based tools. To appropriately apply AI-based tools in the classroom, it is important for the teacher to possess a basic knowledge of AI's capabilities, constraints and ethical considerations. As with any digital tool, it is essential to know how to select tools that align with the curriculum, pedagogical goals, and students' requirements, while considering the efficacy, ease of use, and privacy issues associated with these tools. To support and enrich the learning experience, educators should incorporate AI tools into their lesson plans while considering how AI can be used for teaching and for supporting students' learning and assessment, e.g., to personalise learning, provide feedback, or improve collaboration between peers. It is important for teachers to be aware of ethical implications such as bias, fairness, accountability, explicability and transparency of AI, also to assess regularly the effectiveness of AI tools used in the classroom and to ensure that learning objectives are being met and educational experiences are being enhanced. Collaboration between teachers, promoting the sharing of experiences, ideas, and best practices for using AI in the classroom can lead to more effective implementation of AI and other digital tools, as well as a better understanding of its potential benefits and limitations.
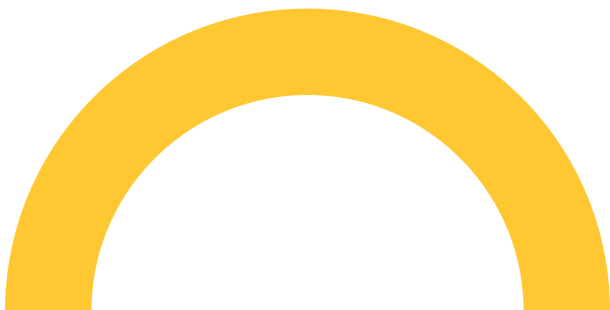
## Use scenario 1: Automatic content generation

**Idea:**

- Taking advantage of generative AI tools
- *Why:* to create initial versions of documents, images or art that can be later improved by students.
- *How:* by means of generative AI tools

**Target level:** all

**Topic:** text creation, language, arts, maths

**Possible resources:**

*Name:* **Genial.ly generative AI in education**

- **Link:** https://view.genial.ly/63ec8abdc804dc0018561bbe?fbclid=IwAR3FfHFK_hWIsiVoW8GFjYaLeL8XZfkKfILVB94oiKumKpUohLL0AG_lxgk
- **Description:** Collection of content creation tools.

*Name:* **Language styles**

- **Link:** https://chat.openai.com and https://you.com
- **Description:** Write a first draft using you.com or ChatGPT. Use the chosen AI to improve content. Then compare with the other groups, what must be changed to switch between different writing styles. Similar approach for foreign languages: to enrich vocabulary, find synonyms, etc, use Google/Microsoft Speech-to-Text for pronouncing exercises of new vocabulary.

*Name:* **Text to images**

- **Link:** https://labs.openai.com and https://you.com/imagine
- **Description:** For science: classification of animals or fruits. Exploring characteristics of animals or fruits more in depth and use that knowledge to train teachable machine to classify them.

  For language: create a scene from a story. Be aware of the descriptions given.

  For art: Use https://digitalcurator.art/ to create a gallery of a certain style or period. Explore the characteristics of the paintings. Use DALL-E to create your own in the chosen style, confront in group, use a teachable machine to train.

*Name:* **Teachable machine**

- **Link:** https://teachablemachine.withgoogle.com
- **Description:** Simple visual tool to create machine learning models

  Biology, categorisation, of birds, insects, etc. and text to image

  Introduction of dynamism (e.g., Giacomo Balla - "Dynamism of a Dog on a Leash", 1912) as well as physical education and anatomy.

*Name:* **Learning with quizlet**

- **Link:** https://quizlet.com
- **Description:** Doing flashcards, quizzed with Quizlet or other apps. Creation of flashcards and using them for learning is important.

## Use scenario 2: Intelligent tutoring systems

**Idea:**

- Support teachers on equalising the advance level of students in different subjects.
- *Why:* to simplify the management of heterogeneous groups.
- *How:* by using a learning platform that provides individualised monitoring

**Target level:** secondary school

**Topic:** mathematics, programming

**Possible resources:**

*Name:* **GOORU NAVIGATOR**

- **Link:** https://gooru.org/about/navigator/
- **Description:** Navigator is an intelligent tutoring system, which monitors students' training in different subjects to reach desired learning outcomes. It provides personalised materials to students.
- **Demo video:** https://www.youtube.com/watch?v=c1IXDN952GM
- **Demo video for K12 maths:** https://youtu.be/IkaAjce1l28
- **NOTE:** It is not free (https://gooru.org/about/pricing/).

*Name:* **DOMOSCIO SPARK**

- **Link:** https://domoscio.com/en/domoscio-spark-2/
- **Description:** An intelligent tutoring system, which monitors students' training in different subjects to reach desired learning outcomes. It provides personalised materials to students.
- **Demo video:** https://www.youtube.com/watch?v=3LygEeV-NhQ
- **NOTE:** It is not free.

*Name:* **COBIE AI**

- **Link:** https://cobie.io/smart-classroom/
- **Description:** Intelligent tutoring system that helps students learn to code. The teacher monitors what students are doing and provides help if needed to multiple students at the same time with the help of Cobie AI assistant. The system also includes a lecture synthesis system so that teachers can easily and quickly create personalised lectures.
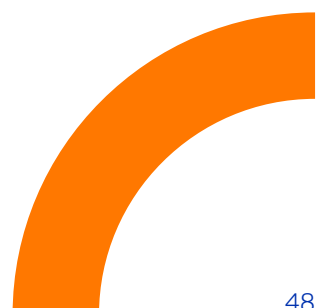
## Use scenario 3: Automatic translation of conversations

**Idea:**

- Showing students how to maintain a conversation in real time in two languages, to communicate with other persons quickly using the smartphone.
- *Why*: to show them that language knowledge should not be an obstacle for socialising.
- *How*: by means of AI-based technology and their own smartphone.

**Target level:** all

**Topic:** conversation, language

**Possible resources:**
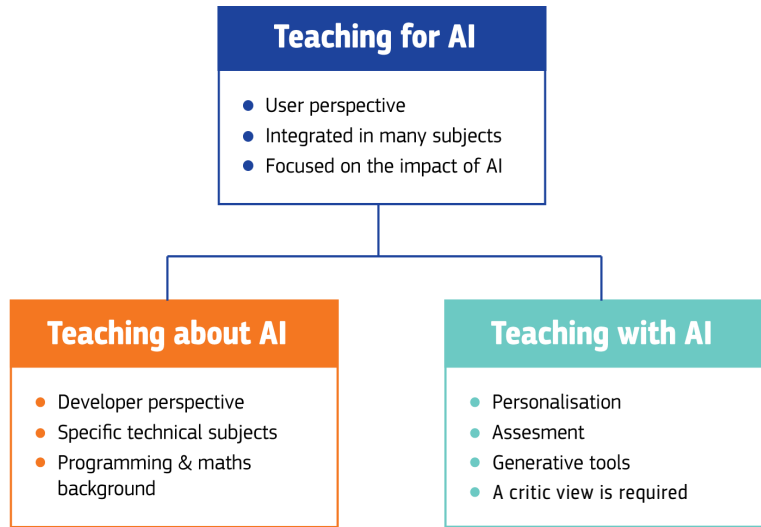
*Name:* **SAYHI**

- **Link:** https://www.sayhi.com/en/translate
- **Description:** It is a smartphone app that detects your speech in any language and translates it to any other language in real time.

# Recommendations by the Squad

The following diagram summarises the conceptual organisation of AIEd teaching categories presented in this chapter:

## Teaching for AI

- User perspective
- Integrated in many subjects
- Focused on the impact of AI

## Teaching about AI

- Developer perspective
- Specific technical subjects
- Programming & maths background

## Teaching with AI

- Personalisation
- Assesment
- Generative tools
- A critic view is required

It can be observed that our main recommendation places Teaching *for* AI is on the top, representing the idea that it should be a pre-requisite for the other two.

Focus first on teaching *for* AI by means of practical projects and learning scenarios that provide activities for teachers to engage students in activities that improve knowledge, skills, and attitudes towards how AI systems are used in today's society and focus on everyday application that are driven by AI.

Take advantage of existing resources for teaching *with* AI to enhance teaching and learning. It is essential to know how to select tools that align with the curriculum, pedagogical goals, and students' requirements, while considering the efficacy, ease of use, and privacy issues associated with these tools.

Apply a developer approach when teaching *about* AI to train more specialised students in the fundamental areas of real-world AI, like perception, reasoning, representation or learning. They must face different AI challenges through hands-on and programming projects, so they attain the AI basics from a more technical perspective.

# Education about AI

# Introduction

Artificial intelligence education is a highly active field, with new resources and tools arising continuously. In previous chapters you may have read about teaching for, with, and about AI, supporting teachers, and identifying the necessary competences for them to become fluent in emerging technologies. With all these dynamic changes, this chapter aims to highlight the importance of integrating AI literacy into both existing and new curricula. Our focus will be on providing valuable ideas and concrete examples for effectively incorporating AI education.

In the Eurydice report "Informatics education at school in Europe", artificial intelligence is mentioned in the "Awareness and Empowerment" area (one of ten areas analysed) in the context of awareness of the impact of emerging technologies. The report points out that while the "Awareness and Empowerment" area is an integral part of informatics, it is often covered in other subjects such as social sciences. As it is linked to transversal competencies like critical thinking and responsibility, it can be taught in all subjects. In addition, AI is mentioned in the context of continuous professional development for teachers and curriculum reforms, with the intention of including artificial intelligence literacy and data literacy (European Commission / EACEA / Eurydice, 2022).

The report AI Watch National Strategies on Artificial Intelligence: A European Perspective mentions that some Member States have national AI strategies with dedicated sections on AI skills, mostly focused on higher education, but some also address secondary, primary or pre-school levels.

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.

This is why the current document proposes some examples of different countries' approaches on education about AI. As you will see below, some countries have chosen to develop new curricula, while others integrated AI into their existing ones.
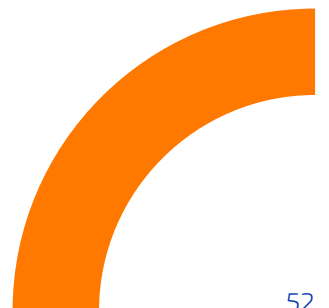
# Country Use-Cases

## Belgium

Education in Belgium is managed, controlled and financed by one of the 3 linguistic communities: Flemish, French and German-speaking. Each community's education system operates as a distinct federal region based on the language of that community. The Federation Wallonia & Brussels focuses on French, the Flemish Community on Dutch, and the German-Speaking Community on German. One notable aspect of this organisation is the high degree of independence of each community, which leads to different approaches regarding the integration of AI into curricula.

Regarding digital education, the most recent report from the EU Education and Training Monitor highlights the following:

- The Flemish Community is actively involved in curricular reform, digital equipment, strengthening media literacy, and creating innovative learning environments (Vlaamse Regering 2019, Strategisch Plan Geletterdheid 2017-2024). Each school is encouraged to have a digital strategy. Digital competences, based on the DigComp framework, are gradually being integrated into the new primary and secondary curricula as cross-curricular attainment goals.

- The French Community is in the process of drafting curricula for pupils up to 15 years old and teacher training programs, based on an adaptation of the DigComp framework (Digital education at school in Europe Eurydice, 2019). However, planned reforms of initial teacher training and curricula are facing delays and will be rolled out gradually. Measures to improve students' digital competences are not yet in place.

