Empowering Learners for the Age of AI

An AI Literacy Framework for Primary and Secondary Education

OECD

European Commission

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Welcome!

Empowering Learners for the Age of AI: An AI Literacy Framework for Primary and Secondary Education (AILit Framework) is a joint initiative of the European Commission and the Organisation for Economic Co-operation and Development (OECD). CodeAI and leading international experts support its development. The AILit Framework contributes to the PISA 2029 Media & Artificial Intelligence (MAIL) Literacy assessment.

The AILit Framework is conceived as part of a broader international effort to strengthen AI literacy in education systems worldwide. Its principles and design choices are aligned with globally recognised policy frameworks developed by the OECD (*AI Principles*, *Global Partnership on AI*) and other international organisations, including UNESCO (SDG 4- Education 2030, *AI Competencies Frameworks*), UNICEF (*Policy Guidance on AI for Children*), and the World Bank (Human Capital Project). This global alignment strengthens the promotion of shared international commitments to human-centred, ethical, and inclusive approaches to AI, and promotes its adaptation to diverse education systems, governance traditions, and levels of digital readiness around the world.

This framework also aligns with the broader European Commission efforts to promote quality and inclusive education and skills provision for the digital transformation in the context of the *Digital Education Action Plan 2021-2027* (European Commission, 2020) under the *2021-2030 European Education Area strategic framework*.

In particular, the framework responds to the Council Recommendations (2023a) on digital education and skills. It also complements the 2026 *Updated Ethical Guidelines on the Use of Artificial Intelligence (AI) and Data in Teaching and Learning for Educators* (European Commission, 2026b), the *DigComp 3.0: European Digital Competence Framework* (Cosgrove & Cachia, 2025) and the upcoming *Update of the DigCompEdu* (Redecker, 2017). Furthermore, the EU AI Act (2024), which promotes a human-centred and risk-based approach to the adoption of AI systems, calls for the development of AI literacy.

This publication is based on the draft AI literacy framework launched in May 2025 that has since been revised based on an international review process in order to more closely align with the needs of education stakeholders around the world. The forthcoming 2030 Roadmap on the future of digital education and skills, a deliverable under the Union of Skills, will set out the strategic framework for mainstreaming AI literacy across European education systems.

This framework is non-binding and is intended to support teachers, school leaders and education authorities in promoting safe, inclusive, ethical and trustworthy digital education environments. It is not intended to provide guidance on the enforcement of the EU Artificial Intelligence Act (Regulation (EU) 2024/1689).

Expert Group

An international team of experts informed the development of this publication. Their insight ensures that the framework aligns with research and practice at the intersections of learning design and technology.

Cathy Adams, University of Alberta, Canada

Romina Cachia, Joint Research Centre of the European Commission, Spain

Kari Kivinen, European Intellectual Property Observatory, Spain

Victor Koleszar, Ceibal, Uruguay

Lidija Kralj, Independent Expert in AI and Data Education, Croatia

Victor R. Lee, Stanford University, USA

Tara Nattrass, Lenovo, USA (*participated until March 2025)*

Emiliano Pereiro, Ceibal, Uruguay (*participated Fall 2025)*

Florian Rampelt, Stifterverband / KI-Campus, Germany

Pati Ruiz, Digital Promise, USA

Joseph South, International Society for Technology in Education and the Association for Supervision and Curriculum Development (ISTE+ASCD), USA

Thierry Viéville, National Research Institute in Computer Science and Control Theory (INRIA), France

Development Team

Empowering Learners for the Age of AI: An AI Literacy Framework for Primary and Secondary Education is a joint initiative of the European Commission and the Organisation for Economic Co-operation and Development (OECD). Its development is supported by international experts. Project management, research, drafting, and feedback processes were supported by CodeAI (Veronica Ellis, Katie Finnegan, Marty Creel, Aleksandar Lazovski, Anchal Sayal, Pat Yongpradit and Anthony Owen). The European Commission co-funded the framework and assisted with expertise built on previous work at the EU level.

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Introduction

What is AI Literacy and Why is it Important?

Artificial Intelligence (AI) is increasingly woven into the fabric of the digital world, shaping how people experience information and interact with one another. In some cases, users are aware that they interact with AI systems in the tools and platforms they regularly use. Other times, AI systems operate invisibly to affect real-world outcomes. Its growing presence is neither neutral nor temporary.

Education systems exist to prepare young people for participation in civic, professional and social life. As the prevalence of AI grows in these domains, so too does the importance of supporting young people to navigate the presence of AI in daily life and to develop skills to use it ethically and creatively.

AI literacy, as a set of knowledge, skills and attitudes, equips learners to understand how AI systems work, critically evaluate their outputs and use them ethically and creatively. It supports informed decision making about the opportunities and risks that AI presents to oneself and others. To fully realise the potential of AI, key barriers to implementing AI literacy must be addressed, including:

- A lack of a shared understanding of what AI literacy is and how to teach it.
- Inconsistent implementation of strategic initiatives to develop AI literacy across education systems.
- Demystifying the role of AI in daily life, including addressing anxiety or misconceptions about AI itself.
- Insufficient understanding of appropriate pedagogical approaches that use AI to enhance and support learning.

AI literacy is different from AI tool use. AI literacy draws from understanding how AI works and critically evaluating the role of AI in daily life. These understandings can lead to more creative, effective, inclusive and ethical use of AI tools; however, simply interacting with AI tools neither develops nor depends on the knowledge, skills or competences detailed in this framework.

This publication serves as a starting point for establishing a common language for AI literacy and demonstrates how AI literacy can support learners' success within and beyond the classroom. The framework articulates desired outcomes for primary and secondary learners and clarifies how different stakeholders can help bring about these outcomes. Adaptation of the framework content is both expected and encouraged to ensure that implementation strategies are appropriate for and relevant to each context.

Definition of AI Literacy

AI literacy represents the technical knowledge, durable skills and future-ready attitudes required to thrive in a world influenced by AI. It enables learners to engage, create with, manage and shape AI, while critically evaluating its benefits, risks and ethical implications.

This definition builds on existing definitions from the European Parliament EU AI Act (2024), OECD (2024) and UNESCO (Miao & Cukurova, 2024; Miao et al., 2024) among others.

What is AI?

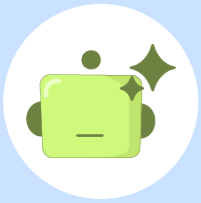
AI is defined in the EU AI Act (European Parliament, 2024) as:

"A machine-based system that is designed to operate with varying levels of autonomy and that may exhibit adaptiveness after deployment and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations or decisions that can influence physical or virtual environments."

The term "AI" in this publication refers to a broad range of AI systems. When appropriate, specific terms such as "generative AI" or "machine learning" are used.

Types of AI

There are many kinds of AI that operate differently based on how they are developed and deployed. While this publication references "AI systems" as a broad term, it is important for any AI user to examine the specific capabilities, limits and impacts of individual systems in context.



Generative AI, or "GenAI," creates new content based on existing materials in its training data, powering tools like chatbots, coding assistants and image generators. These systems can produce compelling outputs that appear to be original, but are based on user input and existing training data, thereby raising questions about authenticity, copyright and ownership (Graves et al., 2026; Microsoft, n.d.).

Predictive AI is trained to detect patterns in existing data and to forecast what is likely to happen next. These predictive systems are embedded in tools like recommendation engines, spam filters and personalised learning applications (Microsoft, n.d.). Because these systems often influence decisions that affect learners, educators must interpret predictions carefully, question their fairness and ensure they genuinely support learners (Gándara and Anahideh, 2025).

By understanding different types of AI and where they are commonly used – and how they might evolve – educators can make informed decisions about responsible classroom use.

Young People are Experimenting with AI and Need Guidance

For many young people, AI tools are now familiar and no longer futuristic. Recent studies from the European Union and United States illustrate that teens' AI use is not only widespread but deeply woven into daily life. A 2025 survey of European teens found that 88% of younger teens (ages 13-15) and 96% of older teens (ages 16-18) use AI tools for learning and creative tasks at least a couple times a week, turning to platforms for schoolwork, research, translation and search functions (Google & Livity, 2025). Moreover, a Eurostat report of AI use in the European Union found that young people aged 16-24 use GenAI nearly twice as much as the general population (Eurostat, 2026). Such encompassing use introduces opportunities to enhance academic and social experiences but comes with real risks. Young people must navigate dis/misinformation, inappropriate content, built-in biases and gender stereotypes, privacy concerns and the expanding implications of their digital footprints. According to findings from Common Sense Media, teenagers see AI companions as amiable conversation partners and replacements for social interactions with humans (Robb & Mann, 2025). Coupled with findings about the relationship between AI tool use and diminished critical thinking skills (Gerlich, 2025), these trends raise questions about the impact of AI on learning, agency and cognitive development. Without appropriate guidance, learners may rely on AI in ways that diminish reflection, persistence or independent reasoning.

For learners who cannot remember a time devoid of these technologies, AI literacy becomes essential: by understanding how AI systems work, learners can recognise the limitations of AI, question outputs and evaluate opportunities and risks in context. AI literacy empowers them to cultivate distinctly human capacities – curiosity, empathy, ethical reasoning, creativity and critical thinking – while maintaining agency over how AI might shape their learning, communities and the environment. This need is increasingly urgent, with 63% of respondents to the 2025 Flash Eurobarometer survey agreeing that everyone will need to be AI-literate by 2030 (European Commission, 2025b). Education systems face a critical responsibility to respond to such a need, thoughtfully and proactively.

Confusing AI with Humans is a Problem

While AI can generate outputs that resemble human interactions, AI itself is not human. AI systems use data to produce outputs that are statistically likely to meet an objective or reward. These systems do so without awareness, understanding or intent; they are incapable of authentic relationships (Russell & Norvig, 2022; Touretzky & Gardner-McCune, 2022).

A study by Common Sense Media found that 72% of surveyed teens in the United States had used AI "companions," tools designed to have meaningful conversations with users (Robb & Mann, 2025). In some cases, they had chosen to have a serious conversation with an AI tool instead of a human; other times, they shared personal information with the AI tool (Robb & Mann, 2025). AI companions may generate inappropriate material or provide "advice" that leads to harmful real-world outcomes. These interactions can lead to dangerous social and emotional outcomes for young people, especially as their brains are still developing (Robb & Mann, 2025; Varsik & Vosberg, 2024). From an educational perspective, the potential reduction in human interaction resulting from the increased usage of AI "companions" can be a cause for concern, as it might have an impact on social skills and mental health. It is therefore important to teach healthy practices – including critical thinking – to prevent overreliance, address emotional engagement and support well-being.

