



European  
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# Teachers' competences

**Briefing report No. 1**

**by the European Digital Education Hub's squad on artificial  
intelligence in education**

**EUROPEAN  
DIGITAL  
EDUCATION  
HUB**

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## 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).





## 1. Information and data literacy

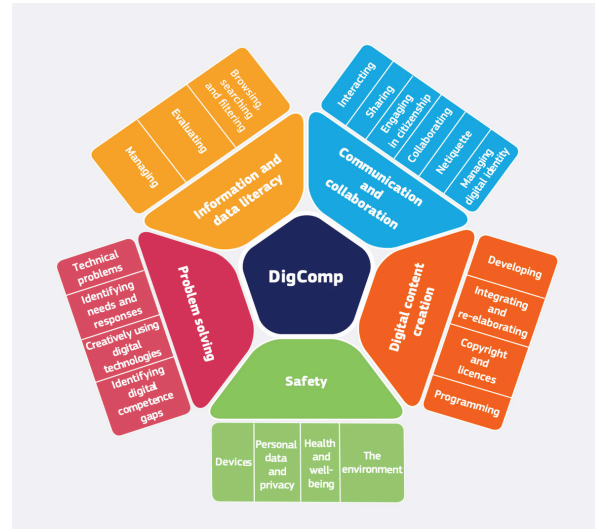
4. Aware that search engines, social media and content platforms often use AI algorithms to generate responses that are adapted to the individual user (e.g. users continue to see similar results or content). This is often referred to as “*personalisation*”.

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).



Competence areas in DigComp

## 2. 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.

### 3. 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](#).

### 4. 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.

### 5. 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).







# 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.

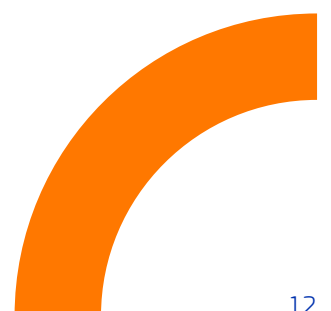




Educator-specific digital competences are captured also in the [DigCompEdu Framework](#) (2017) which aims to describe digital competences to effectively and responsibly use, create and share digital resources for learning, focusing also on the potential of digital technologies for learner-centred teaching 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:

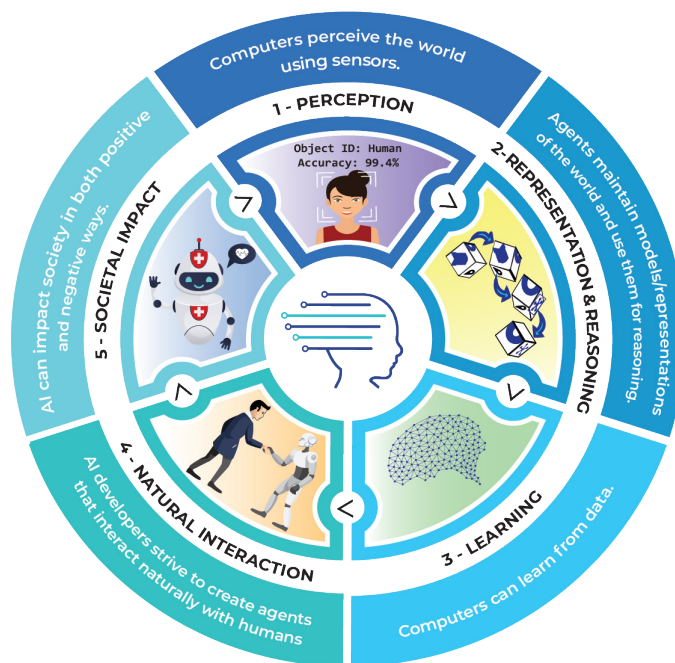
- The main areas of AI competency for teachers are AI literacy, AI and pedagogy, ethics of AI, the use of AI for continuous professional development, and the ability to foster AI competencies for students. It is important that AI literacy and competencies incorporate both the technological and human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



AI4K12 [Grade Band Progression Charts](#)



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.



*Members of the EDEH squad on artificial intelligence in education who dedicated time for this briefing report: Yann-Aël Le Borgne, Francisco Bellas, Dara Cassidy, Riina Vuorikari and Lidija Kralj.*

*EDEH squad work around preparation of education for, about and with AI continues in briefing reports that follow.*