Although AI competences are briefly mentioned in the new curricula, there is little detail provided regarding what should be taught to students. A few Belgian organisations, mostly from the non-formal education sector, are starting to implement drafts of AI curricula aimed at the primary and secondary schools. The most notable initiatives are:

- At the federal level: The AI4InclusiveEducation consortium, funded by the Digital Belgium Skills Fund

- In the Flemish Community: Dwengo, Amai!, and the Sint-Lievescollege (Prof. Robbe Wulgaert)

- In the French Community: Namur University Scholl-IT, Edu-Lab
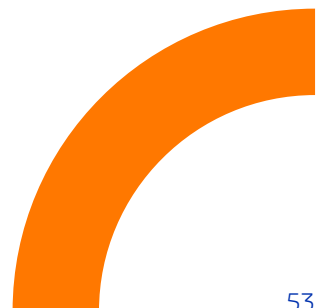
## Ireland

The Department of Education in Ireland published the Digital Strategy for Schools in 2022. It serves as a roadmap for schools to develop an overall direction for school management and in utilising digital technology in educational settings at both primary and post-primary levels. It aligns with the aims and objectives of the European Digital Education Plan and is built on three main pillars or axes.

**Pillar 1:** Supporting the embedding of digital technologies in teaching, learning and assessment

**Pillar 2:** Digital Technology Infrastructure

**Pillar 3:** Looking to the future: policy, research and digital leadership

It is within Pillar 3 that specific mention is made of artificial intelligence. Building on an earlier document, the National Strategy on Artificial Intelligence (AI) titled 'AI-Here for Good', there is a specific mention of the need to ensure that the strategy aims to build an understanding of how data and AI may be applied in an educational context.

Using the Digital Strategy document as a basis, some curriculum work has been done in the past year to develop pupils' understanding of AI. A specific module called 'AI in my Life' has been developed by Dublin City University (DCU) and offered to all upper secondary schools in 2023. This module follows a pilot program involving approximately 8,000 secondary school pupils from 100 schools in 2022. The module, which covers about 20 hours, focuses on topics such as learning about AI and how it works, exploring ethical and privacy implications, and evaluating the role of AI in their lives and society. It also explores future career paths in AI.

## Italy

Since the pandemic and the lockdown, which necessitated distance learning, Italy has introduced several reforms and funding to promote digital skills and literacy among teachers and learners. The latest action plan is 4.0 Schools (2022). While the Next Generation Classrooms initiative generally focuses on teaching/learning spaces and methods to improve metacognitive (critical thinking, creative thinking, learning to learn and self-regulation) and non-cognitive skills (empathy, self-efficacy, responsibility and collaboration), the Next Generation Labs specifically addresses the training of specialised digital skills from secondary school onwards. These labs cover topics such as robotics and automation, cybersecurity or data processing. The labs are designed to be fluid learning environments where different experiences can be lived, personal skills can be developed in collaboration with peers, teamwork can be learned, and specific job-oriented digital skills can be acquired across different economic sectors, allowing the management of flexible curricula oriented towards new jobs that require more advanced digital skills.

In the Italian education system, the curriculum is based on guidelines that provide schools with a framework they must comply with when defining their own curriculum. To this end the guidelines describe the general and specific learning objectives, compulsory subjects, and timetables. Freedom of teaching is a principle outlined in the Italian Constitution (Article 33). The choice and use of teaching methods and materials must be consistent with the school curriculum included in the Three-year Educational Offer Plan (Piano triennale dell'offerta formativa – PTOF), which, in turn, must be consistent with the general and educational objectives of the national guidelines for the curriculum (Indicazioni nazionali per il curriculum). The document "National Indications and New Scenarios," referenced in Ministerial Note No. 3645 of March 1, 2018, provides schools with new guidelines for updating school curricula to computational thinking and the development of digital skills. While safeguarding the freedom in teaching, the National Guidelines for the curriculum suggest some basic methodological approaches, such as, taking advantage of pupils' experiences and knowledge, promoting exploration and discovery activities, encouraging cooperative learning, developing awareness of one's own learning method, carrying out in-lab learning, etc. The most common teaching methods used are frontal teaching,

exercises, and individual/group work. Schools generally have facilities such as a gymnasium, a library and ICT, science, and multimedia laboratories. Almost all classrooms (99%) are equipped with interactive whiteboards (IWB). Teachers at all grades can choose the textbooks and other teaching materials for their classes. Textbooks can be in digital or mixed versions (either paper or paper and digital versions), all including integrative digital content, and must align with the curriculum and the school's Three-year Educational Offer Plan (PTOF). In addition, for specific subjects, schools can create their own digital teaching tools which students can use as textbooks (law 128/2013).

Civic education was introduced **for all school grades** in 2020/2021 and the lesson time could be used to teach transdisciplinary topics like in this case AI skills, focusing on ethical, societal and political aspects of AI. Students can learn AI ethics, discussion topics like privacy, data security, and bias. They can understand the influence of AI on politics and democracy, such as its potential role in misinformation campaigns. The social impact of AI, such as employment and inequality, and the intersection of AI and law could be discussion points to foster students' understanding of how AI impacts daily life.

## Spain

The new education law in Spain (LOMLOE) includes contents of AI in different levels, from primary school to high school, mainly related with technology subjects.

But the strategy is open, and other fields and subjects from humanities also include AI topics. The following graphic provides an overview of the roadmap for integrating AI into curricula across different education levels.
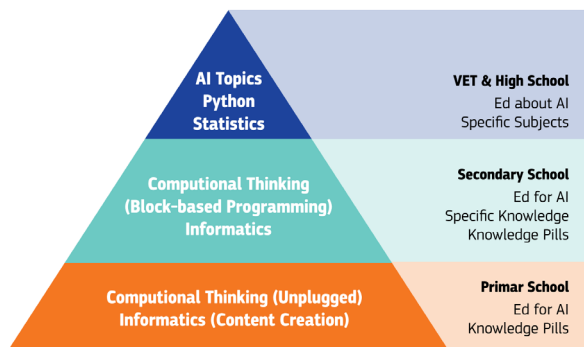


*Figure 3: Ovweview of the roadmap for integrating AI; Source: Francisco Bellas, licensed under CC BY 4.0*

As can be observed, at the lower levels (upper primary school, 10-12 years old), the focus is on developing computational thinking and basic digital skills, such as computer usage. AI concepts are not specifically taught at this level, but teachers can incorporate activities related to technical thinking in general. Moving on to secondary school, at the lower levels (12-14 years old), the aim is to build upon the primary school strategy by introducing block-based programming alongside basic training in mathematics, logic, and informatics. At the upper secondary school level (14-16 years old), teachers can use specific AI resources within their subjects or even create dedicated AI courses. However, the approach should be geared towards "teaching for AI", where students do not require advanced programming skills or background knowledge. Lastly, in high school and vocational education, the emphasis shifts to a "teaching about AI" approach, which is more technical in nature. Students are expected to program AI-based solutions and learn about science of data and machine learning.

Below, you will find a specific example of an AI curriculum implemented in the Galician region, following national guidelines. The curriculum highlights the AI skills and knowledge incorporated into the mentioned subjects:

### Digitisation (4th level – 15 years old)

Block 3. Computational thinking:

- CA3.1. Understand the foundation of artificial intelligence algorithms, valuing the importance of making ethical use of information processing in the development of applications.

- Introduction to artificial intelligence. Creating practical applications of AI.

Block 5. Critical digital citizenship:

- Ethics in the use of data and digital tools: artificial intelligence, algorithmic and ideological biases, technological sovereignty and sustainable digitisation.

## Education in civic and ethical Values (3rd level – 14 years old)

Block 2. Society, justice, and democracy

- The challenge of artificial intelligence.

## Technology (4th level – 15 years old)

Block 4. Programming, automation, and robotics

- CA4.2. Use, with a critical and ethical sense, computer applications and digital control and simulation technologies, such as the Internet of Things, big data and/or artificial intelligence.
- Introduction to artificial intelligence and big data: practical applications. Shared spaces and virtual disks.

## Technology and digitiation (2nd level – 13 years old)

Block 4. Programming, control, and robotics

- CA4.2 Program simple applications for different devices (computers, mobile devices, and others) using programming elements appropriately and applying editing tools and artificial intelligence modules that add functionality.

- Introduction to artificial intelligence.

## Philosophy (1st high school – 16 years old)

Block 2. Knowledge and reality

- The mind-body problem from the modern age to artificial intelligence.

## Technology and engineering II (2nd high school – 17 years old)

Block 5. Programming, automation, and control

- Artificial intelligence, big data, distributed databases and cyber security.

The following are the specific AI subjects that will start in year 2023/24. The first one follows the "Education for AI" approach, while the second one follows the "Education about AI" one:

### AI for society (4º ESO – 15 years old)

B1. What is artificial intelligence?

B2. Impact of AI

B3. Areas of AI

B4. AI technologies

### AI technologies (1º bach – 16 years old)

B1. Fundamentals of Python programming for AI

B2. The intelligent agent

B3. Computer vision projects and impact

B4. Natural language projects and impact

B5. Supervised learning projects and impact

## Ukraine

To include modern topics such as AI in education, it is not always necessary to rewrite the entire curriculum or study program, which can be a lengthy process. By having a broadly defined curriculum, it becomes possible to update the content to include AI while keeping the learning outcomes of the current program intact. For instance, in a standard high-school informatics course, the module originally named "Informational Technologies in Society" covered information technologies and systems in modern society, future professions, aspects of cybersecurity, e-government systems, and more. The learning outcomes were formulated quite broadly and flexibly:

- Explain the role of modern information and communication technologies in society and human life.
- Understand the general principles of work and areas of application of artificial intelligence systems, the Internet of Things, and smart technologies.
- Independently learn and adapt to new technologies.
- Recognise the communicative role of IT and the evolving trends of the digital society, as well as the impact of information technologies on people's lives.
- Make informed decisions about future careers by consciously applying IT knowledge.

- Respect rights and freedoms, including freedom of speech, online privacy, copyright and intellectual property, personal data, etc.

A working group comprising school and university teachers, along with IT professionals, was able to suggest AI-oriented content that could be covered in approximately 10 hours of class time. The content is designed to provide a general introduction to the topic of AI, rather than focusing on specific technologies or in-depth understanding.

The lessons in the "Artificial Intelligence" cycle are based on the educational series "Artificial intelligence for schoolchildren" developed by the Ministry of Digital Transformation. Most of the suggested lessons are practice-based and introduce various AI tools.

1. Information technologies and systems in modern society
2. Artificial intelligence
3. Technologies and tools of data analysis
4. Social aspects of large-scale data analysis
5. Digital citizenship and electronic governance
6. Information security
7. Practical problems and career opportunities

# Conclusion and Recommendations

Examples presented in this chapter show us that there is no right or wrong path towards education about AI; it is simply a matter of analysing the cultural, technical, social, and educational context of the country and deciding which approach is optimal. By taking a more critical approach to AI integration into curricula, different countries might even develop new and creative ways of implementing it into education.

Different countries have made different decisions regarding AI integration into curricula. Some decided to create new curricula to teach about AI, others to integrate it into existent curricula. It is thus important to have a critical approach when thinking about integrating AI into curriculum, take into consideration the local context but also look at the solutions found by other countries.

While approaches may vary, there is a growing consensus on the importance of introducing AI concepts to students at different educational levels, ensuring that they are equipped with the necessary skills and knowledge to thrive in a world increasingly influenced by AI and related technologies.

# Recommendations by the Squad

- To ensure a comprehensive and unbiased approach to learning, it is essential that AI curricula are not tied to specific technologies or brands.
- With the aim of facilitating the development of the European Education Area, it would be beneficial if Member States shared good practice examples, thereby ensuring that students entering tertiary education possess comparable levels of competence about AI.
- Integrating AI into curricula requires both resource development and teacher training.
- The evidence-based approach would enhance the content and effectiveness of AI curriculum.
- Education about AI is needed, but freely embracing education with AI needs to be done with some caution.