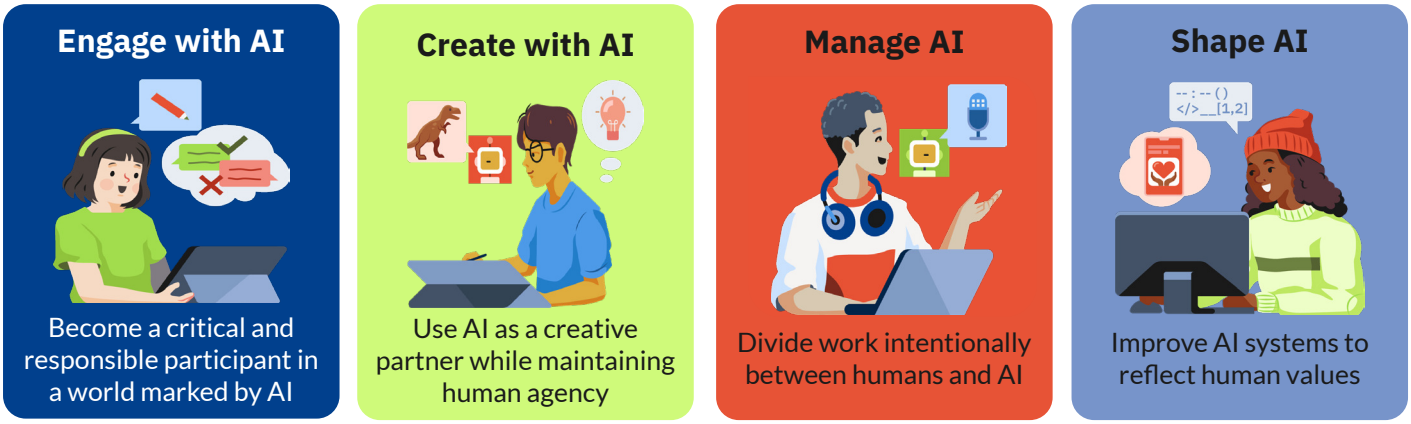
Young people may harbor misconceptions about the accuracy and effectiveness of AI-generated recommendations and might not recognise problematic content or use as such. Parents and educators can support young people by recognising the warning signs of unhealthy AI use and addressing misconceptions that AI is all-knowing, provides appropriate guidance for every situation and is capable of an authentic relationship. AI literacy that emphasises critical judgement empowers young people to understand what AI can and cannot do, evaluate its outputs thoughtfully and make choices that support their own well-being and development.

02

Foundations of the AILit Framework

About the AILit Framework

The AILit Framework supports learners across subjects and developmental stages. Practitioners can adapt the framework content based on their subject-area expertise and understanding of AI, as well as learners' needs. The framework establishes competences that are grouped into four domains. **The domains are presented sequentially to reflect a potential learning approach:**



Engage with AI, as a foundational domain, sets the basis for learners to think critically about the role of AI in daily life. Once learners have a grasp of the foundational competences presented in this domain, they can **Create with AI** and **Manage AI**. These two domains occur in parallel and emphasise hands-on experiences with AI to explore novel ideas and delegate tasks. The domains culminate with **Shape AI**, which empowers young people to integrate their understanding of how AI systems work with reflection about how AI systems can be improved for societal benefit. This domain introduces competences that draw from technical learning experiences. While this domain may seem new or unfamiliar to some learners and settings, **Shape AI** prepares young people to move beyond simply using existing AI systems and positions them to shape how those systems work. Its standing as a culminating domain reflects that it is an essential component of AI literacy that may require additional scaffolding and time to develop.

Together, the framework's four domains build on one another to equip young people with the agency to make informed judgements about AI for themselves and others.

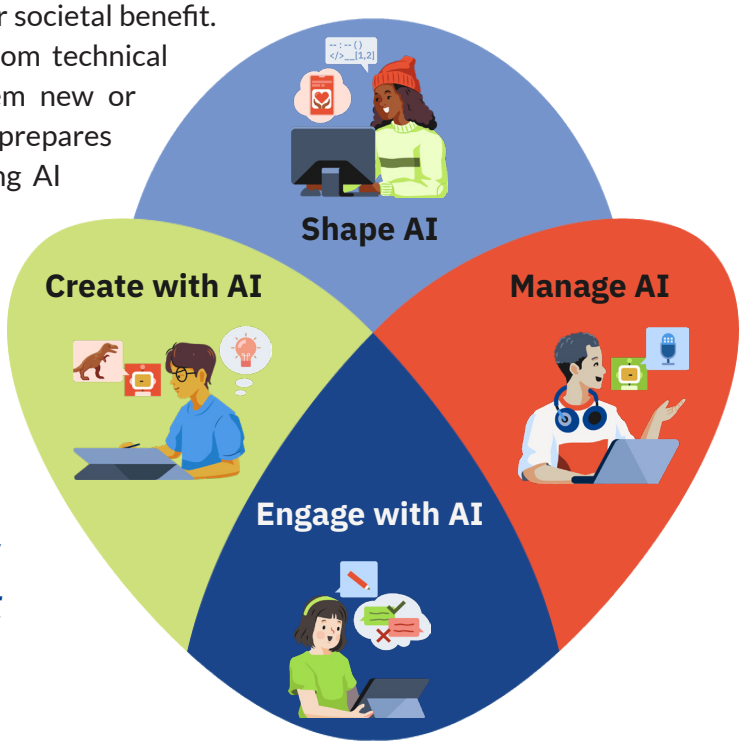


Figure 1: The Domains of the AILit Framework.

The framework's **Competences** establish concrete descriptions of the key understandings and actions that support learners' thriving in contexts affected by AI. The **Competences** are based on the framework's **Knowledge**, **Skills** and **Attitudes** and span many settings and disciplines. They integrate a learner's understanding of AI with practical use, guided by a learner's own disposition.

"Choose an appropriate AI approach for a task by comparing how different AI systems operate and what they are best suited to do."

Knowledge

The Knowledge section identifies facts and concepts essential to understanding AI systems and examining associated societal and ethical implications.

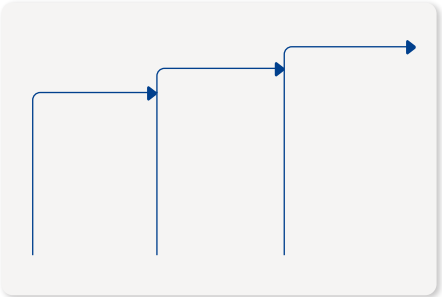
Skills

The Skills section details how human skills – such as collaboration and critical thinking – can be developed to enable responsible and creative interactions with AI.

Attitudes

The Attitudes section describes the mindsets and dispositions that learners should adopt when using AI systems in both familiar and novel situations.

Learner Expectations



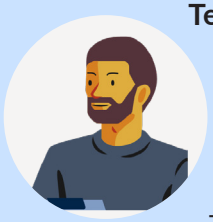
In the Classroom

Learner Expectations and **Learning Scenarios** accompany each Competence statement and illustrate how teachers and educators might put this framework into practice. **Learner Expectations** break each competence into developmental progressions to illustrate how a learner's understanding and ability may grow over time. These levels are not tied to specific grades or ages, as learners begin with different background knowledge about and exposure to AI. Instead, they provide scaffolding so that teachers and educators can meet learners where they are and design instruction that appropriately advances their confidence.

Learning Scenarios provide "In the Classroom" examples suited to primary and secondary settings that can be integrated across subject areas. AI literacy encompasses a wide range of concepts and practices; given this breadth, it may not always be realistic for one educator to address every aspect in depth. **Teachers and educators are encouraged to draw from their pedagogical expertise to determine how to introduce AI literacy in ways that are appropriate for their learners and setting.**

AI Literacy Requires a Broad and Coordinated Effort

To affect meaningful and lasting change, AI literacy must be grounded in coordinated, collaborative work across the education ecosystem. While teachers and educators are at the forefront of integrating AI literacy into learning, they cannot carry this responsibility alone. Effective partnerships within education systems will prepare primary and secondary learners to navigate emerging technologies in a changing world. As the prevalence of AI increases throughout schools, societies and the workforce, supporting learners' AI literacy development requires such shared ownership. As the intended audiences for this framework, each group fulfills distinct yet connected roles:



Teachers and Educators facilitate learners' informed, critical and creative engagement with AI technologies. AI literacy itself does not rest on a single educator – or a single subject area. Teachers and Educators across grade levels and subjects, including trainers in the context of initial Vocational Education and Training (VET), can collaborate to determine where certain aspects of AI literacy fit best. The AILit Framework introduces entry points in the form of Learner Expectations that require educators to use their expertise to determine appropriate pedagogical approaches.

Learning Designers and Training Providers translate goals into experiences for learners, teachers and educators. They can reinforce Knowledge, Skills, Attitudes and Competences across grade levels and subject areas through activities and assessments. Training providers may use the AILit Framework as a basis to support teachers' and educators' continued understanding of AI literacy.

School and Education System Leaders implement initiatives to develop AI literacy and put AI literacy frameworks into practice. They establish partnerships to support AI literacy development and capacity-building among school communities, parents, learners and educators. The AILit Framework identifies Competences for education leaders to prioritise across disciplines.

Education Policymakers develop and roll out policies to ensure modern and future-oriented education to support young people and prepare them for a transforming society and thriving workforce. This work enables learners' continuous development as they move beyond the classroom, where AI literacy has become a foundational competence. These policies enable conditions to support educators and learners while upholding governance, ethics and responsible use.

Parents, **Families** and **Caregivers** support young people's AI literacy by attending to how AI and digital technologies shape children's well-being, relationships and decision making. While the AILit Framework focusses on school-based learning, parents and families can support classroom outcomes at home. Families might use this framework as a starting point for conversations about AI in ways that are meaningful and relevant to them and to surface topics that might not arise at school. This ensures additional support for AI literacy development and positions parents as trusted adults who can guide learners appropriately.

A collective approach ensures that AI literacy is developed across learning environments and reflects shared values about responsible technology use. This reinforces AI literacy not merely as a collection of knowledge to be acquired, but as an essential practice for navigating modern life. As such, it develops skillful learners who are adaptable to an unknown future and can shape the role of AI in a changing technological landscape.

The Role of Teachers and Educators

Figure 2: AI literacy is a shared responsibility, with each educator contributing their unique expertise.

The EU AI Act reminds us that AI literacy is key for educators as they empower students to navigate the benefits and risks of AI. By prioritising AI literacy, we are empowering this generation of students with critical thinking and informed decision making skills that will tap into AI's potential and help them thrive in a rapidly changing world.

- Romina Cachia, Joint Research Centre of the European Commission, Spain

Teachers and educators play a central role in any education system. Their important work lays a foundation for learners' success within the classroom and beyond. As AI tools become more common in classrooms, teachers' and educators' professional judgement, trusting relationships and pedagogical expertise become more essential in practice.

The widespread integration of AI into learners' lives and academic experiences introduces new instructional responsibilities for teachers and educators. They are not only expected to support learners' academic development, but also to guide young people in understanding the nuances of complex technologies that emerge at a rapid pace. These new responsibilities demand robust support: to guide learners to make sound decisions about AI, teachers and educators must feel comfortable doing so themselves. Reflecting this need, the European Commission (2025b) Flash Eurobarometer survey found that 81% of European citizens "agree that all teachers should be equipped with the skills to use and understand AI, including generative AI." Yet evidence from the 2024 OECD Teaching and Learning International Survey (TALIS) found that only one in three teachers uses AI on average and three of four teachers report that they lack the knowledge and skills to teach using AI (OECD, 2025b). Teachers and educators already navigate competing demands, including foundational academic goals, assessment

pressures and school-specific objectives. Expecting meaningful AI literacy integration without investing appropriate time and resources for professional learning risks exacerbating existing strain.

School and system leaders must invest in supporting teachers' and educators' capacity to evaluate AI systems and the self-efficacy to teach AI literacy. This change has already taken shape in some settings: according to the TALIS findings, almost 40% of teachers across OECD education systems were trained about AI in 2024 (OECD, 2025b). For half of these education systems, attending professional learning opportunities about AI reduced the likelihood that a teacher reported a high need for continued professional development in the area. Teachers in locations that reported high AI use also reported having received professional learning about using AI. While these trends demonstrate the adaptability of school systems and impacts of intentional support, they also underscore what is left to accomplish.