Image source: Maskot / Westend61

# Influence of AI on Governance in Education

# Introduction

Education governance refers to **how decision making happens in education systems** and how education systems allocate roles and responsibilities, determine priorities and designs, and carry out education policies and programmes (OECD, 2019). From an education governance point of view, it is increasingly important to explore and discuss the possibilities, risks and limits of artificial intelligence (AI) in education. Observing the institutionalisation of new education governance practices that emerge as a result of the integration of digital technologies into education is necessary in order to share best practices and gain knowledge. To discuss these new governance practices, the UNESCO guidance for policy makers for AI in education and European Parliament proposal of AI Act (adopted text, June 2023) are taken into consideration.

A number of AI tools for educational purposes are already in use (see Chapter 3 for Use Scenarios and Practical Exaples of AI Use in Education). Many positive examples for effective use start to emerge, however, there are also many concerns for responsible adoption, such as the lack of strategies to specify measures that are conducive to effective use of AI for educational purposes. There is a need for establishing an integrated education governance package for AI that encompasses educational reform, ensuring inclusive, equitable and ethical use of AI. Policies and strategies for using AI in education are central to maximising AI's benefits and mitigating its potential risks as a new tool to accelerate the progress towards the achievement of the UN's sustainable development goal 4 (SDG 4) – **Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.**

# Risk-Based Approach

In June 2023, the European Commission has proposed, and the European Parliament has adopted the text for the legal framework on AI which addresses the risks of AI ensuring that Europeans can trust what AI has to offer. 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.

"Depending on the circumstances regarding its specific application and use, as well as the level of technological development, artificial intelligence may generate risks and cause harm to public or private interests and fundamental rights of natural persons that are protected by Union law. Such harm might be material or immaterial, including physical, psychological, societal or economic harm" (AI Act proposal, EP, June 2023). The proposed text also points out some potential risk of AI in education which will be highlighted below.
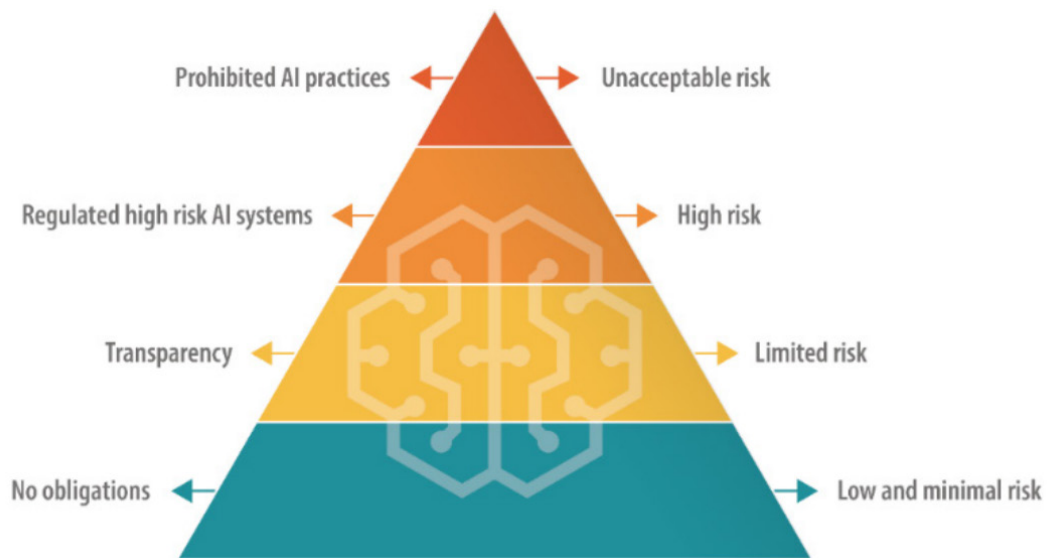


*Figure 4;*
*Source: Illustration from European Parliament briefing on AI Act (January 2022)*

## Unacceptable risk

All AI systems considered a clear threat to the safety, livelihoods and rights of people will be banned. Prohibited are among others: crime prediction based on the profiling of individuals, 'real-time' remote biometric identification systems in publicly accessible spaces and 'post' remote biometric identification systems, creation of facial recognition technology databases through the scraping of facial images from the internet or CCTV footage and **inferring the emotions of individuals** in certain areas, such as in workplace, by **education institutions**, law enforcement or border management (AI Act proposal, EP, June 2023).

## High risk

AI systems identified as high-risk include AI technology used in critical infrastructures, some cases in educational or vocational training that may determine the access to education and professional course of someone's life. Those are the systems that could put the life and health of citizens at risk (EC, 2022).

High-risk AI systems should have adequate risk assessment and mitigation systems, high-quality datasets, logging of activity, detailed documentation, clear and adequate information to the user, appropriate human oversight measures, and high level of robustness, security and accuracy (EC, 2022). High-risk AI systems shall be tested for the purposes of identifying the most appropriate and targeted risk management measures and weighing any such measures against the potential benefits and intended goals of the system. Testing shall ensure that high-risk AI systems perform consistently for their intended purpose and they are in compliance with the requirements set out in the AI Act proposal (EP, June 2023).

"**AI systems used in education or vocational training,** notably for determining access or materially influence decisions on admission or assigning persons to educational and vocational training institutions or to evaluate persons on tests as part of or as a precondition for their education or to assess the appropriate level of education for an individual and materially influence the level of education and training that individuals will receive or be able to access or to monitor and detect 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 affect their ability to secure their livelihood. When improperly designed and used, such systems can 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". (AI Act proposal, EP, June 2023).

"Hight-risk AI systems in education and vocational training are:

**(a) AI systems** intended to be used for the purpose of determining access or materially influence decisions on admission or assigning natural persons to educational and vocational training institutions;

**(b) AI systems** intended to be used for the purpose of assessing students in educational and vocational training institutions and for assessing participants in tests commonly required for admission to those institutions;

- **(b a) systems** intended to be used for the purpose of assessing the appropriate level of education for an individual and materially influencing the level of education and vocational training that individual will receive or will be able to access.
- **(b b) AI systems** intended to be used for monitoring and detecting prohibited behaviour of students during tests in the context of/within education and vocational training institutions." (AI Act proposal, EP, June 2023).

## Limited risk

Limited risk refers to AI systems with specific transparency obligations. For example, when using AI systems such as chatbots, users should be aware that they are interacting with a machine so they can take an informed decision to continue or step back (EC, 2022).

## Minimal or no risk

The AI Act proposal allows the free use of minimal-risk AI. This includes applications such as AI-enabled video games or spam filters.



| STEP1 | STEP2 | STEP3 | STEP4 | |
|---|---|---|---|---|
| A high-risk AI system is developed. | It needs to undergo the conformity assessment and comply with AI requirements.* \n\n *For some systems a notified body is involved too. | Registration of stand-alone AI systems in an EU database. | A declaration of conformity needs to be signed and the AI system should bear the CE marking. **The system can be placed on the market.** | If substantial changes happen in the AI system's lifecycle |

GO BACK TO STEP 2

How does it all work in practice for providers of high risk AI systems?

*Figure 5:*
*Source: Illustration from Regulatory framework proposal on artificial intelligence (EC, 2022)*

AI applications should remain trustworthy even after they have been placed on the market. This requires ongoing quality and risk management by providers.

# Emerging Practices and Benefit-Risk Assessment for AI in Education

The application of AI in education has developed in multiple directions as is already mentioned in Chapter 1 and Chapter 3 of this report. Importantly, the introduction of AI into education also put and accent on issues of pedagogy, organisational structures, access, ethics, equity, and sustainability.

Furthermore, if the potential of AI to support education for sustainable development is to be fully realised, all the possible benefits of the tools need to be identified and leveraged, and the risks acknowledged and mitigated. Consequently, the ways in which education is organised also need to be continuously reviewed, which might suggest a fundamental reshaping of education's core foundations.

To help and support educational systems to respond to these complex challenges, UNESCO in its Beijing Consensus on Artificial Intelligence and Education determines more than thirty policy recommendations related to the questions:

- How can AI be leveraged to enhance education?
- How can the ethical, inclusive, and equitable use of AI in education be ensured?
- How can education prepare humans to live and work with AI?

From the perspective of governance of AI systems in education, and through a prism of EU ethical principles, some examples of guiding questions are proposed in a JRC publication on Emerging technologies and the teaching profession: Ethical and pedagogical considerations based on near-future scenarios (2020):

- What procedures and policies are in place to support humans in the working environment, and the aim of creating meaningful work?
- What procedures and policies are in place to ensure that the AI systems cannot cause or exacerbate adverse impacts due to asymmetries of power or information, such as between employers and employees, businesses and consumers or governments and citizens?
- What protocols are in place to respond to and to prevent harm? What early warning systems are there that can trigger action if harm may be occurring?

- What procedures and policies are there to ensure that AI systems positively address rather than exacerbate inequity, discrimination and prejudice in education? What evidence is there that an AI system can be used to address equity concerns in schools?

- How will those in governance or procurement positions ensure genuine traceability, verifiability, non-deception and honesty, and intelligibility of AI systems prior to purchase and during implementation?

- How will transparency be operationalised if harm occurs?

- Do policy-makers, procurement officers, and school leaders have access to appropriate independent technical expertise to explain and advise on AI systems?

- Is there a rigorous process for seeking parental consent and student assent before systems are deployed?

More Guiding questions, from a teachers' and school leaders' perspective are available in the Ethical guidelines on the use of artificial intelligence and data in teaching and learning for educators (2022, p. 19-25) to facilitate the evaluation of an AI system prior to its installation in a school or during its use. The inquiries may be directed to the educators themselves, the decision-makers at the management level, or the system providers. The queries can also be used to guide discussions with students, parents, and other members of the school community.

# AI Strategies and Planning the Use of AI in Education

According to the European Commission's AI Watch, almost all European countries have an AI strategy, 23 out of 27 member states as stated in the 2022 edition of AI Watch.

The European Schoolnet report Artificial Intelligence. Role in K12 Education (2021) mentions that national policies addressing AI and education developments are diverse. Education is mostly mentioned in general AI strategies or AI is mentioned in education or digital strategies, while a thematic approach focusing on AI and education is rare.

According to the 2022 edition of AI Watch, AI strategies usually dedicate a section related to AI skills. The focus is mainly put onto measures for higher education institutions and the reskilling of the working age population, only briefly mentioning primary and secondary education. Few countries envisage policy measures for pre-school education and set out mechanisms for the impact assessment of skill policies. Countries are working on several models for reskilling and upskilling and the introduction of AI skills in formal and informal education, but specific measures targeting assessment of AI use in education are not present.

The AI Act proposal (June 2023) also mentions the importance of AI literacy mandating that providers and deployers of AI systems ensure a sufficient level of AI literacy among their staff and other individuals dealing with AI systems on their behalf, taking into account their technical knowledge, experience, education, and training, as well as the context in which the AI systems will be used. The proposal explains that 'AI literacy' refers to the skills, knowledge, and understanding that enable various stakeholders to deploy AI systems in an informed manner and to know about the opportunities, risks, and potential harms of AI. The AI Act proposal emphasises the importance of promoting the development of a sufficient level of AI literacy across all sectors of society, for people of all ages, including women and girls.

In the [Beijing Consensus on Artificial Intelligence and Education](#), UNESCO suggests four strategic targets which should be covered in AI policies:

- ensuring the inclusive and equitable use of AI in education;
- leveraging AI to enhance education and learning;
- promoting the development of skills for life in the age of AI, including teaching how AI works and its implications for humanity;
- safeguarding the transparent and auditable use of education data.

The planning should be interdisciplinary and governance inter-sectoral. The policies need to be developed on equitable, inclusive, and ethical use of AI planning to use AI for education management, teaching, learning, and assessment. Pilot testing, monitoring, and evaluation, and building an evidence base as well as fostering local AI innovations for education should be carried out.

The education policies should be tailored to equip current and future generations with the necessary tools to harness AI for sustainable development and ensure that it operates based on **human rights**, as a shared set of values and ethics for the benefit of all humanity. When adopting the education policies for AI, the steering wheel must be a humanistic approach. AI education policy development and practices should focus on protecting human rights and equipping people with the values and skills needed for sustainable development and effective human-machine collaboration in life, learning and work ([UNESCO](#)).

AI implementation in education should be based on **system-wide readiness** and cost-value assessment including assessment of infrastructure, internet connectivity, the availability of data, AI tools, local AI talent, the skills of key policy implementers, and stakeholders' awareness. [The Government AI Readiness Index 2022](#) presents readiness of governments to implement AI in the delivery of public services, monitoring 39 indicators across ten dimensions, organised in three pillars: the government pillar; the technology sector pillar, and the data and infrastructure pillar.

**Interdisciplinary and multistakeholder expertise** should be mobilised to inform policy planning and build the capacities of policy-makers. Inter-sectoral governance and coordination mechanisms, open and iterative cycle composed of key steps in planning, implementing, monitoring and updating policy need to be set up (UNESCO).

**Pilot testing, monitoring and evaluation,** and building an evidence-based approach of applying AI in education are necessary steps, while also putting efforts in strengthening **research and evaluation** in the field of AI and education and foster local AI innovations for education. In May 2023, the International Research Centre On Artificial Intelligence published the IRCAI Global Top 100 Report 2022 for which they evaluated projects across four key criteria: scientific maturity and use of AI tools, impact on relevant SDGs, market readiness, and ethical ramifications, with particular attention to ethical and rights-based awareness of the applicants in their proposed AI solutions.

The Ethical guidelines on the use of artificial intelligence and data in teaching and learning for educators (2022, p. 26- 27) suggest using an incremental approach to **gradually introduce AI tools into school contexts** and to constantly monitor the societal effects that can emerge, leaving open the possibility to step back when unintended consequences occur. Several steps are proposed for planning effective use of AI and data in school:

1. reviewing current AI systems and data use;
2. initiating policies and procedures;
3. carrying out a pilot of the AI system;
4. collaborating with the AI system providers;
5. monitoring the operation of the AI system and evaluate the risks;
6. raising awareness and community engagement (discussing and collaborating with colleagues and other schools, communicating with parents, learners and the school community and keeping them up to date).

# Recommendations by the Squad

With AI and the associated data, new norms and new governance models emerge, and new actors enter the education sector while others lose their value in the system. Although national authorities are reacting quickly establishing or improving their AI strategies, it is difficult at the moment to have a clear picture of what this virtual AI-based ecosystem will look like, what governance it will have, and what actors will be involved, but four common areas of concern emerge from the national and regional policies:

- the importance of governance for data and privacy;
- the importance of openness to ensure equal universal access and promote transparency;
- curriculum innovation that can address the potential and implications of AI;
- financial support for the effective implementation of AI.

The primary purpose of applying AI in education should be to enhance learning, enabling every learner to develop their individual potential, and policies should reflect and support it. A comprehensive AI strategy is recommended covering interdisciplinarity, humanity, ethics, scalability and sustainability, responsibility, equity and lifelong learning for all.

# AI and Ethics, Human Rights, Law and Educational Data

# Introduction

In March 2023, more than a thousand technology leaders and researchers have called for a halt in the development of powerful artificial intelligence (AI) tools, pointing out the risks that the current race to develop more powerful AI could pose to society, especially considering the huge number of unknowns with these technologies and the lack of regulation (Future of life institute, 2023).

Following this letter, UNESCO has called for the immediate implementation of the Recommendation on the Ethics of AI that was unanimously adopted by its member states in November 2021. In this call, the organisation raises its concerns about "many of the ethical issues raised by these innovations, in particular discrimination and stereotyping, including the issue of gender inequality, but also the fight against disinformation, the right to privacy, the protection of personal data, and human and environmental rights". UNESCO also states that industry self-regulation is insufficient to avoid ethical harms and that AI developments should abide by the rule of law, avoiding harm, and that mechanisms should exist to ensure accountability and redressal (UNESCO, 2023).

The issues linked to 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 rights of students, teachers and other people in the educational sphere. If this duty must be mainly the responsibility of the states, other actors, including schools, teachers as well as tech companies have an important role to play. Ensuring that students are aware of these issues is also important for them to understand how AI systems work and what their risks are.

# Ethics of AI

Adopted in 2021, the [UNESCO Recommendation on the Ethics of Artificial Intelligence](#) is a non-binding international instrument, the first-ever global instrument to deal with the topic of ethics of AI. The Recommendation highlights four core values that should lay the foundations for AI systems and ten core principles that lay out a human-rights centred approach to the ethics of AI. The core values are:

- Respect, protection and promotion of human rights and fundamental freedoms and human dignity;
- Living in peaceful just, and interconnected societies;
- Ensuring diversity and inclusiveness;
- Environment and ecosystem flourishing.

The core principles are:

- Proportionality and doing no harm;
- Safety and security;
- Right to privacy and data protection;
- Multi-stakeholder and adaptive governance and collaboration;
- Responsibility and accountability;
- Transparency and explainability;
- Human oversight and determination;
- Sustainability;
- Awareness and literacy;
- Fairness and non-discrimination.

The Recommendation highlights that AI raises new types of ethical issues, including their impact on education and that new ethical challenges are created because of the potential of AI algorithms to exacerbate already existing biases and discrimination (paragraph 2c). It further states that it pays specific attention to education, "because living in digitalizing societies requires new educational practices, ethical reflection, critical thinking, responsible design practices and new skills, given the implications for the labour market, employability and civic participation" (paragraph 3a).

The Recommendation also gives concrete policy recommendations, including for education and research (policy area 8). It notably recommends states to provide adequate AI literacy education, to encourage research initiatives on the responsible and ethical use of AI technologies in teaching, teacher training and e-learning, to promote the leadership of girls and women, diverse ethnicities and cultures, persons with disabilities and vulnerable people, to develop AI ethics curricula or to ensure a critical

evaluation of AI research, and proper monitoring of potential misuses or adverse effects (UNESCO, 2022).

The draft regulation of the **European Parliament and of the Council**, laying down [harmonised rules on artificial intelligence (AI Act)](#) and currently under discussion, highlights the importance of deploying AI

systems to modernise education systems, enhance educational quality both offline and online, and increase access to digital education for a wider audience. However, the use of AI systems in education, particularly for decisions regarding admissions, evaluations, and determining appropriate levels of education, carries ethical implications. These AI systems should be classified as high-risk due to their potential to shape an individual's educational and professional trajectory, impacting their ability to secure their livelihood. Improperly designed and used AI systems can be intrusive, violating the right to education, perpetuating discrimination, and reinforcing historical patterns of bias against certain groups, such as women, specific age groups, individuals with disabilities, or those of certain racial, ethnic groups, or sexual orientations.

AI systems identified as high-risk include AI technology used in critical infrastructures, and some cases in educational or vocational training that may determine the access to education and professional course of someone's life. Those are the systems that could put the life and health of citizens at risk (EC, 2022).

"AI systems used in education or vocational training, notably for determining access or materially influence decisions on admission or assigning persons to educational and vocational training institutions or to evaluate persons on tests as part of or as a precondition for their education or to assess the appropriate level of education for an individual and materially influence the level of education and training that individuals will receive or be able to access or to monitor and detect 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 affect their ability to secure their livelihood. When improperly designed and used, such systems can 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" (AI Act proposal, May 2023, p. 113).

Previously, the European Parliament resolution on artificial intelligence in education, culture and the audiovisual sector (2021), already called to include education in the regulatory framework for high-risk AI systems, "given the particularly sensitive nature of data on pupils, students and other learners" (European Parliament, 2021). In its general observations, this resolution also highlighted that the use of AI in education raises concerns about the ethical use of data, learners' rights, data access and protection of personal data, hence putting at risk fundamental rights, including through the risk of creation of stereotyped models of learners' profiles and behaviour that could lead to discrimination
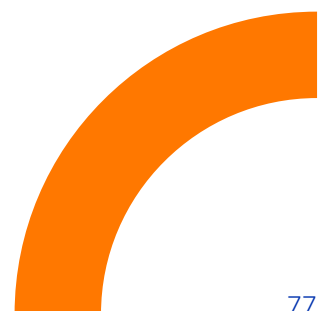
or doing harm by scaling up bad pedagogical practices (§ AD). The part dedicated to education, while recognising that AI can offer a wide range of great possibilities and opportunities in education, also points out the various issues that can arise and expresses notably the need for strengthening digital skills, the fundamental role of teachers and the necessity to direct more public money towards AI research universities. It also states that there are specific risks to use AI automated recognition applications and that the European Commission should ban automated biometric identification such as facial recognition for educational purpose, unless its use is allowed by the law (§45).

It is interesting to note that the **Consultative Committee of the Convention 108 on data protection, issued guidelines on facial recognition** in 2021, (Consultative Committee Convention 108, 2021) in which it did not recommend to ban facial recognition in education but affect recognition. It stated that: "affect recognition can also be carried out with facial recognition technologies to arguably detect personality traits, inner feelings, mental health or workers' engagement from face images. Linking recognition of affect, for instance, to hiring of staff, access to insurance, to education may pose risks of great concern, both at the individual and societal levels and should be prohibited" (1.1).

## Examples of national or institutional regulation on AI

The Cyberspace Administration of **China** (CAC) has released a draft regulation titled "Regulations on Governing the Service of Generative AI" for consultation. The regulation aims to govern the use of Generative AI (GAI) services within the People's Republic of China. It encourages innovation, trustable AI, and the use of safe software, tools, computing, and data sources. Discrimination based on race, ethnicity, religion, nationality, gender, age, or profession is prohibited throughout the AI design process. Intellectual property rights and business ethics must be respected, and unfair competition is not allowed.

GAI providers are expected to adhere to core values, avoid the unauthorised use of personal information and commercial confidentiality information, avoid unlawful content, and refrain from generating disinformation or content that may cause social or economic disruptions.

Providers are responsible for ensuring the authenticity, accuracy, objectivity, and diversity of the data. Transparency is emphasised, with providers required to disclose information about data sources, labelling, algorithms used, and user complaints mechanisms should be in place. Users should be provided with guidance on responsible AI usage and prevention of harm to others by providers.

Before offering GAI services to the public, providers must undergo security assessments and register with the Cyberspace Administration of China. Non-compliance with the regulation can result in penalties, including fines and service suspension.

On a different continent, the authorities in **Brazil** are in the process of drafting a new framework for regulating the ethical and responsible use of Artificial Intelligence (AI) systems. This new bill, which will result in the replacing of three previous bills, comes about after a lengthy consultative process. The bill consists of eight separate chapters dealing in depth with the following points:

- Establishing national norms for ethical and responsible use of AI systems;
- Protecting individual rights;
- Risk based approach to AI regulation;
- Governance and algorithmic impact assessments of AI systems;
- Civil liability for damages caused by AI systems;
- Regulation and oversight of AI law.