To build on this momentum, school and system leaders can collaborate with teachers and educators to design AI-focussed professional learning that is responsive to local needs and can be sustained over time. These professional learning experiences should not focus solely on tool use, but on appropriate teaching methods to support meaningful ethical reflection and bolster student agency. Moreover, AI literacy and appropriate pedagogies should be increasingly incorporated into training programs to ensure adequate preparation for future teachers and educators. These approaches will introduce benefits beyond staying up-to-date on emerging technologies: such work contributes to teachers' and educators' sense of self-efficacy, a key factor in job satisfaction and well-being (OECD, 2025b). As self-efficacy has consistently been associated with high-quality pedagogical practices and strong learning outcomes, this ensures that young people learn about AI in meaningful, developmentally-appropriate, motivating and innovative ways (Holzberger et al., 2013; Klassen & Tze, 2014; Rampelt et al., 2025; Zee & Koomen, 2016). Sustained investment in teachers and educators will ensure that classrooms not only keep pace responding to technological change but proactively shape learners' capacity to navigate it.

While AI is often introduced to classroom settings to bolster teachers' and educators' efficiency, the purpose of education is greater than saving time. Teachers and educators cultivate empathy, foster intellectual curiosity and resilience, model ethical reasoning, create inclusive learning environments for learners and provide targeted and individualised support to learners regardless of their background. Maintaining teachers' and educators' professional autonomy and prioritising their continued growth will ensure that technological innovations serve learners' development rather than undermine it.

Opportunities and Risks of AI in Education

AI tools are not new to education. Predictive AI systems have been used in intelligent tutoring systems (ITSs) to assess learners' knowledge and provide targeted feedback (Burns et al., 2026). However, the rapid development and widespread uptake of GenAI marks a significant shift in their presence in the classroom. Unlike earlier systems, these tools are often directly accessible to learners and are increasingly embedded in everyday learning practices. This exponential growth has intensified both interest in AI's potential to create innovative, personalised learning experiences and curiosity about its applications. AI also holds particular promise for inclusion, as it can provide differentiated and individualised support for learners with special educational needs or disabilities. However, evidence to support GenAI's efficacy for learning is still mixed.

When used with a clear pedagogical purpose, AI can support learners' critical thinking, creativity, collaboration and deeper conceptual understanding of a topic (Bushnell & Harrison, 2025; Guo & Wang, 2024; Meniado et al., 2024). Learners who use AI may indeed complete higher quality work or demonstrate mastery of concepts more quickly than learners who do not use AI; however, these outcomes do not translate into durable learning gains (OECD, 2026a). Offloading one's cognitive efforts to AI may foster "metacognitive laziness," weakening learners' critical thinking and self-regulation (Fan et al., 2025). Overreliance on AI tools can also leave young people underprepared for assessments where AI use is restricted (Villar Onrubia et al., 2025). Beyond these concerns, the increased integration of AI in classrooms raises additional challenges. These include risks of algorithmic bias, inaccuracies or fabricated information and questions about academic integrity and ethical uses.

Further research is needed to clarify when AI enhances or undermines learning; this is complicated by the rapid pace of technological developments, which can quickly outdate the dissemination of research (Smith et al., 2025). In this context, strengthening AI literacy is essential. Learners need support for engaging with AI in ways that promote active learning rather than passive dependency. Teachers likewise require professional development and institutional support to purposefully scaffold AI use and integrate it into pedagogically sound practices. Ultimately, education must prioritise the development of valued human knowledge and skills, regardless of AI use (OECD, 2026a). AI enhances learning when it promotes active engagement with the content at hand, is purposefully scaffolded by educators and strengthens interactions among learners, teachers and educators.

03

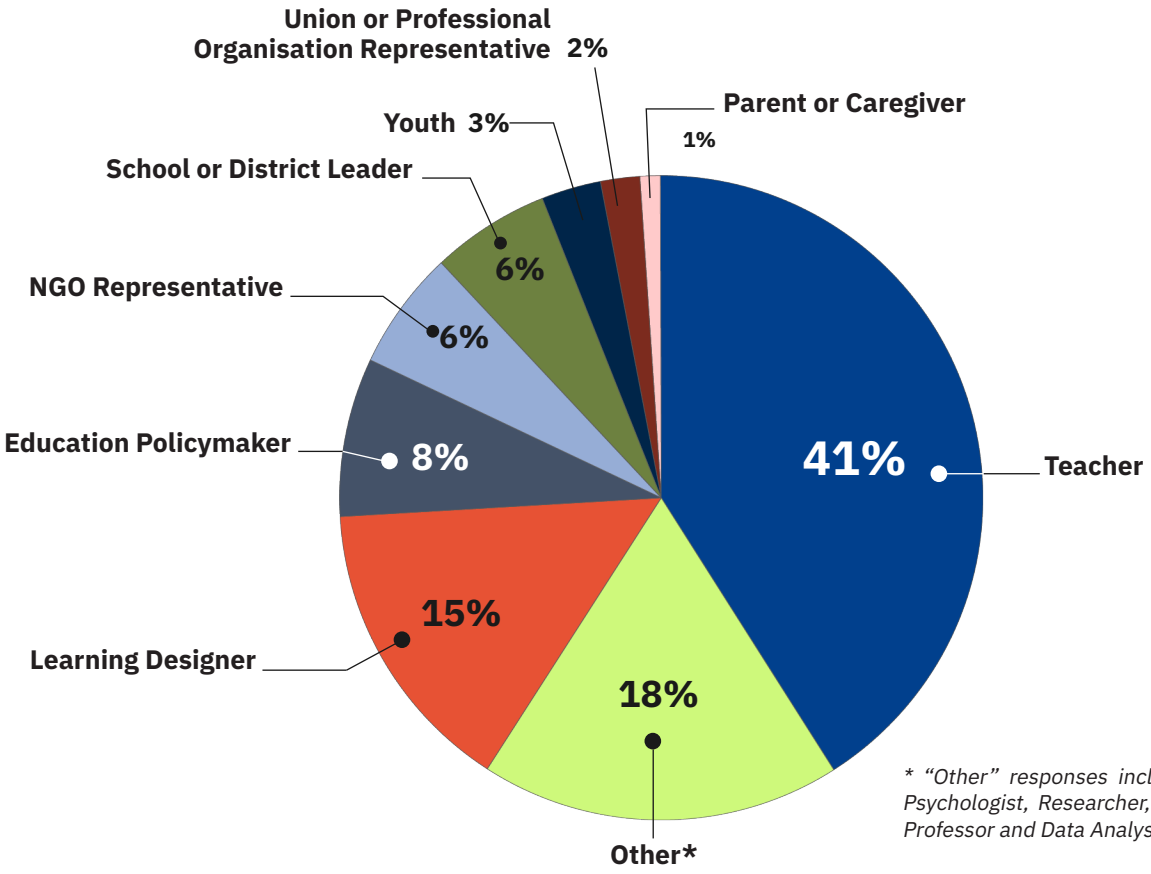
Development Process

Revising the Draft Framework

Following the launch of a draft framework in May 2025, a comprehensive international consultation process informed areas for content and structural revisions. The framework presented here is the result of extensive stakeholder engagement, including an online survey, a series of virtual and in-person focus group consultations and feedback that includes written reviews from Ministries of Education of the European Union.[1] Insights gathered through these consultations informed revisions to reflect teachers' and educators' priorities and respond to real-world opportunities and challenges in digital education.

In total, more than 2 000 individuals contributed feedback to the draft framework across multiple modalities. Participants represented a wide range of stakeholder groups: teachers, learning designers, education policymakers and education researchers, as well as representatives from NGOs, including trade unions, parent associations and national and regional education public authorities. This engagement represented over 100 countries with participation from individuals and organisations on all continents.

Stakeholders agreed that the draft framework addressed a real need in education and shared how they have already started adapting the framework to their settings. They also suggested ways to make the material more adaptable, practical and relevant. An analysis of stakeholder feedback appears in **Annex 1**.

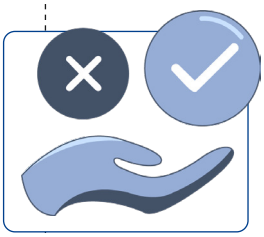


** "Other" responses included roles such as Psychologist, Researcher, Engineer, Librarian, Professor and Data Analyst.*

Figure 3: Professional roles of respondents to the AILit Feedback Survey

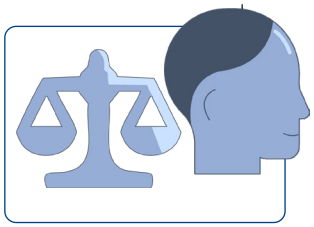
[1]**Ministries of Education within the European Union represented Belgium-Flanders, Bulgaria, Denmark, Finland, France, Hungary, the Netherlands, Poland, Portugal, Spain and Sweden.**

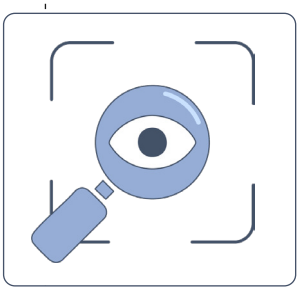
Ethics in the Framework



The AILit Framework weaves ethical considerations throughout framework materials rather than establishing ethics as a separate topic or category of AI use. Given the extent that AI systems reflect human choices and perspectives across design, development and deployment, ethical considerations cannot be separated from an understanding of the systems themselves.

The framework upholds a set of guiding principles to support learners' judgement in varied contexts. These principles emphasise learner agency; transparency and explainability in how AI systems operate; responsibility to use AI in fair, inclusive and accountable ways; consideration for personal privacy; environmental stewardship; and ongoing inquiry into who benefits from and who might be disadvantaged by AI use.





Evaluating the ethical and societal implications of AI systems requires learners to understand not only how AI works, but also how design and development choices serve different purposes across contexts. The ethical principles included in the AILit Framework are intended to guide learners before, during and after interacting with AI technologies. Ultimately, the AILit Framework aims to empower both primary and secondary learners to become advocates for ethical and intentional AI use and to promote responsible decision making with and about AI in their communities.

Relationship to Other Topics

The AILit Framework reflects scholarship across multiple topics and disciplines. AI literacy itself draws from ethics, computer science, media and digital literacy, data science and social studies.

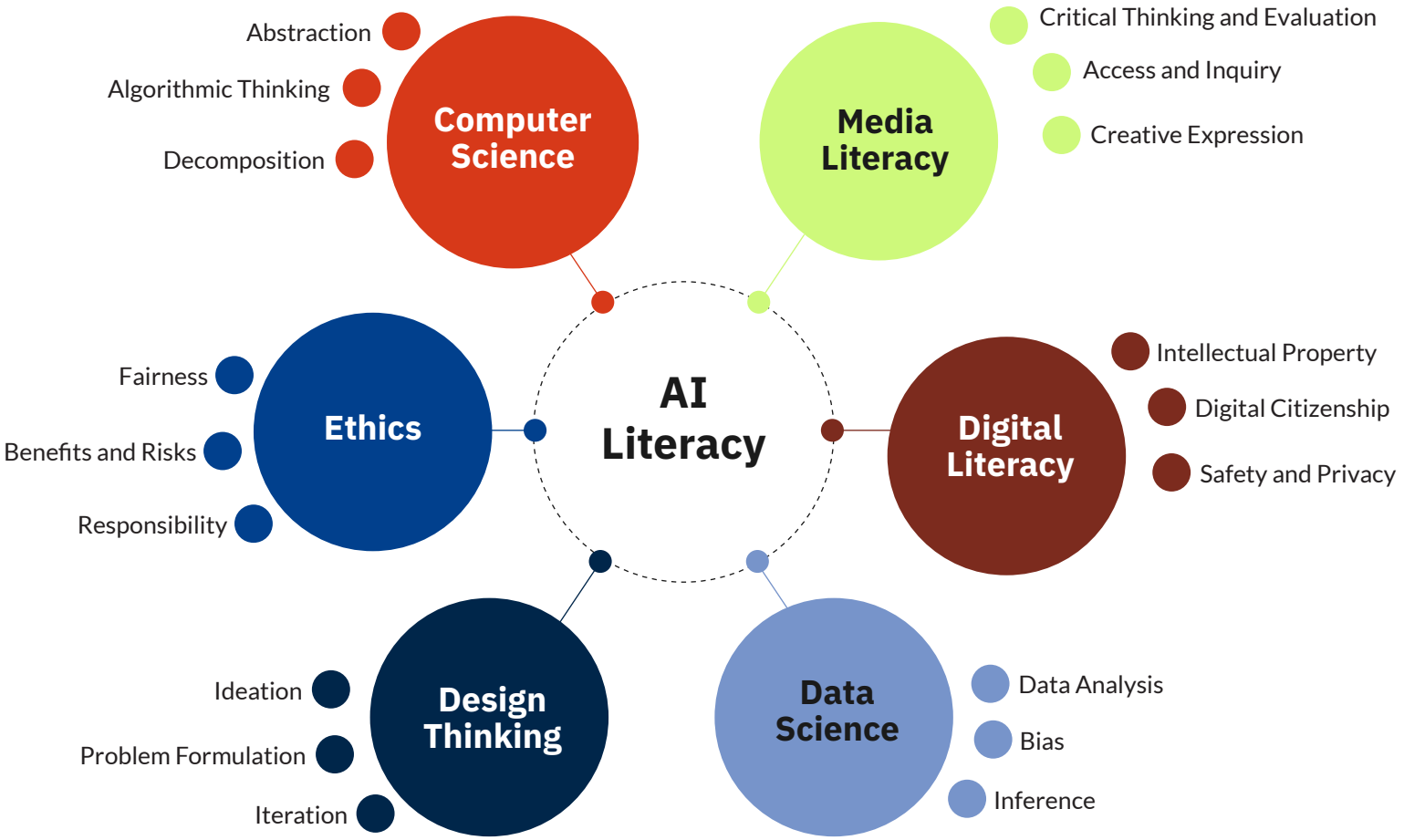


Figure 4: AI literacy draws from scholarship in a range of topics

Building on Existing Frameworks

The AILit Framework contributes to the PISA 2029 Media and Artificial Intelligence Literacy (MAIL) assessment, which aims to measure to what extent learners can critically navigate this digital media landscape that is increasingly influenced by AI systems (OECD, 2026b). While the two frameworks naturally overlap given the intersection of AI systems and media platforms, the AILit Framework takes a more targeted, AI-specific approach. Conversely, the PISA 2029 MAIL assessment adopts a broader view of media literacy in the context of advances in AI and provides more detailed guidance on measurement strategies and tools to support international data collection.

The AILit Framework builds on ideas and practices from established digital competence and AI literacy frameworks, namely the *Digital Competences Framework* (Cosgrove & Cachia, 2025); the UNESCO *AI Competencies Frameworks for Students and Teachers* (Miao & Cukurova, 2024; Miao et al, 2024); the Digital Promise *AI Literacy Framework (*Mills et al., 2024); AI4K12's *5 Big Ideas in AI* (2022); the ETS *Preparing K–12 Students With AI Literacy: Proposed Framework, Progression and Task Design Principles* (Chakraburty et al., 2025)*;* and the aiEDU *AI Readiness Framework* (2025). Collectively, this integration ensures that the AILit Framework is well-informed, relevant to primary and secondary education, and grounded in the technical and social dimensions of AI literacy. The AILit Framework builds on these efforts, emphasising a durable foundation, interdisciplinary integration, practical application and insights from a global community of experts and stakeholders. It outlines essential concepts that will remain relevant as AI continues to evolve, with a focus on competences that transcend specific tools or trends. Further detail on how these frameworks informed the development of the AILit Framework is provided in **Annex 2**.

The AILit Framework

04

The AILit Framework

Knowledge

- The Nature of AI
- AI Reflects Human Choices and Perspectives
- AI's Capabilities and Limitations
- AI's Role in Society

Skills

- Critical Thinking
- Collaboration
- Creativity
- Problem Solving
- Computational Thinking
- Communication
- Self and Social Awareness

Attitudes

- Reflective
- Responsible
- Curious
- Innovative
- Adaptable
- Empathetic

Knowledge

The Knowledge statements listed below include facts, concepts, ideas and processes reflecting disciplinary, interdisciplinary, epistemic and procedural knowledge. They outline the technical and societal understandings that learners need to apply and engage with AI systems.

1. The Nature of AI

1.1: AI is not human. AI systems use algorithms to combine step-by-step procedures with statistical inferences (e.g. weights and biases) to process data, detect patterns and generate outputs based on probabilities (Russell & Norvig, 2022).

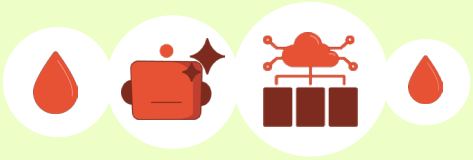
1.2: Machines "learn" by inferring how to generate outputs in response to patterns in the data they were trained on and new information they receive. They do so with varying levels of autonomy, adaptiveness and accuracy (Russell & Norvig, 2022). These outputs can take the form of predictions, content or recommendations that influence physical or virtual environments.

1.3: GenAI uses probabilities to generate advanced outputs across various modalities (e.g. text, audio, visuals) but lacks authentic human understanding and intent (Bender et al., 2021; Ng et al., 2021).

1.4: There are many types of AI systems, which operate differently depending on their purpose, programming and training data (Burrell, 2016; Russell & Norvig, 2022). Depending on the type of tool, users may know they are interacting with AI; at other times, AI systems may operate in the background or as part of a tool and its influence is not evident (Bender et al., 2021).

1.5: AI requires significant resources, such as energy, minerals and water, to sustain computing power needs. The energy and infrastructure required to develop and sustain AI systems contribute to increased carbon emissions. The long-term sustainability impact of AI, both positive and negative, largely depends on how it is implemented and used (Bashir et al., 2024; Luccioni et al., 2025; United Nations Environment Programme, 2024).

The Environmental Impact of AI



AI systems require natural resources to support the hardware and software used for operation. Each stage of AI development – from computer chip production to electronic waste ("e-waste") disposal – has an effect on the environment (United Nations Environmental Programme, 2024). At the same time, AI systems are being deployed to help combat environmental problems and to facilitate transitions to sustainable, energy-efficient practices (World Economic Forum, 2025; Nwokolo et al., 2024).

The rapid deployment and widespread use of AI demands careful, informed consideration about how one's own use might affect the environment. When deciding whether to use AI or not, users must ask themselves: is there a greener alternative?

2. AI Reflects Human Choices and Perspectives

2.1: Building and maintaining AI systems relies on humans to design algorithms, collect, manage, evaluate and label data and moderate harmful content. These systems reflect human choices, assumptions and labour practices, and are shaped by unequal global conditions (Ma et al., 2025; Mittelstadt et al., 2016; Rani & Dhir, 2024).

2.2: AI is trained on vast datasets sourced from publicly available information, user-generated content, curated databases and/or real-world data collected through sensors, interactions and digital systems (Touretzky & Gardner-McCune, 2022). These datasets may include copyright-protected materials, synthetic data, unverified information, as well as private and public data obtained in unethical or nonconsensual ways (Buolamwini & Gebru, 2018; Noble, 2018).

2.3: AI systems can gather data during interactions with users that influence decisions, processes and outputs in real time (Burrell, 2016; King & Meinhardt, 2024; Ma et al., 2025).

2.4: AI systems are trained to identify patterns among data elements that humans have selected, categorised and prioritised (Noble, 2018). This training can also involve reinforcement learning, where AI systems improve performance through trial-and-error interactions with environments guided by feedback and rewards (Touretzky & Gardner-McCune, 2022).

2.5: Bias inherently exists in AI systems, which can also reflect societal biases embedded in training data or algorithm design. Humans can increase or mitigate those biases in AI systems – accidentally or deliberately – during design, development, testing or use of AI. This can have far-reaching consequences for individual users and entire societies (Buolamwini, 2024; Buolamwini & Gebru, 2018; Mittelstadt et al., 2016; Noble, 2018).

3. AI's Capabilities and Limitations

3.1: AI can perform tasks like pattern recognition, automation and content creation. It lacks emotions, ethical reasoning, critical thinking, context and originality despite simulating those in its outputs (Burrell, 2016; Heintz, 2022; Huckins, 2023; Weidinger et al., 2021).

3.2: The capability of generative AI, particularly large language models (LLMs), to produce highly advanced content can make fact and fabrication hard to distinguish, increasing risks of dis/misinformation, "hallucinations," misrepresentation and manipulation (Weidinger et al., 2021).

3.3: AI systems may produce different outputs in response to the same input, depending on both the input itself and how an AI system is designed to select or prioritise specific features and parameters (Kim & McGill, 2025).

3.4: AI systems and their underlying algorithms operate at varying degrees of transparency and interpretability (Barbiero et al., 2025). In some cases, one might be able to determine how an algorithm is optimised for certain variables and outcomes. Other times, this is difficult or impossible to achieve (Bengio et al., 2024; Burrell, 2016; Eslami et al., 2019).

4. AI's Role in Society

4.1: AI systems can influence decisions in many areas of daily life. They are increasingly used for tasks that have positive and negative impacts, including information filtering, recommendations, classifications and pattern recognition (Abendroth-Dias et al., 2025; Buolamwini & Gebru, 2018). Across all AI uses, humans must exercise agency and preserve the capacity to make intentional and autonomous decisions (Schlosser, 2019).

4.2: AI systems should be understood, audited and regulated to ensure that their use maximises benefits and minimises harm for individuals and society (Hutchinson & Mitchell, 2019).

4.3: Responsible and ethical AI design encompasses fairness, transparency, explainability, accountability, respect for privacy and legal compliance (Fjeld et al., 2020; Long & Magerko, 2020; Nezhad et al., 2025).

Skills

The Skills section represents fundamental human capabilities applied to an AI context. These skills guide learners in using AI ethically and ensure that learners actively shape how AI fits into their lives.

Critical Thinking: Evaluate AI use and AI-generated content for accuracy, fairness and bias to make informed and ethical decisions.

How do I know if using AI is relevant, appropriate or responsible?
How can I check the accuracy of AI-generated outputs and reduce the risk of harmful bias?

Critical Thinking in an AI context requires learners to question the basis for AI use altogether to determine how it aligns with ethical principles and personal values. It includes questioning sources of information, verifying the accuracy and relevance of AI outputs and evaluating how the outputs should be used responsibly. Learners should reflect on their own intentions for AI use. They should practise awareness regarding how their interactions with AI systems may affect their mental health – particularly if AI tools or chatbots are perceived as human-like and are used for emotional support. Altogether, Critical Thinking becomes increasingly important as AI generates content that can seem convincing but may be incorrect, biased and/or manipulative. These actions increase awareness of AI's impact on the information system, foster a commitment to discerning truth and help young people make informed, ethical decisions about AI use – including in education.

Collaboration: Guide interactions with AI by communicating clearly, providing feedback and navigating shared tasks.

How can I use AI iteratively and intentionally to accomplish a goal?