Its primary aim is to grant individuals significant rights and place specific obligations on companies that develop or use AI technology (AI suppliers or operators). To achieve this, the bill establishes the creation of a new regulatory body to enforce the law and takes a risk-based approach by categorising AI
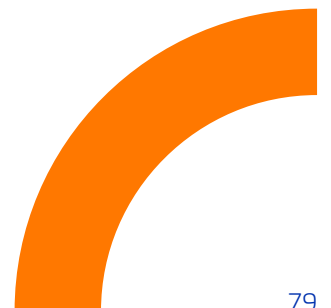
systems. It also introduces a protective system of civil liability for providers or operators of AI systems, along with a reporting obligation for significant security incidents.

Ethics is not only about defining principles top-down, but also about the discourse of the people involved or affected. In **Switzerland** for example, a data use policy for the digital education area is being developed with, among other things, ten use cases, which are being accompanied in various contexts. By monitoring the use cases, potentials and challenges are identified, norms of education are discussed, and relevant stakeholders are involved (Educa, 2021).

The challenge of academic honesty in a world driven by AI applications is also a major area of concern at the moment. In the Chapter 7 this area is covered in some detail. It is worth reiterating here for example that some organisations are beginning to put a greater focus on this area both for staff and students. For example, the **International Baccalaureate Organisation** (IBO) puts a strong emphasis on academic integrity of both teachers and students. Each school has its own academic integrity policy based on the IBO recommendations. As a response to the raising worries of IB educators worldwide regarding students' usage of AI software,

Matt Glanville, Head of Assessment Principles and Practice at IBO, shared in a blogpost from February 2023 his views on the latest developments of AI. Furthermore, in March 2023, IBO published an official statement about ChatGPT and AI in assessment and education.

**Universities** worldwide, concerned by the same academic integrity issue, have started publishing guides on their library websites about how to reference generative AI and use ChatGPT-like apps in university assignments.

## Guidelines on applying AI specifically to education

While the frameworks mentioned above concern AI in general, other guidelines, e.g., Ethical guidelines, Beijing consensus, Guidance for policy-makers and Guidance for Generative AI in Education and Research have been published that apply directly to education.

**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.
- **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.
- Consideration for the people, their identity, integrity, and dignity comprise **humanity.** For a meaningful human connection, we must consider the well-being, 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.

Key Requirements for Trustworthy AI recommendable for any AI system deployed and used in education are human agency and oversight, transparency, diversity, non-discrimination, and fairness, societal and environmental wellbeing and privacy and data governance.

The Ethical guidelines on the use of AI and data in teaching and learning 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 International Conference on Artificial Intelligence and Education**, held in Beijing in May 2019, led to the adoption of the Beijing Consensus on Artificial Intelligence and Education, the first ever document to offer guidance on how best to harness AI technologies to achieve the Education 2030 Agenda (UNESCO, 2019). Among the recommendations included in this consensus is "ensuring ethical, transparent and auditable use of education data and algorithms". The parties to the Consensus recommended the following for educators:

*"Be cognizant of the dilemmas of balancing between open access to data and data privacy*

*protection. Be mindful of the legal issues and ethical risks related to data ownership, data privacy and data availability for public good. Be mindful of the importance of adopting principles of ethics-, privacy- and security-by-design.*

*Test and adopt emerging AI technologies and tools for ensuring teachers' and learners' data privacy protection and data security … Develop comprehensive data protection laws and regulatory frameworks to guarantee the ethical, non-discriminatory, equitable, transparent and auditable use and reuse of learners' data."*

Released in 2021, the <u>UNESCO guidelines on AI and education for policy makers</u> aim to offer "guidance for policy-makers on how best to leverage the opportunities and address the risks presented by the growing connection between AI and education" (UNESCO, 2021). Some of the policy recommendations are about policies and regulations for equitable, inclusive and ethical use of IA and include to:

- establish and monitor measurable targets to ensure inclusion, diversity and equality in teaching and developing AI services;
- review AI's ability to either alleviate or exaggerate biases;
- create AI applications that are free from gender biases and ensure that the data used for development are gender-sensitive;
- establish data protection laws which make educational data collection and analysis visible, traceable, and auditable by teachers, students and parents;
- investigate options for striking a balance between open access and data privacy;
- facilitate open debates on issues related to AI ethics, data privacy and security, and concerns about AI's negative impact on human rights and gender equality.

Recently, UNESCO also released <u>Guidance for generative AI in education and research</u> (2023), which aim to support countries in implementing actions to ensure a human-centred vision of these technologies, including by proposing key steps to regulate the use of generative AI in education. Among these steps are notably the adoption and implementation of data protection laws and the definition and enforcement of an age limit for the use of generative AI which should not be below 13 (UNESCO, 2023, p.21)

# Data Protection

The right to privacy is a long-established fundamental right at the international level (European Union Agency for Fundamental Rights), enshrined for example in the **International Covenant on Civil and Political Rights and the Convention on the Rights of the Child**. At the European level, it is enshrined in the European Convention on Human Rights (ECHR, Art. 8) and at the level of European Union, in the Charter of Fundamental Rights of the European Union (Art. 7).

Furthermore, other instruments also include provisions on personal data protection, such as the Treaty on the Functioning of the European Union (Art 16) and the EU Charter of Fundamental Rights of the European Union (Art 8), or are even entirely dedicated to the topic, such as the Convention for the Protection of Individuals with Regard to Automatic Processing of Personal Data (Convention 108+), the Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data (GDPR), as well as the EU Regulation 2018/1725.

Some non-binding guidelines have also been released, such as the **Council of Europe** Guidelines on Children's Data Protection in an Education Setting. These guidelines aim to help explain the data protection principles of Convention 108+, previously referred to in this document, and to tackle the challenges in the protection of personal data brought by new technologies and practices, whilst maintaining technologically neutral provisions. The guidelines aim to ensure that the full range of the rights of the child are met as pertains to data protection as a result of interactions with an educational setting, among which are the rights to information, to representation, to participation, and to privacy (Consultative Committee Convention 108, 2020). They should be fully respected and given due consideration for the child's level of maturity and understanding.

In the **United Kingdom, the Open University** UK published a Policy on Ethical Use of Student Data for Learning Analytics, which include 8 principles, among which are defining purpose and boundaries regarding the use of learning analytics, transparency of data collection, and absence of bias. In the **Netherlands,** the SURF foundation published a guiding paper on how to treat educational data in a privacy conform way under the Dutch Data Protection Act in 2017. This guiding paper on how to use learning analytics (collection and analysis of data, LA) in education under the Dutch Data Protection Act includes a step-by-step plan. It explains what personal data is, the compliance for collection, security disclosure

requirements and storage requirements, along with all the obligations institutions must consider before using LA. The providers must be specific about:

- which data is collected;
- why is the data collected;
- how will the data be collected;
- how will the data be used (what will be done with it);
- who had access to the data;
- users right to access data;
- users right to correct or remove data;
- users right to object.

Some interesting points are firstly that the act does not allow for automatic decision-making on a personality profile, as systems using LA can only make recommendations (e.g., the system can grade a student, but not force the student to do more exercises). All decision-making must be done by human intervention. Furthermore, in the EU processing's agreement cloud services and third parties are required to account for confidentiality, privacy and ownership. The final interesting point is the exception of the law on aggregated data (made anonymous by statistics), which can be used freely.

## Some examples of cases regarding violation of privacy and data protection in education

Cases have already been brought to court regarding alleged violation of privacy and data protection in education. For example, at the European level, the European Court of Human Rights recognised a violation of Article 8 of the ECHR, in the case of _Antović and Mirković v. Montenegro_, in 2017. It was initiated by two professors who complained about an invasion of privacy because of video surveillance installed in areas where they taught, on which they stated to have no control over the information collected. The court found that "the camera surveillance had amounted to an interference with the applicants' right to privacy and that the evidence showed that that surveillance had violated the provisions of domestic law. Indeed, the domestic courts had never even considered any legal justification for the surveillance" (ECHR, 2017).

At the EU level, the European Court of Justice (ECJ), in the case _Nowak_ in December 2017, stated that Article 2 of the GDPR must be interpreted as meaning that, in circumstances such as in this case, "the written answers submitted by a candidate at

a professional examination and any comments made by an examiner with respect to those answers constitute personal data, within the meaning of that provision" (ECJ, 2017).

In France, the administrative court of Marseille cancelled the regional decision to install facial recognition programs in two high schools in 2020. The decision was partly based on Articles 9 (related to biometric data management), 4. 11 and 7 (related to the notion of consent) of the GDPR. The administrative court stated that sufficient guarantees should have been put in place to overcome the potential lack of clear and free consent due to the relation of authority between the school and the students. Furthermore, the court also considered that there was not enough proportionality, because it was not demonstrated that usual control such as access badges, and perhaps cameras, were not sufficient enough (TA Marseille, 2020).

# Education and Ethics of AI

While AI systems have the potential to bring new opportunities to education and address some of the challenges it is facing, this can only be done by also recognising and addressing the various risks and challenges that can arise with AI. Many rights can be infringed by using AI in education, and the effects of these violations can be very important with long lasting effects, including for (but not limited to) career development and health. For a detailed review on how different human rights can be affected by the use of AI in education, see the report of the Council of Europe on AI and education "A critical view through the lens of human rights, democracy and the rule of law" (2022).

Some legal protections already exist, notably in terms of privacy and data protection, but it needs to be drastically reinforced, especially regarding ethics of AI, for which no binding instrument exist at the international nor regional level for now. It is encouraging to see that steps are taken at the international and national level to regulate the development and use of AI, however much more needs to be done considering the rapid development of AI and the potential consequences. The recent call for a halt in the development of powerful AI tools is another example of the awareness that exists globally about the urge to address this topic.

The various frameworks and guidelines that currently exist on the topic, while addressing different aspects, often include the following considerations: ethics of AI (including potential bias), AI literacy, gender perspective, societal and environmental wellbeing, the necessity to develop legal frameworks, high sensitivity of data on learners, data protection and the right to privacy, recognition of the roles of teachers, the need to strengthen the research for AI (especially in the public sector), safety, security, transparency, fairness and non-discrimination, proportionality and accountability.

While developing legal frameworks is a prerogative of the states, teaching and learning about AI can already help users to better use and understand AI systems.

We may distinguish between two main perspectives on the use of AI in education. The first one relies on AI-based tools that can be used for different tasks in education, like automatic student assessment, personalised learning, content-creation, etc. The second has to do with teaching and learning about AI, that is AI literacy. But they share a common background in terms of ethics being that adequate training in basic

AI principles provides essential support to students and teachers in judging the response of an AI-based tool from an ethical point of view.

Regarding education with AI-based tools, as explained by Holmes (2023), the ethics behind such systems must address important questions centred on pedagogy, assessments, knowledge, and student and teacher agency. An adequate ethical framework for AI in education needs to be built using learning and human development as a starting point, so it can be used as the core for regulation of AI-based systems used in education. It should be the responsibility of policy makers to create such a regulatory framework, so researchers and commercial actors behind the development of AI-based tools can follow such rules.

AI literacy and digital citizenship are essential topics that should include formal training for responsible use of AI and data-driven technologies, with a critical mindset to be aware of the possible directions and limitations of these systems. Here, an important aim is to help learners to navigate ethical issues related to digital practices, such as that of human autonomy which underpins many of the EU's values. With reliable knowledge about AI from users, learners and educators, the possible unethical response of AI-based tools will be more controlled.

For students at a given age, it will be important to include legal issues such as personal data protection (e.g., GDPR) and privacy, ethical considerations in data collection, storage and use, as well as bias and fairness in AI algorithms. It could also be useful to include examples on AI applications in tools and services, including the use of AI-powered tools for productivity, communication and entertainment, the integration of AI services in custom applications via application programming interfaces (APIs), and the evaluation of AI services in relation to privacy and data security. Similarly, students should be introduced to exploratory data analysis methods using descriptive statistics and data distributions, data visualisation techniques and tools, as well as data-driven decision-making based on automatic analysis.