Collaboration with AI includes iterating on original ideas with support from AI systems to brainstorm, plan a process or generate feedback. With support from teachers and educators and family, learners can communicate their goals, constraints and questions clearly to AI systems, then assess AI outputs and revise their efforts. They should continuously draw on peers or perspectives from teachers and educators for ethical reasoning, creativity and contextual awareness that AI cannot provide. Not only does this require a learner's clear understanding of the task at hand, but it also requires an understanding of what information should or should not be shared with AI systems. This includes an awareness of privacy and the importance of protecting personal, proprietary or sensitive data. By collaborating intentionally and iteratively, learners have opportunities to reflect on and improve their own understanding of the topic and task.

Creativity: Use AI to build and reflect on original ideas or to explore new ones.

How did my idea grow or change with AI?
How can I use AI responsibly to bring my creative visions to life?

When learners practise creativity, they pursue questions shaped by their own curiosities and interests. Creative thinkers draw on different types of knowledge and develop meaningful connections to the problems they are trying to solve. Learners begin by imagining possibilities, then brainstorm and iterate to explore new approaches. To refine their thinking, they seek feedback from peers, trusted adults and – where appropriate – AI. This process itself often takes priority over the final product. Learners should reflect on their learning and how their ideas may have evolved. They should also grapple with ethical questions of ownership, originality, attribution and copyright.

Problem Solving: Determine if, when and how to use AI for a task by assessing its capabilities, risks and ethical implications.

How do I know that AI is the right tool for the task at hand?

Using AI to solve a problem begins with reflecting on the nature of a task to determine whether and how AI might meaningfully support a solution. Learners define a problem, clarify goals and constraints, and consider the task's technical and ethical requirements. They compare possible strategies – with and without AI – and justify their approach before moving forward. Learners then experiment, monitor progress and evaluate outcomes. They evaluate AI outputs for accuracy, relevance, bias and alignment with their goals, then revise their inputs and adjust their strategy as needed. In some cases, AI may support each step; other times, learners may limit or abandon AI use when it proves inefficient, unreliable or misaligned with their aims. Over time, learners build judgement about when AI adds value and when human oversight, creativity or domain expertise should take the lead. Problem Solving with AI involves continuously assessing progress, remaining open to changing course and using evidence from results to inform future decisions.

Computational Thinking: Decompose problems and provide instructions in ways that allow AI systems to effectively contribute to solutions.

How do I frame my problem so that AI can help solve it?

Computational Thinking helps learners approach and solve problems in ways that leverage the capabilities of AI and account for its limitations. As a cornerstone principle of computer science and informatics education, this skill assumes a new significance as human-computer interactions become more frequent. Because AI systems operate using algorithms, data and structured decision making, learners must consider how to frame human ideas and questions in ways AI and computing systems can interpret. This involves processes like decomposition – breaking down complex problems into structured components – as well as pattern recognition, abstraction and algorithmic thinking. Computational Thinking supports learners with tasks like debugging code, evaluating progress toward a goal, and describing goals and constraints in ways that AI systems can effectively process (e.g. through prompting). It supports learners as they approach the technical components of AI systems, particularly as they consider ways to improve or adapt AI systems. Learners who practise Computational Thinking should know what distinguishes humans from AI systems and when a human or AI-based approach works best. They exercise agency in deciding how to use AI to support problem solving, learning or creative tasks.

Communication: Describe how AI works in a way that promotes transparency, avoids anthropomorphism and encourages responsible use.

How can I describe AI for myself and others?
How can I use my knowledge about AI to promote ethical use?

Communication about AI requires a foundational understanding of how common AI systems work and where they are used. Learners who communicate effectively can explain an AI system's purpose to others and compare the capabilities and limitations of different systems. They can describe how AI may have shaped content or decisions that learners experience themselves, acknowledging that the transparency and explainability of a particular AI model can influence its outputs. This skill emphasises that learners have a responsibility to accurately describe AI and address misconceptions about it without mischaracterising it or assigning human traits to its functions. By engaging in open dialogue about AI, learners should help ensure informed, ethical use within their communities.

Self and Social Awareness: Recognise how AI influences personal choices, relationships and communities and reflect on its broader societal and environmental impacts.

How does AI impact me, my classmates, my community and the environment?

Self and Social Awareness are vital when interacting with AI. These skills begin with recognising the presence of AI in daily life and understanding how it influences decisions in both virtual and physical spaces. Learners should analyse how AI might be used to amplify biases, promote certain viewpoints, manipulate users or encourage specific behaviours. They must question how AI might affect their learning, communities and environments in the short- and long-term by considering who benefits or is disadvantaged by its use. They avoid using AI for activities that can cause harm to the well-being and mental health of those around them (e.g. cyberbullying, creating deepfakes). They should reflect on their own AI use to adjust their personal habits, build mental resilience and advocate for responsible use. Learners are also aware that AI perception and use vary across cultural, social and economic contexts. When learners practise Self and Social Awareness, they move from mere identification of AI to monitoring and responding to its intended and unanticipated effects on individuals, communities and the environment.

Attitudes

The Attitudes reflect aspects of a learner's mindset that prepare them to approach AI with an awareness of its impacts. Learners may embody multiple attitudes at the same time, or prioritise each differently based on the situation at hand.

Reflective

Learners question the assumptions and narratives surrounding AI use to determine how AI might factor into their own lives. They critically appraise AI tools and outputs, weigh the opportunities and risks of using AI, and test new claims using reasoning and evidence. They apply a discerning lens to evaluate new technology across different use cases.

Responsible

Learners think carefully about how they use AI and recognise that they are accountable for their choices. They consider both the intended and the unintended effects of their actions and are committed to preventing harm to others and the environment. Learners see the importance of transparency and informed decision making about AI use, including the choice to not use AI.

Curious

Learners are eager to explore what AI can and cannot do today and how it might evolve in the future. They want to understand how AI affects their personal lives and future careers. They consider learning an ongoing process and embrace experimenting, believing meaningful discoveries arise from exploration.

Innovative

Learners seek to use AI to address real-world challenges and embrace new opportunities. They experiment, try different approaches and think creatively to solve a problem. Learners see themselves as empowered users, decision makers and active creators of a world marked by AI, not just consumers of different technological solutions. They see potential for AI to be a powerful tool in their own lives and communities.

Adaptable

Learners show perseverance and flexibility when working with AI. They are open to diverse ideas and perspectives. They know how to reframe problems and approaches in response to biased outputs and unpredictable behaviours. Rather than simply accepting the output that comes from an AI tool, adaptable learners understand that learning with AI is an iterative process shaped by feedback and revision. They recognise that there are many possible ways to solve a problem.

Empathetic

Learners thoughtfully examine how AI impacts individuals, communities and the environment. They weigh the potential opportunities and risks of using AI through the lens of its possible impacts, understanding that it can introduce unintended outcomes that vary for different groups of people. They also judge the effect AI tools can have on their own mental health, as well as others' well-being. When considering whether or how to use AI, they adopt others' perspectives and think about the ethical implications of their choices in the short- and long-term.

Competences and Learner Expectations

Competences, along with Learner Expectations and Learning Scenarios, illustrate how AI literacy may develop over time. Learner Expectations detail progressions of use that span from Basic to Intermediate and Advanced. These progression levels apply to primary and secondary education outcomes, but do not correspond to specific age ranges or grade levels. They present AI literacy development as a complex task that changes over time. Teachers and educators are encouraged to use these Learner Expectations to build their own evaluation rubrics and implement appropriate learning experiences within their unique settings. The activities featured as "In the Classroom" Learning Scenarios should be adapted to local contexts, guidance and legislation, especially as they relate to social media or technology use in the classroom.

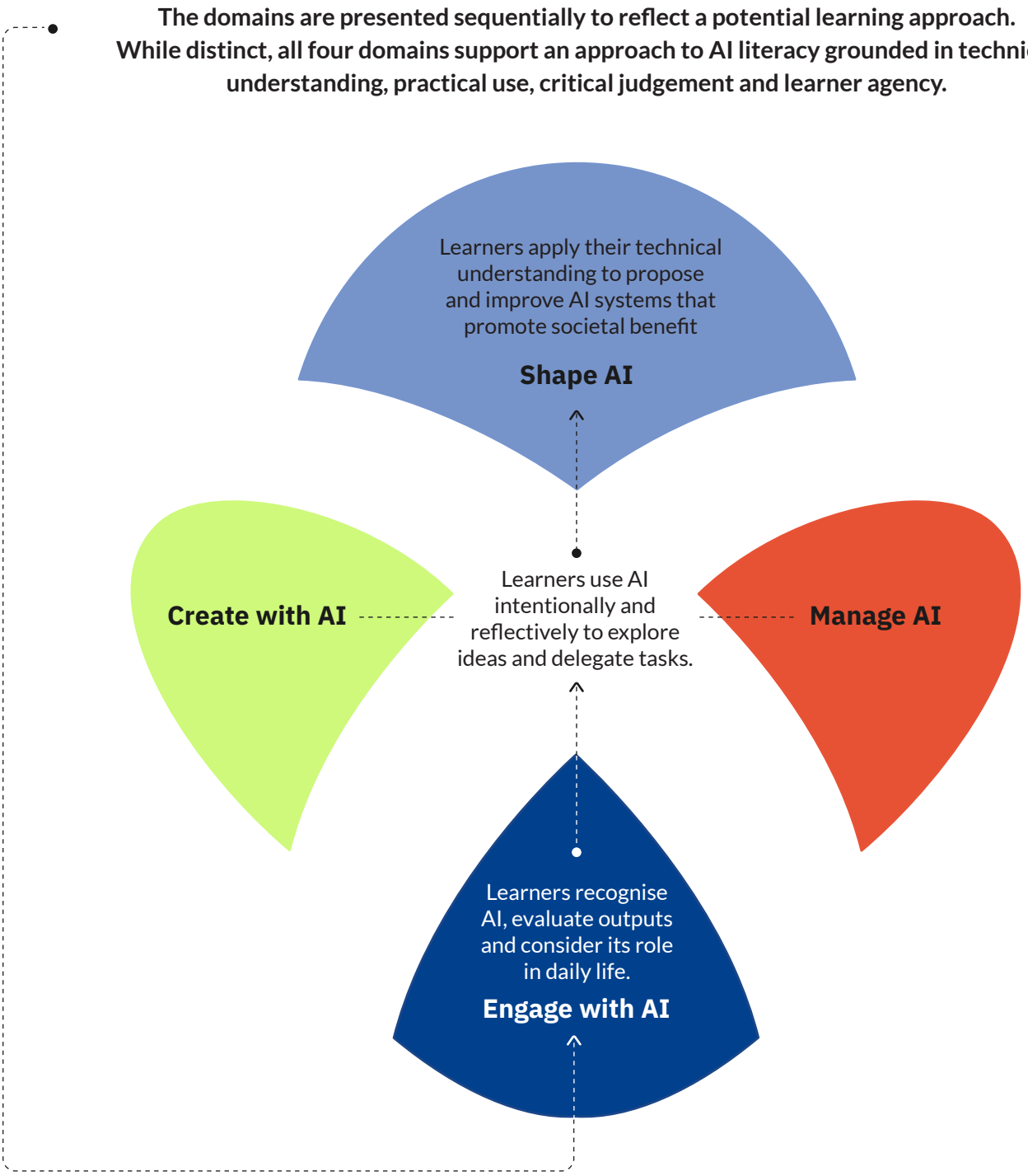


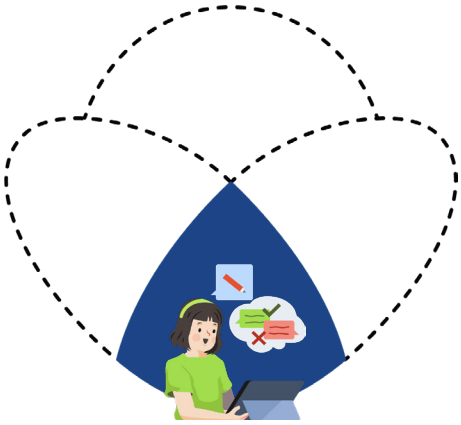
Figure 5: The Domains of the AILit Framework

Engage with AI

Become a critical and responsible participant in a world marked by AI

Engage with AI is the foundational domain of the framework. It sets a basis for what all learners should know and be able to do as they interact with AI across contexts. This includes identifying and accessing AI systems, understanding the opportunities and risks of AI use, evaluating AI outputs and making decisions about the role and use of AI in daily life. A learner who demonstrates competence in this domain uses AI intentionally and responsibly and reflects on the impacts of AI on themselves, their communities and the environment. These competences support a foundation for AI literacy that endures as technologies emerge and their usage changes.

Engaging with AI is more than just having digital skills—it demands critical thinking, media literacy and the ability to challenge AI outputs, identify misinformation and understand how data and ideas are used.
- Kari Kivinen, European Intellectual Property Observatory, Spain



Engage with AI Competences

1. Recognise AI's role and influence in different contexts.
2. Describe how AI systems perform tasks using language that addresses and clarifies common misconceptions.
3. Evaluate whether AI outputs should be accepted, revised or rejected.
4. Examine how predictive AI systems provide recommendations that can inform or limit perspectives.
5. Compare how AI systems consume energy and natural resources.
6. Explain how AI could be used to amplify societal biases.
7. Analyse how well the use of an AI system aligns with ethical principles and human values.

Engage with AI 1: Recognise AI's role and influence in different contexts.

Knowledge: 1.4 **Skills:** Self and Social Awareness **Attitudes:** Curious, Responsible

Basic

Learners can identify where different types of AI are present in their everyday lives.

In the Classroom

Learners play "AI or Not" with their teacher. Given examples, such as smart home devices, social media or apps, they can categorise each based on whether it uses AI.

Intermediate

Learners share examples of how AI systems have influenced their own choices and experiences at home, in school or online.

In the Classroom

Learners compare examples of "for you" landing pages on social media platforms and reflect on how and why they are influenced by what appears.

Advanced

Learners can analyse how AI systems may shape individuals' beliefs and behaviours as consumers, learners, workers and citizens.

In the Classroom

Learners explore screenshots from AI chatbots and apps to identify when it may be designed to persuade, rather than inform. With a teacher, they discuss how features like "streak" counts, character names or overly-agreeable responses might be engineered to increase engagement.

Engage with AI 2: Describe how AI systems perform tasks using language that addresses and clarifies common misconceptions.

Knowledge: 1.3, 1.4 **Skills:** Communication **Attitudes:** Reflective, Responsible

Basic

Learners know AI is a non-human tool that produces outputs based on patterns of data and lacks authentic context or understanding.

In the Classroom

As their teacher introduces common phrases used to describe AI use (e.g. "AI thinks," "AI understands,"), learners identify which ones are misleading and why. Learners develop better descriptions using technically accurate and age-appropriate language, then reflect on how language shapes their understanding of what AI can or cannot do.

Intermediate

Learners accurately describe how a specific AI tool carries out a task in order to address commonly-held misconceptions about how AI works.

In the Classroom

Learners identify a common AI myth among peers (e.g. "AI understands like humans" or "AI is always correct"). They create an artefact, such as a poster, short video or podcast to address the misconception by explaining how AI works.

Advanced

Learners explain how different AI systems work using language that does not attribute human traits or abilities, knowing that their phrasing shapes understanding.

In the Classroom

Learners review different types of AI tools and compare design choices that make the systems appear human-like, friendly or intelligent. In small groups, learners practise explaining how the tools produce outputs, focussing on programmed processes rather than human qualities. As a class, they share and refine their explanations and reflect on how different design features affect understanding and trust in AI systems.

Engage with AI 3: Evaluate whether AI outputs should be accepted, revised or rejected.

Knowledge: 3.1, 3.2 **Skills:** Critical Thinking **Attitudes:** Responsible

Basic	Intermediate	Advanced
Learners understand why AI-generated outputs should be verified and recognise how they can verify the content themselves.	**Learners verify AI-generated outputs for accuracy and relevance by consulting trusted sources and considering task-specific expectations.**	**Learners assess AI-generated outputs and justify decisions to accept, revise or reject them.**
In the Classroom Learners review an AI-powered tool's solution to a maths problem and accompanying explanation, then compare the AI-generated content to the process that their teacher has introduced to the class.	**In the Classroom** In small groups, learners plan an itinerary for a tourist visiting their hometown. When the teacher provides AI-generated recommendations for local restaurants, learners compare the recommendations using other sources to determine if the information is outdated, inaccurate or a "hallucination." From there, learners draw from their own knowledge and experience to decide whether the locations would be appealing to a visitor.	**In the Classroom** When their teacher presents different AI-generated interpretations of a historical event, learners turn to trusted secondary or primary sources to verify the accuracy of the interpretations and argue which one they would include in a final report.

Engage with AI 4: Examine how predictive AI systems provide recommendations that can inform or limit perspectives.

Knowledge: 1.1, 3.2, 4.1 **Skills:** Self and Social Awareness **Attitudes:** Curious, Reflective

Basic	Intermediate	Advanced
Learners know that AI can use data about a user to provide recommendations or predictions for them.	**Learners consider when AI-generated recommendations might be helpful to them or when they may seem too narrow and too general.**	**Learners weigh the benefits and drawbacks of AI systems using data to shape access to information and consider how this might influence worldviews, ideas or behaviours.**
In the Classroom Learners make a list of movie and television recommendations for a favourite book character, justifying their choices with textual evidence. As a class, they share their lists and discuss their knowledge of the characters, then compare the process to the ways AI generates recommendations.	**In the Classroom** Learners compare a music app's recommendations to a list of their own favourite songs and artists, then discuss when the algorithms reinforced existing preferences or introduced them to new genres.	**In the Classroom** Learners review case studies of how social media recommendation systems have affected public understanding of an issue, then discuss how this might impact individuals' voting behaviours.

Engage with AI 5: Compare how AI systems consume energy and natural resources.

Knowledge: 1.5 **Skills:** Self and Social Awareness **Attitudes:** Responsible

Basic	Intermediate	Advanced
Learners recognise that computers and AI systems require resources to function.	**Learners describe different ways that AI impacts the environment (e.g. hardware production, data centre development, water use, energy intensity).**	**Learners analyse how individual choices along with different design, deployment or business decisions can affect AI's overall energy and resource use.**
In the Classroom Learners list the classroom devices that must be charged and cooled and recognise that AI systems also require electricity and hardware to run.	**In the Classroom** Learners create an informational artefact (e.g. written article, podcast or video) explaining how training large AI models compares to household or individual energy use.	**In the Classroom** Learners research the environmental impacts of AI use and data centre development across different communities. They then identify policies and strategies that promote responsible AI use and development.

Engage with AI 6: Explain how AI could be used to amplify societal biases.

Knowledge: 2.1, 2.5, 4.1 **Skills:** Critical Thinking, Self and Social Awareness **Attitudes:** Empathetic, Responsible

Basic	Intermediate	Advanced
Learners understand that biases can exist in the data used to train AI and can be perpetuated when humans design, develop and use AI systems.	**Learners explain how biased data or design choices (e.g. stereotyped content, misclassification, unequal recommendations) can lead AI systems to generate unfair or skewed outcomes for certain groups.**	**Learners analyse how individuals, companies or institutions may build and deploy AI systems to serve particular interests and how these systems might shape opportunities, representations or public perceptions.**
In the Classroom With their teacher, learners explore different types of data that can be collected about a person (e.g. height, favourite colour). They note the nuances that data can capture effectively, but draw from their knowledge of each other to identify what is left out.	**In the Classroom** Learners explore how and why facial recognition technology performs differently across demographics and discuss possible real-world impacts when it is used for decision making in everyday life.	**In the Classroom** With a teacher, learners evaluate real-world examples of AI being used to influence an event (e.g. misinformation and disinformation on social media). Then they explore how an institution's choices regarding AI use might benefit certain groups while having a negative effect on others.

Engage with AI 7: Analyse how well the use of an AI system aligns with ethical principles and human values.

Knowledge: 1.4, 4.1, 4.3 **Skills:** Critical Thinking, Problem Solving, Self and Social Awareness **Attitudes:** Reflective, Responsible

Basic

Learners recognise that ethical AI use depends on a number of factors that include AI system design, development and a user's own intentions.

In the Classroom

Learners identify recognisable aspects of artists' work across AI-generated examples. With a teacher, they discuss whether the examples constitute fair and appropriate use and identify implications for the human artists.

Intermediate

Learners identify when AI use may have unintended impacts or implications that are different from a user's immediate goals.

In the Classroom

Learners analyse a case study where an AI tool uses one's browsing history to advertise discounts and sales on products they have viewed in the past. With their teacher, learners weigh the opportunities to save money with risks the AI tool poses for personal privacy. They discuss the pros and cons of using the tool in the long- and short-term.

Advanced

Learners evaluate the use of AI according to multiple ethical principles, considering trade-offs and who may benefit or be harmed.

In the Classroom

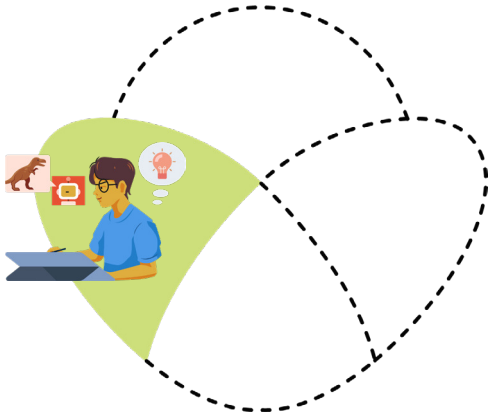
Learners explore how AI is used to analyse climate data to spot patterns and make predictions. They evaluate trade-offs between the tool's predictive power and the reduced transparency of an AI model. Learners weigh the opportunities for clearer forecasts with the risks of "hallucinations," or if important uncertainties are misunderstood or ignored.

Create with AI

Use AI as a creative partner while maintaining human agency

Create with AI positions learners as imaginative creators who use AI to explore open-ended questions and develop novel ideas and solutions. This approach unfolds with iterative use of AI tools as learners brainstorm and articulate their ideas, ask questions, reflect and refine AI outputs. In this way, learners use AI as a vehicle to realise, rather than replace, their creative visions. Learners also consider ethical questions related to originality, intellectual property and fair use of AI outputs. Create with AI prioritises a learner's own ideas as they use tools that can bring those ideas to life, prompt new iterations and bring about opportunities for reflection and learning.

Where does creativity come from? We want to think it is all in one person's head. But even at professional design schools, they put people in groups in these big, colourful rooms with sticky notes because having those things helps you to be more creative. It helps you to get out more ideas. So, LLMs used well can be similar. If I have a thought partner that I can improvise with, that could actually be a great creativity amplifier.
- Victor R. Lee, Stanford University, USA



Create with AI Competences

1. Use AI systems to explore new perspectives and approaches that build upon original ideas.
2. Visualise, prototype and combine ideas using different types of AI systems.
3. Direct generative AI systems to elicit feedback, refine results and support reflection.
4. Analyse how AI can safeguard or violate content authenticity and intellectual property.

Create with AI 1: Use AI systems to explore new perspectives and approaches that build upon original ideas.