It must be pointed out that education about AI could follow a developer approach, in the sense that students could act not only as users but also as programmers of simple AI systems. In this realm, it is important that they learn about the ethics and regulations about AI because they will be creating AI-based systems.
To learn more on the topic and on the existing tools helping for teaching about this issue, please refer to Chapter 3 of this report.

# Recommendations by the Squad

Caution should be a keyword at every level in using AI in education. Students need to be taught their rights and how to protect themselves, teachers need to be cognisant of the range of information collected in the AI tools they use, developers need to guard against undue influence and be aware of potential bias, and finally governmental bodies need to take a firm position with robust legislations to protect their citizens while excising a rigorous approach to their own use of AI in data collection.

In general, we recommend the following learning goals related to AI literacy and ethics:

- Identify and analyse the ethical and environmental opportunities and threats arising from the everyday use of AI.
- Promote a safe, responsible and conscious use of digital tools and technologies related to AI.
- Analyse and understand the human footprint and the influence of risks in automated decision-making processes.
- Identify and evaluate the ethical and policy implications of the design and use of AI systems, including fairness, bias, discrimination and accountability.
- Critically analyse the potential of AI to improve peoples' quality of life, assessing its operability in different social, economic and cultural contexts.
- Know and understand the risks and benefits of AI in different areas, such as health, security and privacy.

# Teaching with AI – Assessment, Feedback and Personalisation

# Introduction

The focus of this chapter is to explore the potential of a number of related areas in the domain of teaching *with* artificial intelligence (AI) – assessment, feedback and personalisation. It builds on the previous chapters, each of which have explored different facets of the use of AI in education. One of the most touted benefits of AI for education is the potential it offers for personalisation - the delivery of education interventions that are tailored to the specific needs of individual learners. This may be manifest in a variety of ways, including via adaptive learning and intelligent tutoring systems. At the core of this capacity is the ability to assess a learner's mastery of a particular concept, identify gaps in knowledge or areas for improvement, and deliver feedback or resources to address that gap (Phillips et al, 2020). The ability to harness AI to create high quality assessments, feedback and tailored resources has the potential to deliver benefits for individual students, teachers, education institutions, and society as a whole.

In considering this potential, it is important to consider education in all its complexity and be mindful of the potential risks as well as the benefits. As detailed in Chapter 5 of this report, the draft EU Artificial Intelligence Act proposes a risk-based approach to AI focused on four risk levels: unacceptable, high, limited, and minimal. Throughout this chapter, we aim to draw attention to the potential for risk as we explore how AI's capacity for personalisation might deliver benefits at many levels (learner, teacher, institution, using the same distinction as the Wayne Holmes et al, 2022 report) of the education system and ultimately at the broader societal level.



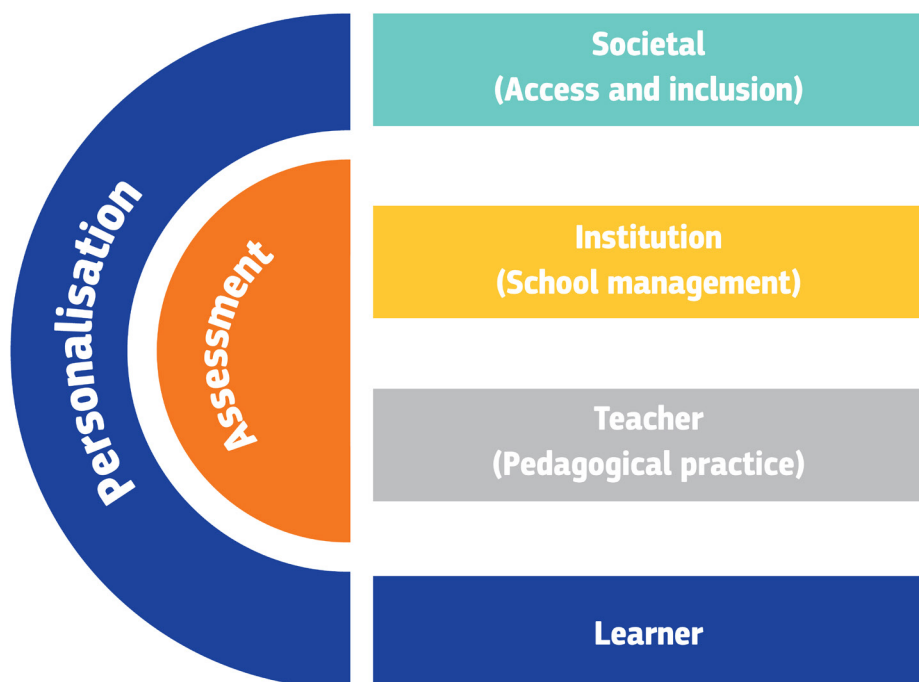*Figure 6;*
*Source: Dara Cassidy & Jessica Niewint-Gori, licensed*
*under CC BY 4.0*

# Student Focus

The Ethical guidelines on the use of AI and data in teaching and learning (EC, 2022) distinguishes between AI tools that are focused on teaching students and those that are focused on supporting them. Chapter 3 provides examples and use cases of the former in relation to intelligent tutoring systems. Another very recent example of this is the Khanmigo system, from Khan Academy. Still in beta at the time of writing, this platform leverages the power of AI to offer individualised coaching to students on the Khan Academy platform.

In terms of supporting students, one of the most significant affordances of AI is the potential it offers for personalised learning approaches. Personalised learning refers to the ability to tailor aspects of the learning process, such content or pace to individual abilities, interests and learning preferences.  The ability to personalise the learning process offers the promise of greater autonomy for students and has the potential to increase engagement and motivation.

AI also offers potential benefits in terms of its ability to deliver feedback on performance. Feedback has been shown to be one of the most powerful influences of student attainment and the provision of quality, timely feedback as part of an assessment *for* learning strategy is recognised as highly valuable for the learning process as can be read in Teachers' feedback practice and students' academic achievements. Given that the provision of useful feedback has been recognised  as challenging at all levels of education (A qualitive study of primary teachers' feedback rationales, Value and effectiveness of feedback in higher education, and Misconceptions about teachers' feedback), the potential of AI to deliver enhancements certainly merits exploration.

For example, applications such as learning analytics dashboards could provide benefits in supporting student

success and increasing learner awareness and regulation of their learning processes, providing visual cues and features that enable students to monitor their progress, identify areas for improvement and make data-driven decisions. In addition, learning analytics tools promote personalised feedback, enabling students to identify areas for improvement and adjust their learning strategies accordingly. The dashboards also play a role in improving motivation by giving learners a sense of control over their learning process through progress tracking and goal setting. Teachers could also benefit from these insights, enabling them to effectively support students who may need additional help.

**Personalised**
Feedback can be tailored to each learner's specific goals and can help them identify areas where they need to improve.

**Immediate**
AI can provide learners with immediate feedback on their performance, allowing them to make adjustments to their learning strategies in real-time. This can help learners to stay motivated and engaged, as they can see the impact of their efforts straight away.

**Multimodal**
AI can provide feedback in a variety of formats, including text, audio, and video. This can help learners to engage with the feedback in a way that is most meaningful to them and can help to reinforce learning.

**Actionable**
Feedback that provides specific and concrete suggestions or steps that can be taken to improve or address a particular situation or performance.

**Interactive**
AI-powered systems can provide learners with interactive feedback that allows them to engage with the feedback in a more meaningful way. For example, learners may be able to ask questions or receive additional information about specific concepts or topics.

**Detailed**
AI-powered systems can provide learners with detailed feedback on their performance, including specific areas where they need to improve and suggestions for how to do so. This can help learners to better understand their strengths and weaknesses and develop more effective study strategies.

*Figure 7: Shows some good practice aspects of feedback that AI can be harnessed to deliver.*
*Source: Dara Cassidy & Jessica Niewint-Gori, licensed under CC BY 4.0*
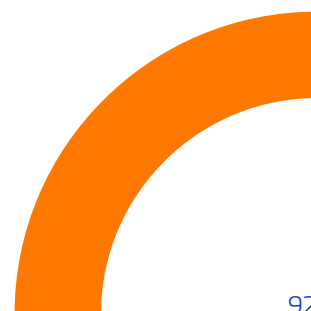
Imagine that a student, named John, is working on a STEM project about plastic pollution for a formative assessment in his class. John's project involves elements from all four STEM disciplines: Science, Technology, Engineering, and Maths. John is using an AI-powered platform to develop his project, which provides feedback on his progress throughout the project.

As John works on his project, the AI platform uses machine learning algorithms to analyse his work and provide feedback. The AI system evaluates John's work across all four STEM disciplines, including his understanding of the scientific principles behind plastic pollution, his ability to design and build a prototype solution, and his mathematical analysis of the environmental impact of plastic pollution.

Based on this analysis, the AI system provides feedback to John on his project work. For example, the system may identify that John needs to work on improving his data analysis skills to provide a more accurate assessment of the environmental impact of plastic pollution. Additionally, the system may identify that John's prototype could be improved by using more advanced materials or technologies, and suggest specific resources or strategies to help him make these improvements.

The feedback provided by the AI system is personalised to John's specific project and STEM skills, providing him with actionable guidance on how to improve his work. The feedback is also provided in a clear and concise manner, making it easy for John to understand and apply to his project.

The AI system provides John with valuable feedback on his STEM project work, helping him to identify areas for improvement and work towards achieving his academic goals. By providing personalised feedback across all four STEM disciplines, the AI platform supports John in developing a well-rounded and comprehensive understanding of the complex issue of plastic pollution.

**Potential risks in this scenario**

A key issue in the field of AI in education relates to the fairness, accountability, transparency, and ethics (FATE) of educational tools that are based on AI algorithms, such as the intelligent tutoring systems or automatic assessment systems discussed above. This is due to the "opaque" nature of the machine learning techniques used to create models of different aspects of the learner from data captured while he/she is interacting with the tool. For AI to be more trusted in education, there is a need for more research into Explainable AI (XAI), which promotes the use of methods that produce transparent explanations and reasons for the decisions AI systems make.

Another issue relates to the purposes for which the AI platform data are used. If the feedback provided by the AI system is used to grade John's work, it could indirectly influence his academic record, which could affect his access to educational or vocational opportunities. So, if the AI's evaluation and feedback are used to grade John, that AI system falls into the high-risk category. Also, the AI system could potentially influence John's level of education and training, particularly if it is used to tailor his education to his specific skills and interests. For example, if the AI system identifies that John excels in maths and science, but needs more support in technology and engineering, this could influence the classes he is placed in or the support he receives. This can be positive, but it also holds a risk if the AI system makes incorrect assessments due to biases or inaccuracies in its algorithms. If AI is used in exam proctoring, its monitoring of John's behaviour could raise privacy concerns (Coghlan et al, 2020). Moreover, algorithmic bias could result in John being inaccurately flagged for cheating. If as a result, John was suspended from school, the school might be in breach of the GDPR if it had relied on the AI judgement and had not conducted a human investigation of the cheating allegation.

While the use of AI for formative assessment can be considered minimal or limited risk, its use for high-stakes assessment could be more problematic if it extends beyond well-established objective formats such as multiple-choice questions into grading more open-ended type assessments, such as essays and reports. Moreover, the advent of widely available generative AI poses risks for many long-standing assessment formats and requires educators to reconsider their validity in the age of AI. Whilst plagiarism detection services are working to develop reliable generative AI detection capabilities (Khalil & Er, 2023), at present this remains aspirational and a study by Sadasivan et al (2023) suggests that it is unlikely to be possible. Issues regarding academic integrity are discussed further in Chapter 6 of this report.