Knowledge: 1.4, 4.1, 4.3 **Skills:** Critical Thinking, Problem Solving, Self and Social Awareness **Attitudes:** Reflective, Responsible

Basic	Intermediate	Advanced
Learners explore how different AI tools can expand their thinking or spark new ideas.	**Learners compare AI-generated suggestions to their own ideas during a brainstorming process.**	**Learners purposefully integrate AI-generated outputs with their own ideas to develop comprehensive solutions and creative approaches.**
In the Classroom Learners discuss AI-generated images to create story settings based on their classmates' ideas (e.g. "a jungle in space"), then write new stories inspired by unexpected results.	**In the Classroom** In response to a teacher's assignment, learners brainstorm independently before reviewing AI-generated ideas. They compare their own ideas with the AI-generated ones and discuss how exposure to AI suggestions may shape originality, confidence or decision making.	**In the Classroom** Learners develop their own arguments for a class debate, then analyse AI-generated counterarguments provided by the teacher. They remix and reject the counterpoints to strengthen their final argument.

Create with AI 2: Visualise, prototype and combine ideas using different types of AI systems.

Knowledge: 1.4 **Skills:** Collaboration, Creativity **Attitudes:** Adaptable, Curious

Basic	Intermediate	Advanced
Learners use AI to generate an image, story or model to represent an idea.	**Learners experiment with AI tools (e.g., text, image or music generators) to develop diverse ideas and produce varied outputs.**	**Learners select and integrate outputs from multiple AI systems to develop, refine or present a final product.**
In the Classroom Learners choose a theme (e.g. "hope," "winter" or "community") and use an AI image generator to create a visual representation. They generate one image and write a short explanation of how specific elements of their prompt shaped the final result, noting any unexpected or surprising aspects of the output. They assess how well the generated result matches the idea they had in mind.	**In the Classroom** Learners design a concept to share about a new club at their school. They generate multiple mission statements, activity ideas and visual styles using text and image generators. Then they compare how different prompts and tools produce varied interpretations of the same idea.	**In the Classroom** Learners use AI tools to design a simple interactive project (e.g. a motion-activated light display). They use a text generator to outline how the system should respond, an image generator to visualise the setup and an AI coding assistant to draft basic control code. They generate examples from different tools, compare outputs and revise their prototypes. Learners ensure the plan, visuals and code align into one functional prototype and seek peer feedback before finalising their work.

Create with AI 3: Direct generative AI systems to elicit feedback, refine results and support reflection.

Knowledge: 2.3, 3.3 **Skills:** Computational Thinking, Creativity **Attitudes:** Adaptable, Innovative

Basic	Intermediate	Advanced
Learners know how to prompt AI systems to generate accurate feedback and helpful responses to an idea.	**Learners refine their work through iterative exchanges with AI, comparing those outputs to their own ideas to determine what serves their goals.**	**Learners critically evaluate how AI-generated feedback shapes their own ideas, then reflect on how they would like to use AI in their creative process.**
In the Classroom Learners are shown two different versions of a prompt designed to get feedback on the same idea. They compare AI-generated responses to the two prompts and analyse which prompt led to an output with more accurate or useful feedback. Then they explain what features (e.g. context, specificity, constraints) made it more effective.	**In the Classroom** Learners design a three-dimensional model of a geometric garden using ratios and proportions. They compare AI-suggested dimensions to their own calculations to ensure mathematical accuracy and consider new creative approaches to inform the design.	**In the Classroom** Learners compare an early draft of a writing assignment to a final version that was revised with feedback from an AI tool. They annotate key changes to the assignment that indicate when each revision was influenced by the AI tool or their own thinking. They write a brief reflection explaining how they decided which suggestions to use, adapt or ignore to meet their goals.

Create with AI 4: Analyse how AI can safeguard or violate content authenticity and intellectual property.

Knowledge: 1.4 **Skills:** Collaboration, Creativity **Attitudes:** Adaptable, Curious

Basic	Intermediate	Advanced
Learners know that AI-generated content may reuse or copy work protected by intellectual property or copyright laws and recognise implications for the humans who created the original work.	**Learners consider when attribution, permission or avoidance of AI is appropriate for a creative task and apply these choices in their own work.**	**Learners assess the ethical implications of AI-generated outputs for creative work, distinguish inspiration from replication in their outputs, and justify how their use of AI maintains authenticity and respects other creators.**
In the Classroom Learners examine examples of music generated with AI to imitate a famous artist. With their teacher, learners discuss how this raises concerns about copyright, ownership and attributing proper credit to the artist.	**In the Classroom** Learners compare original work to AI-generated poems, then discuss with their teacher what makes something "original." They then identify school-based guidelines for attributing AI use.	**In the Classroom** Learners are presented with examples of art created entirely by a human, generated by an AI system and created by an artist along with AI. Learners consider what choices a human did or did not make for each piece, who should be credited as the artist, what should be protected by copyright and how AI may change artistic creation in the future.

Manage AI

Divide work intentionally between humans and AI

Manage AI positions learners as intentional decision makers who carefully consider how work is delegated from humans to AI tools. Learners compare different AI approaches, break problems into parts and decide when AI should automate or augment tasks so that human effort is focussed on judgement, creativity, relationship building and domain expertise. Throughout this process, learners monitor and adjust AI use to maintain oversight and ensure that AI remains effective, ethical and aligned with human-centred goals.

Effectively managing AI starts with students deciding if AI is truly needed. This requires setting clear learning goals, decomposing problems and distributing work appropriately with AI tools being used to augment human capacity. Students must be able to communicate transparently about their use of AI and follow guidelines that ensure fairness while centring justice and human judgement.

- Pati Ruiz, Digital Promise, USA

Manage AI Competences

1. Decide whether to use AI systems based on the nature of the task.
2. Choose an appropriate AI approach for a task by comparing how different AI systems operate and what they are best suited to do.
3. Decompose a problem to determine when and how AI systems should be used to automate or augment tasks.
4. Monitor and evaluate AI use throughout a problem-solving process.

Manage AI 1: Decide whether to use AI systems based on the nature of the task.

Knowledge: 3.1, 4.3 **Skills:** Computational Thinking, Problem Solving **Attitudes:** Innovative, Responsible

Basic

Learners identify a variety of AI systems and the tasks they are designed to support.

In the Classroom

Learners follow guidance established by their teacher to match appropriate tools with academic tasks (e.g. AI for summarising, search engines for research).

Intermediate

Learners use what they know about AI to determine whether AI is an appropriate digital tool for a specific task.

In the Classroom

As the teacher calls out examples of everyday tasks for the whole class, learners move to corners of the room labelled "AI Only," "AI-Supported," "Human Only," or "Not Sure" based on how they think AI could be used. Learners then defend and explain their choices to peers who had chosen differently and switch corners if convinced.

Advanced

Learners determine whether AI is the right digital tool for a specific task by comparing the task's complexity and need for human judgement with the ethical implications of AI use.

In the Classroom

Learners consider the steps to write an essay (i.e. choosing a topic, researching evidence, organising arguments, drafting paragraphs, revising and proof-reading), then identify which steps AI could assist with and which steps require their own voice and reasoning. They consult their school's guidelines for AI use to tailor their approach.

Manage AI 2: Choose an appropriate AI approach for a task by comparing how different AI systems operate and what they are best suited to do.

Knowledge: 1.2, 1.4 **Skills:** Computational Thinking, Problem Solving **Attitudes:** Adaptable, Curious

Basic

Learners recognise that some types of AI systems can be programmed with specific rules to accomplish tasks, while others can learn patterns from data.

In the Classroom

Learners compare different approaches to building AI systems by completing a trash-sorting task. First, they consider why random outputs would be unlikely to reliably sort items. Next, they direct a classmate role-playing as a robot to sort images of trash based on specific criteria. They observe how the "robot" responds to new images that do not match the criteria. Finally, they explore how a system could use patterns from collected data, such as a class survey, to improve sorting decisions and determine which approach is most appropriate for different tasks.

Intermediate

Learners identify the benefits and drawbacks of using a rules-based approach and a machine learning approach to solve a problem.

In the Classroom

Learners compare technology that follows set rules to execute a task (e.g. calculators, traffic lights, thermostats) with technologies that have been trained on examples from data (e.g., image recognition, translation). With a teacher, they consider why each approach suits the specific task.

Advanced

Learners evaluate when AI is an effective approach for a task by considering factors such as context, data availability and quality, efficiency, transparency, desired outcomes and potential impacts.

In the Classroom

Learners analyse real-world examples of AI use (e.g. route planning, content moderation or resource allocation). They justify whether a rule-based or machine learning approach is more appropriate – or whether AI should be used at all – based on the requirements, constraints and trade-offs involved. They build a case to make a recommendation, then present their chosen approaches to their peers in a class debate.

Manage AI 3: Decompose a problem to determine when and how AI systems should be used to automate or augment tasks.

Knowledge: 1.1, 3.1 **Skills:** Collaboration, Computational Thinking, Problem Solving **Attitudes:** Adaptable, Innovative

Basic

Learners identify the type of problem at hand and consider whether AI might help solve it.

In the Classroom

Learners are given examples of different problems to identify (e.g. predicting the weather, comforting a friend, detecting plagiarism) and classify each as a type of problem (e.g. data-based, emotional, creative). As a class, they discuss whether AI could help solve the problem and if AI solutions are always necessary to accomplish a goal.

Intermediate

Learners break a problem into component parts and consider ways AI might help with specific steps.

In the Classroom

Learners break down the steps to complete a complex research project and identify steps that AI could support (e.g. summarising primary sources and locating relevant commentaries). They work independently to verify claims, assess potential bias in AI outputs and develop their own arguments and interpretations.

Advanced

Learners deliberately assign tasks within a multi-step process based on appropriate human strengths and relevant AI capabilities.

In the Classroom

Learners are given a time-bound challenge to produce two versions of the same product, with and without AI. Before starting the AI-supported task, teams decide exactly which steps will rely on AI capabilities and which will depend on human strengths. After comparing outcomes, learners revise their task assignments and explain how changing human and AI roles affected the quality, trustworthiness and purpose of the final product.

Manage AI 4: Monitor and evaluate AI use throughout a problem-solving process.

Knowledge: 4.1 **Skills:** Collaboration, Problem Solving **Attitudes:** Adaptive, Reflective, Responsible.

Basic

Learners recognise that they should make decisions about AI use that support accountability, learning and fairness.

In the Classroom

Learners explore examples of AI tool use across industries (e.g. sports, journalism, music) to determine if there are tasks where AI use might be advantageous and when a human should play a more active role.

Intermediate

Learners compare AI outputs to desired results and know when to redirect AI systems or improve outputs themselves.

In the Classroom

Learners watch short videos of self-driving cars navigating different driving situations. As a class, learners compare how a human might make a different decision than a self-driving car and discuss when human judgement should override the algorithm.

Advanced

Learners establish checkpoints based on human and AI roles, monitor progress against success criteria and adjust roles accordingly.

In the Classroom

Learners work in teams to create a public awareness campaign about a local issue (e.g. reducing food waste, designing safe bicycle routes). They use AI tools to generate messages or visuals, but pause to compare outputs with audience needs and project goals. When AI-generated content is misleading or off-target, learners adjust roles or workflows to produce an accurate and authentic message.