In all high-risk areas, it is essential to ensure that AI systems are developed and used responsibly, with particular attention paid to the accuracy and fairness of their decisions, as well as respect for privacy rights. This risk could be mitigated by taking steps to ensure that the AI system is transparent and unbiased and its decisions are interpretable and can be overridden by human judgment.

**THINGS TO CONSIDER**

- Explainabilty
- Algorithmic bias
- Generative AI and academic integrity
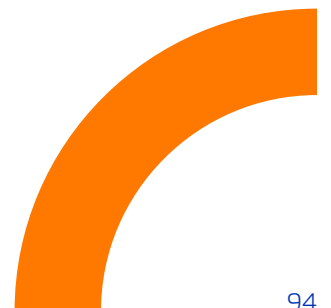
# Teacher Focus

According to the [Ethical guidelines on the use of AI and data in teaching and learning](#), AI offers educators a variety of tools to support their teaching strategies, including administrative tasks and personalised feedback. By automating tasks like grading and attendance tracking, AI could potentially free up teachers' time to focus on more crucial activities. It could also facilitate the implementation of innovative pedagogies that would otherwise be challenging to execute, e.g. collaborative inquiry using game-based learning ([Lee et al, 2021](#)). AI's potential applications in education are vast, ranging from using it to generate lessons plans to supporting simulation-based learning ([Dai & Ke, 2022](#)) to providing real-time feedback based on expert pedagogy. It can generate post-lesson reports, help teachers stay updated with advancements in their field, and boost learner confidence by offering constructive feedback and creating a safe environment for skill development. AI can improve educational processes by evaluating written work, providing feedback on spoken responses, and adapting learning materials through adaptive systems. It can increase engagement through gamification and support collaborative learning. As mentioned above, it can also be used to automate grading, detect plagiarism and academic misconduct, and evaluate assessments to identify learning gaps and measure effectiveness. (See Table 1 for a list of other AI applications that could be useful for teachers).

*Table 1*

| **Analysing written work** |
| --- |
| AI can evaluate written assignments, such as essays, by checking for grammar, spelling, punctuation, and even assessing coherence and structure. This helps students improve their writing skills and **saves time for educators who would otherwise need to review each assignment manually.** |
| **Natural language processing** |
| AI can interpret natural language, the way humans use language to express thoughts, ideas, and emotions. This ability can be **harnessed to provide feedback on spoken responses, presentations, or other verbal communications.** This can be particularly helpful for language learning or public speaking practice. |

| Adaptive learning systems |
|---|
| AI can track students' performance over time, adjusting feedback and learning materials to continually challenge and support their growth. This enables a more dynamic and responsive learning experience that evolves with the student. It thus enables teachers to support the progress of many learners operating at different levels and could be part of **a universal design for learning strategy.** |

| Gamification |
|---|
| AI can be integrated into educational games, providing instant feedback and encouragement, promoting engagement, and **making learning more enjoyable.** |

| Peer review support |
|---|
| AI can facilitate peer review processes by helping students **provide constructive feedback to their peers**, guiding them through the evaluation process, and offering suggestions for improvement. |

| Sentiment analysis |
|---|
| AI could analyse **student emotions and engagement** through factors such as facial expressions, tone of voice, or written communication. This could provide feedback on communication skills, in areas where such skills are critical, such as healthcare. It might also be used to help teachers identify students who may be struggling emotionally or are disengaged from the learning process, and provide appropriate support. However, it seems likely that AI based on emotion recognition systems will not be permitted in EU education systems. |

| Data analysis and insights |
|---|
| AI can process large data sets quickly, identifying patterns and trends that can inform feedback strategies. **This could help educators understand which approaches are most effective and identify areas where additional support may be needed.** |

| Consistency |
|---|
| AI systems should be able to provide consistent feedback based on pre-defined criteria, eliminating the potential for human bias or variability in evaluation to ensure that all students receive **fair and unbiased feedback.** |

| Assessment |
|---|
| AI is making an impact on educational assessment with applications such as automated grading, plagiarism detection, predictive analytics, assessment analytics, and item analysis. Automated grading saves teachers' time and ensures consistent and objective assessment. Plagiarism detection holds students accountable for their work by identifying instances of plagiarism. Predictive analytics uses AI to forecast student performance based on their past assessments and coursework. Assessment analytics analyses data from summative assessments to evaluate students' learning progress and identify knowledge gaps. Item analysis examines the effectiveness of individual assessment questions. These AI-driven approaches aim to enhance the reliability, fairness, and informativeness of assessments, transforming the way student learning and performance are evaluated. |

As always there is gap between what could be done and what should be done. Ethical concerns have been expressed around uses such as the prediction of student performance and the use of sentiment analysis to assess emotions, which may become prohibited in the EU.  While AI has the potential to improve education by personalising and enhancing efficiency, there are risks to address. AI-generated texts may lack diversity and authenticity, and AI models often prioritise quick answers over pedagogical soundness (e.g., predictable and controllable learning pathways that rely on standardised questions which, in turn, encourage standardised answers). Furthermore, the rapid progress of AI can create motivation issues and uncertainty among students regarding the value of their skills. So far, the adoption of AI-based adaptive learning platforms in schools has been slow, and many AI tools used in schools may lack thorough research regarding their usefulness. Factors influencing adoption include the impact on teacher workload, teacher ownership and trust, support mechanisms, and ethical considerations.

## Scenario:

Robert, a computer science professor, is preparing his group of 40 international students for a major project as part of their course. The project involves the development of a piece of software for which the students have to submit a preliminary proposal. Robert is using an AI-powered platform to help his students draft their project proposals and receive feedback before submitting the final proposal. The AI system first analyses the draft proposals using sophisticated data analysis techniques to determine the key concepts and overall logical structure. It then applies a pre-defined coding language model to assess the quality of the proposed software solution, including design, code structure and potential logical errors. Based on this assessment, the AI system generates feedback for each student. The system could highlight if a student is struggling with the design of the software and suggest that they work on making their proposal more robust and practical. It could also identify specific logical or structural flaws and offer suggestions for improvement. The feedback generated by the AI platform is tailored to each student's specific software development skills and needs, giving them practical advice on how to improve their programming skills. The feedback is clear, concise and immediately applicable, helping students to refine their suggestions. Without the AI system, Robert might struggle to provide each student with detailed, personalised feedback on their project proposals.

### Potential risks in this scenario

While this case of AI application appears to be a relatively low-risk scenario, certain challenges could arise if this AI system is used to grade the final project submissions. The marks awarded by the AI could have a direct impact on the students' overall marks for the computing course, potentially affecting their overall academic standing. This could also influence decisions about their options for further study or career choices in computing. While the system, when used formatively, provides valuable feedback that can help students improve their software development skills, when used for summative purposes, it could influence their course outcomes or the resources they receive. In line with the GDPR directive that individuals should not be subjected to automated decision making, a human element needs to be introduced to monitor and validate the AI's assessment and recommendations. In addition, the increasing use of AI in higher education for personalised learning can potentially raise data privacy and security issues. The AI system will have access to significant amounts of personal and academic data, and mishandling or a breach could result in the exposure of sensitive information. Universities should therefore ensure that robust data protection measures are in place when deploying such AI systems.

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### THINGS TO CONSIDER

- **The ethical dimensions of using AI tools**
- **Data protection**
- **Alignment of AI use with educational best practice**

# Institution Focus

The various applications of AI in education include institutional use for tasks such as marketing, curriculum planning and resource allocation. For assessment at the institutional level, AI can support student record systems, scheduling, test preparation, reminders, and learning analytics. For personalisation, AI could contribute to lesson planning, learning management and adaptive learning systems, and provide tutoring and support outside the classroom. It could also help create personalised learning content through recommendation systems. AI could also support students by scheduling courses, suggesting majors and career paths, and providing timely financial aid information. It is helping to prevent students from dropping out through predictive analytics and improving teaching and training through AI-based software systems. However, it is important to consider student autonomy and privacy in these applications.

To support the process of inclusion, AI has the potential to facilitate communication between parents and teachers, to reduce the impact of administrative burden through automated processes and chatbots, or the use of virtual assistants and assistive technologies. AI's potential also extends to overall school and facilities management, including staff scheduling and substitution management, professional development, transportation, maintenance, finance and cybersecurity. It could therefore play an integral role in ensuring the safety and security of the educational environment.

**Student records systems, and scheduling**: When implemented in student record systems, AI can improve the efficiency and accuracy of data management, streamlining administrative tasks such as enrolment, grading and tracking student progress. It can also optimise scheduling by generating optimal schedules for classes, exams and other academic events, taking into account factors such as resources, time constraints and student needs. A list of these uses can be seen in Table 2.

*Table 2*

| Assessment |
|---|
| • Test Prep: AI assists to tailor study plans and materials based on a student's individual learning preferences and progress, leading to more effective study sessions. |
| • Scheduling: AI optimises timetables for exams, balancing the need to spread out assessments while considering student course loads and institutional resources. |
| • Reminders: AI sends automated reminders about upcoming tests or study sessions, reducing the chances of students or faculty forgetting important dates. |
| • Data and learning analytics: analysing large sets of data, AI can provide valuable insights into learning trends and areas needing improvement, making the learning analytics process more precise and actionable. |

| Learning management |
|---|
| • Lesson planning: Assistance in lesson planning by analysing student performance data and identifying individual learning preferences, allowing educators to tailor instructions to meet diverse learning needs. |
| • Adaptive learning systems: Systems powered by AI can adapt the learning pathway to each student's pace and level of understanding. |
| • Tutoring and support outside the classroom: Providing tailored tutoring and support, identifying areas where students struggle and offering targeted resources or exercises. |
| • Recommendation system for learning content creation: By analysing student data and engagement levels, AI can suggest what type of content is most effective and engaging for different groups of learners, aiding educators in creating more impactful learning materials. |
| • Enhance motivation: AI can increase student engagement and motivation in their learning process by personalising the learning experience and providing immediate, constructive feedback. For example, AI algorithms can adjust the difficulty of tasks based on the student's performance, ensuring that they are continually challenged but not overwhelmed. |
| • Immersive learning simulations: By integrating AI with technologies such as virtual and augmented reality, educational institutions can develop realistic simulations of complex concepts or scenarios. These immersive experiences can make learning more interactive and engaging, increasing student motivation, understanding and retention. This advanced, experiential learning method not only motivates students to explore subjects more deeply, but also allows them to apply theoretical knowledge to practical situations in a risk-free environment. |
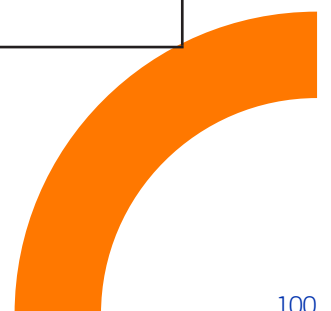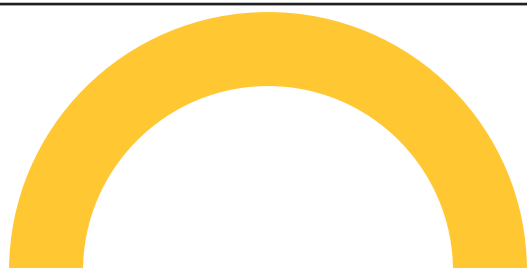
## Inclusion

- Parent-teacher communication: AI has the potential to facilitate parent-teacher communication by providing automated updates on student progress and behaviour, making interactions more frequent and meaningful.
- Chatbots / virtual assistants / assistive technology: additional support, for example reading text aloud, or guiding the user automatically through administrative tasks making them more accessible.

## Additional Areas

- School management, facilities management: staff scheduling and substitute management, professional development, transportation, maintenance, finance, cybersecurity, safety and security.
- Reducing the administrative burden through automated processing: by supporting processes like attendance tracking, streamlining enrolment and admissions or assisting in budgeting, invoicing, and other financial tasks, AI provides a way for educational administrators to save time, increase accuracy, and focus their efforts on strategic decision-making and student interactions.

A school decides to include AI driven technologies to personalise learning, streamline operations and promote inclusivity within the school community. The school began by implementing an AI-powered student records system. This system automated the storage, sorting and retrieval of extensive student data. From managing grades and attendance to tracking behavioural patterns and extracurricular activities, the AI-powered system ensured fast, accurate and seamless management of student records. To streamline administrative processes, the school used AI for scheduling tasks. The AI algorithm optimised class schedules, teacher schedules and room assignments, taking into account elements such as optimal class sizes, teacher availability, and room capacity, significantly reducing administrative work and increasing overall efficiency.

To support and personalise education, the school decided to implement AI-powered automated grading systems. These systems could assess a variety of assignments, from multiple-choice quizzes to written essays and oral presentations. The AI grading system not only reduced teacher workload, but also provided students with timely and consistent feedback, as it also identified patterns in student performance, highlighting areas where additional support might be needed. The AI system also played a key role in personalising learning for each student. It tracked students' progress, identified their strengths and weaknesses, and tailored learning materials accordingly. For example, the AI-enabled learning management system would recommend additional resources for a student struggling with maths or suggest advanced content for a student excelling in science. It could also provide tailored tutoring support outside the classroom.

To promote inclusivity, the school used AI-based assistive technologies. These technologies, such as speech-to-text and text-to-speech converters, supported students with disabilities and ensured their full participation in the learning process. AI-powered chatbots were made available 24/7 to answer students' questions. In addition, AI virtual assistants helped with administrative tasks such as class registration and resource location, making the school more accessible to all students.

**Potential risks in this scenario**

This scenario entails a broad adoption of AI-driven technologies within an educational setting to enhance and streamline various operational and academic aspects. For example, the AI-powered grading system could have a significant impact on a student's academic record, which can in turn influence their educational trajectory and future opportunities. If misapplied, this could lead to unfair decisions that could affect a student's access to further education or training. Moreover, grading and

feedback should be transparent and reliable, and students should have avenues to appeal their grades if they feel they have been unfairly evaluated. The ability of AI to personalise learning could have a significant influence on a student's educational trajectory. This could be advantageous, but it could also limit a students' educational journey if the system classifies them into certain categories. For example, whereas a human teacher may be aware of extenuating family circumstances that are impacting a students' performance and make allowances for that, an AI system's 'objective' assessment may not account for such factors and may unfairly prejudice the student.

A concern across all these areas is data privacy. Managing student records involves handling sensitive information. It is essential that AI systems have stringent data protection measures and comply with relevant data privacy laws and regulations.

Ensuring transparency, fairness, and accuracy in all AI operations to mitigate these risks is a key factor and human oversight should be integrated into these processes to ensure checks and balances.

## THINGS TO CONSIDER

- **Technological infrastructure**
- **Data collection, management and protection**
- **Ethical dimensions of AI for summative assessment**
- **Staff training**
- **Parents and stakeholders**

# Societal Focus

Inclusion and equity, two interconnected concepts, advocating for access to the same educational opportunities for all students, regardless of social categories such as race, gender, class and more. Educational equity is evident when teaching styles are adapted to meet students at their individual learning levels and provide the necessary support. It is also evident when students can identify with their race and community in their educational environment. Inclusive education is essential as it empowers underprivileged and underserved students to overcome challenges and achieve success. Policies to promote these concepts are essential. A good example is the UNESCO guidelines, which serve as a blueprint for ensuring inclusion and equity in education. While equity focuses on access to opportunities, fairness, and justice, inclusion values diversity of identities. Incorporating an equity lens into SEL helps students develop necessary academic and social skills while promoting an equitable and inclusive classroom environment. AI has potential to enhance equity and inclusivity in educational scenarios. Recent trends show an increased focus on diversity, equity and inclusion (DEI) within AI for Education (AIEd). AI's ability to tailor learning experiences, provide individualised support and reduce achievement gaps can greatly enhance equity in education. UNESCO's mandate, which calls for a student-centred approach to AI in education, is consistent with these principles of inclusivity and equity. In addition, AI can be used to help identify and correct bias in educational materials and assessments, fostering an inclusive environment by contributing to the development of fair and unbiased learning opportunities for all students.

In considering all of this, we should be mindful of phenomena such as the Matthew Effect - a process by which early advantages are compounded over time giving further benefits to those who are already privileged. In education, a digital Matthew Effect may see unequal access and different uses of technology between socio-economically advantaged and disadvantaged students reinforce existing inequalities and amplify early advantages.

Nevertheless, *AI has the potential to* enhance equity and inclusivity in education in several ways:

**Personalised learning**: By providing personalised instruction, support and resources, AI can ensure that students are able to learn at their own pace, according to their unique learning preferences.

**Identify and mitigate bias**: Analysing educational materials and assessments to identify potential biases. This could include biases in the way questions are asked, or biases in the materials themselves. Once identified, these biases can be addressed to ensure that all students have access to fair and unbiased learning opportunities.

**Supporting underserved or disadvantaged students:** Providing additional support and resources for students who might otherwise be underserved or disadvantaged. This could include students with disabilities, students from lower socio-economic backgrounds, or students learning in a second language.

**Data-driven insights:** Provide insights into student performance, learning trends, and potential gaps in education to help educators and administrators make more informed decisions about how best to support all students and promote educational equity.

**Accessibility:** AI supported technologies such as speech-to-text and text-to-speech converters or translation services can help make learning more accessible to all students, regardless of their physical abilities or language skills to ensure that all students can fully participate in the learning process, promoting greater inclusivity.

In order to maximise the potential use of AI to enhance equity and inclusivity in education, it is important to:
- ensure that these systems are designed with equity and inclusivity in mind from the outset;
- consider potential challenges, such as data privacy;
- be aware of the risk of algorithmic bias;
- ensure that AI is used in a way that respects students' rights and upholds the principles of equity and inclusivity.
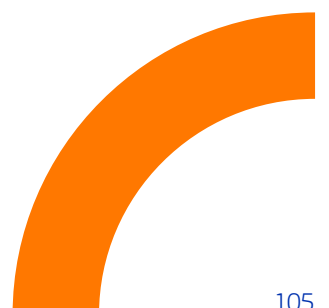
A public school in a low-income neighbourhood faces a few challenges: a high student-teacher ratio, diverse student backgrounds with varying levels of English proficiency, and a significant number of students who struggle academically. To address these challenges, the school administration decides to integrate AI technology into its operations. The goal is to close the education gap and give all students an equal opportunity to succeed, regardless of their socio-economic status. An AI solution is implemented in the student record system to identify student needs based on collected, such as attendance, past performance and behaviour. This system helps to identify students who may be at risk academically or personally, so that interventions can be initiated promptly.

The AI driven system could also optimise scheduling, ensuring that students who need extra help can get it without disrupting their regular academic schedule. It creates personalised learning plans for students based on their specific needs and pace of learning, helping them to catch up with their peers in a supportive environment. AI is also being used to improve assessment. Automated grading and feedback provide an unbiased assessment of students' work, freeing up teachers' time for more one-to-one attention with struggling students.

AI is also used to perform predictive analytics to track student performance, identifying potential learning gaps before they become problematic. In terms of inclusivity, AI-powered adaptive learning platforms and assistive technologies will be made available to all students, regardless of their socio-economic status. These platforms are designed to adapt to each student's unique learning requirements and pace. In addition, for students who do not have access to digital devices at home, the school allocates time during the day to use school computers and tablets to ensure that all students can benefit from these resources.

To engage parents and guardians who may not be fluent in English or have regular internet access, the school uses AI-powered translation services for communication and AI-enabled chatbots that can provide school updates and answer questions with a simple phone call. By integrating AI driven technologies in this way, the educational playing field could be levelled to provide every student with the personalised support and resources they need to succeed in their educational journey.

**Potential risks in this scenario**

This scenario presents a comprehensive use of AI in a school setting and addresses several challenges. Even if the AI does not directly influence decisions on admission or assignment to institutions in this scenario, the personalised learning plans, optimised schedules, and AI assessments could indirectly influence students' progress and future educational pathways. Also, the automatic grading by AI of students' work and provision of feedback, if misapplied, might lead to unfair evaluations. The creation of personalised learning plans based on students' specific needs directly influences the level and type of education students receive; this raises the risk of putting students into learning paths that may potentially limit their growth in some areas.

In this scenario, data privacy and security are critical concerns as extensive student data is being collected and analysed. Addressing socio-economic disparities in education should be done responsibly, ensuring fairness and respect for privacy. For this, human oversight is essential to correct potential errors and biases in AI operations and to address complex situations beyond the AI's ability.

**THINGS TO CONSIDER**

- **Potential to magnify existing inequality**
- **Dangers of autonomous decision making**
- **Potential disempowerment**
- **Data protection measures**

# Conclusion

We have seen in the previous discussion and scenarios that AI has the potential to deliver great benefits for education. However, we have also seen that there are also risks associated with its use. In many cases, we may determine that these are minimal risk. Examples we've discussed include the provision of formative feedback, help for teachers in creating lesson plans, and assistance in some of the administrative functions of schools. As we move away from the use of AI as a support system, so the risk increases. As we have seen, using AI for learning analytics may help teachers adjust their teaching strategies to cater to individual needs. However, using learning analytics without adequate teacher oversight may disadvantage students dealing with adverse life circumstances that are impacting their performance, thus increasing the risk level. When it comes to relying on AI for decisions that may impact a learner's future opportunities, we are moving into the 'high' and perhaps 'unacceptable' risk territories. Therefore, we can see that the level of risk resides not so much within the tool as within the contexts in which they are used. While human oversight may help to mitigate some of the risks, we should be aware of the danger of dependence lock-in, in which humans become increasingly dependent to AI to make decisions. All this underscores the importance of the development of Explainable AI, as discussed above. In order to ensure its responsible use in educational settings, it is important to remain ever aware of the balance that needs to be struck between leveraging AI's benefits and evaluating and mitigating potential risks and ensuring that human oversight is included and human values are served.

# Recommendations by the Squad

AI holds great promise for enhancing education, but it should be implemented responsibly to ensure the protection of students' rights and interests. Proper checks and balances, transparency, and human oversight are key to mitigating the potential risks associated with AI in education. AI should be used to complement and enhance existing pedagogical practices rather than replace them. AI algorithms, especially in education, should be designed to produce understandable and interpretable outcomes. Explainable AI aims to make AI decision-making processes transparent to understand how the system arrived at its conclusions, which is particularly crucial in areas like assessment. Despite the use of AI for automating various processes, human oversight should still be a significant part of the system. Educators should have the final say in grading or making decisions that significantly affect students' academic standing. AI systems must respect and protect the privacy of the students. Data handling procedures should comply with privacy laws and regulations, ensuring the confidentiality and security of sensitive student information. Biases can influence the fairness of the system and have serious implications for all stakeholders in education, so efforts should be made to identify and mitigate biases in AI algorithms. Also, if the system fails or produces erroneous results, there should be mechanisms in place to identify the cause of the issue and rectify it. To ensure the accuracy of the performance of AI systems, they should be regularly monitored and evaluated to identify and address any emerging issues promptly and to help to ensure fairness and effectiveness.

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