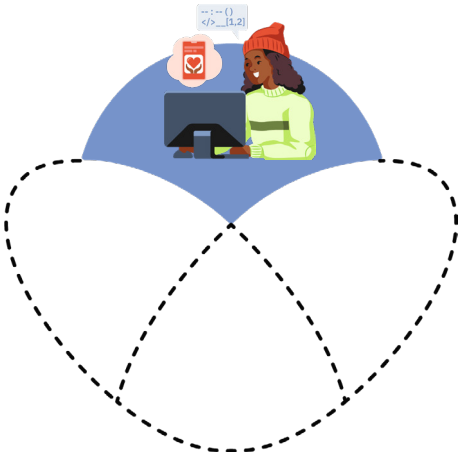
Shape AI

Improve AI systems to reflect human values

Shape AI empowers learners to examine the relationship between the technical underpinnings of AI systems and the human choices that influence their behaviour and impact. Through hands-on, age-appropriate exploration of computer science principles in an educational context, Shape AI compels learners to see AI systems as deliberate and human-driven, rather than inevitable. This draws from a deeper, more technical set of experiences and understandings. The goal of this domain is not for learners to develop commercial products or put them into service, but to empower young people to create or improve AI systems that reflect human values, diverse perspectives and the common good. In turn, learners who Shape AI come to see themselves as responsible creators, rather than passive consumers. These capabilities can only be realised when learners can reason about the role and influence of AI systems, understand their backgrounds, and can navigate emerging technologies safely and effectively. This may require collaboration with computer science educators, AI-related initiatives and capacity, or community partners. Schools and education systems are encouraged to explore partnerships and cross-curricular approaches that make these competences accessible, even where dedicated technical infrastructure or instruction is not yet in place. This domain is feasible to achieve when learners have the competences of the previous three domains: Engage with AI, Create with AI and Manage AI.

Students do not need to be AI engineers to build with AI. Even simple, age-appropriate explorations of how AI systems work can spark powerful learning — and help students see they can shape technology, not just be shaped by it.

- Cathy Adams, University of Alberta, Canada



Shape AI Competences

1. Investigate how an AI system is intended to work, whom it is designed for and what its limitations are.
2. Evaluate AI systems using defined criteria, expected outcomes, test cases and user feedback.
3. Design AI systems with attention to how data sources, selection and information flow influence behaviour and outputs.
4. Improve AI systems to address and promote human well-being and societal benefit.

Shape AI 1: Investigate how an AI system is intended to work, whom it is designed for and what its limitations are.

Knowledge: 1.2, 2.1 **Skills:** Communication, Problem Solving, Self and Social Awareness **Attitudes:** Curious, Reflective, Responsible

Basic

Learners identify what different AI systems are designed to do.

In the Classroom

Learners review model cards that describe how an AI system works, its training data, intended uses and possible limitations. As a class, they discuss appropriate uses of the AI system.

Intermediate

Learners describe the purpose, intended users and basic constraints of a specific AI tool.

In the Classroom

Learners examine several examples of AI tools (e.g. a chatbot, recommendation system or route-planning app). For each, learners identify its primary task and explain in simple terms what input it uses and how the outputs execute the task.

Advanced

Learners assess the strengths and limitations of an AI tool by considering its purpose, intended users, constraints and potential impacts.

In the Classroom

Learners analyse how an AI-enabled navigation app uses traffic data to suggest efficient routes. They discuss how the app might reduce travel time for some while increasing congestion, noise or safety risks in certain neighborhoods.

Shape AI 2: Evaluate AI systems using defined criteria, expected outcomes, test cases and user feedback.

Knowledge: 1.2, 1.4 **Skills:** Collaboration, Computational Thinking **Attitudes:** Adaptable, Innovative, Reflective

Basic

Learners define criteria for whether an AI system has accomplished a task.

In the Classroom

Learners examine an AI system that recommends new music. In small groups, they define criteria for what would make the system successful and compare the system's recommendations for users with different interests or interaction histories.

Intermediate

Learners assess an AI system performance of a task using defined criteria and feedback from human reviews or benchmark tests.

In the Classroom

Learners identify strategies they would use to solve a word puzzle. The teacher presents a sample algorithm for the same task. Using defined criteria (e.g. efficiency, consistency, clarity), learners compare their peers' strategies to the algorithm, identifying strengths, limitations and trade-offs in each approach.

Advanced

Learners design their own evaluation criteria for an AI system, compare performance across different inputs and users and use it to propose improvements.

In the Classroom

In pairs, learners draft proposals for an AI tool and share their ideas. Each learner asks their partner a series of questions about their proposal. Next, each partner fills out a model card to identify intended and unintended users, impacts and use cases for the other's idea. They provide feedback to each other based on the model cards and revise their own tool proposals accordingly.

Shape AI 3: Design AI systems with attention to how data sources, selection and information flow influence behaviour and outputs.

Knowledge: 1.2, 2.2, 2.4 **Skills:** Computational Thinking, Self and Social Awareness **Attitudes:** Innovative, Responsible

Basic

Learners identify examples of data that might be used to train AI systems.

In the Classroom

Learners are tasked with designing an AI tool that can sort recyclable materials. In small groups, they decide what data they could collect on the internet to train the AI tool. With support from a teacher, they discuss which aspects of the data would be most important to train an effective and accurate AI tool.

Intermediate

Learners compare the importance of data selection and collection methods in cases when AI is used to make decisions that affect others.

In the Classroom

Learners compare different methods for organising a set of animals, such as grouping them based on physical characteristics. They discuss what happens when new animals are introduced to the set that do not fit into the existing groups.

Advanced

Learners evaluate how specific properties of a dataset (e.g. size, features, biases) affect the performance and impact of an AI model.

In the Classroom

Learners conduct a class survey to choose a class pet and represent the results using a bar chart. They compare these results with their individual preferences, as well as data from a grade-level survey and a school-wide survey. Learners discuss how increasing the size and diversity of the dataset changes the outcomes of the survey and consider how an AI system might make different recommendations based on its training data.

Shape AI 4: Improve AI systems to address and promote human well-being and societal benefit.

Knowledge: 4.1, 4.2, 4.3 **Skills:** Computational Thinking, Problem Solving, Self and Social Awareness **Attitudes:** Empathetic, Innovative, Responsible

Basic

Learners recognise that AI systems can be designed or adjusted to better support individuals, communities and the environment.

In the Classroom

Learners discuss everyday challenges in their classroom or school, such as finding study resources or sharing information on time. They explore examples of AI tools and identify simple changes that could make these tools more helpful or inclusive, such as clearer instructions, age-appropriate outputs or options for different needs. Learners explain who would benefit from these improvements and why.

Intermediate

Learners propose specific design changes to improve an AI system for themselves and others.

In the Classroom

Learners consider the use of an AI tool that would predict which library books are most in demand. They analyse how design choices around data sources, categories and recommendations influence what interests are represented. Learners suggest and plan concrete changes (e.g. adding user input, adjusting categories, including feedback loops) to improve variables like access, inclusion or usefulness. They identify features that ensure recommendations and interfaces are accessible and supportive for learners with different abilities or learning needs.

Advanced

Learners design and justify improvements to an AI system based on technical constraints, ethical considerations and user needs.

In the Classroom

Working in teams, learners design or modify a model that uses local environmental data to alert community members with asthma about health risks. They practise making deliberate design decisions about which data to include, how predictions are generated and how users receive alerts from the model. Learners test and refine their system using feedback to explain how their improvements better support human well-being and community trust.

05

Supporting Materials

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Glossary

Term	Definition	Source(s)
AI Agent	Advanced AI systems designed to autonomously reason, plan and execute complex tasks based on high-level goals.	Generative AI Outlook Report (Abendroth-Dias et al., 2025); Types of AI Agents (Stryker, 2025)
AI Companion	Sophisticated AI entities designed for supporting and enhancing human experiences in daily activities, such as learning, working and others. They encompass emotional, social and practical aspects of daily life while fostering interactions and relationships with humans.	Defining AI Companions: A Research Agenda—from Artificial Companions for Learning to General Artificial Companions (Chou et al., 2025)
Algorithm	A formula or set of rules (or procedure, processes or instructions) for solving a problem or for performing a task. Common examples include decision trees, clustering algorithms, classification algorithms or regression algorithms.	DigComp 3.0 (Cosgrove & Cachia, 2025). Adapted from Generative AI Outlook Report (Abendroth-Dias et al., 2025)
Anthropomorphism	An interpretation of what is not human or personal in terms of human or personal characteristics.	Merriam-Webster Dictionary (Merriam-Webster, n.d.)
Artificial General Intelligence (AGI)	AI systems that can match or exceed the cognitive versatility and proficiency of a well-educated adult. No such systems currently exist.	Adapted from What is Artificial General Intelligence (AGI)? (Bergmann & Stryker, n.d.)
Augmentation	The use of a machine in one task to increase productivity in other tasks.	The EPOCH of AI: Human-Machine Complementarities at Work (Loaiza & Rigobon, 2024)
Automation	The process of linking disparate systems and software so that they become self-acting or self-regulating.	K-12 Standards (Computer Science Teachers Association, 2017)
Bot/Chatbot	A computer program designed to simulate conversation with a human, usually over the internet, especially one used to provide information or assistance to the user as part of an automated service.	DigComp 3.0 (Cosgrove & Cachia, 2025). Adapted from Generative AI Outlook Report (Abendroth-Dias et al., 2025)

Term	Definition	Source(s)
Bias	A systematic deviation from a true state. There are different forms of bias, such as the subjective bias of individuals, data and algorithm bias, developer bias and institutionalised biases that are ingrained in the underlying societal context.	DigComp 3.0 (Cosgrove & Cachia, 2025). Adapted from Generative AI Outlook Report (Abendroth-Dias et al., 2025)
Coding	The act of writing computer programs in a programming language.	K-12 Standards (Computer Science Teachers Association, 2017)
Computational Thinking	The thought processes involved in formulating a problem and expressing its solution(s) in such a way that a computer – human or machine – can effectively carry it out.	Computational Thinking's Influence on Research and Education for All (Wing, 2017)
Computer Program	A sequence or set of instructions in a programming language for a computer to execute.	Adapted from Cambridge English Dictionary (Cambridge University Press, n.d.)
Computer Science	See *Informatics*	
Copyright	A type of intellectual property that protects original works of authorship as soon as an author fixes the work in a tangible form of expression.	DigComp 3.0 (Cosgrove & Cachia, 2025). Adapted from Generative AI Outlook Report (Abendroth-Dias et al., 2025)
Cyberbullying	An aggressive, intentional act carried out by a group or individual, using electronic forms of contact, repeatedly and over time against a victim who cannot easily defend him or herself.	DigComp 3.0 (Cosgrove & Cachia, 2025)
Data	Any digital representation of acts, facts or information and any compilation of such acts, facts or information, including in the form of sound, visual or audiovisual recording.	DigComp 3.0 (Cosgrove & Cachia, 2025)
Data Literacy	Interacting with data (e.g. collecting, analysing, visualising, interpreting) with criticality, uncertainty and intrigue. It includes components such as context, aggregation, variability, visualisation and inference.	AI Literacy: A Framework to Use, Understand and Evaluate Emerging Technology (Mills et al., 2024); Learning to Reason with Data (Rubin, 2020)

Term	Definition	Source(s)
Decomposition	Breaking down a problem or system into components.	K-12 Standards (Computer Science Teachers Association, 2017)
Deepfake	Generated or manipulated image, audio or video content that resembles existing persons, objects, places, entities or events and would falsely appear to a person to be authentic or truthful.	DigComp 3.0 (Cosgrove & Cachia, 2025). Adapted from Generative AI Outlook Report (Abendroth-Dias et al., 2025)
Design Thinking	An approach to problem solving and innovation focussed on human-centred design, involving four phases (clarify, ideate, develop and implement).	What is Design Thinking & Why is it Important? (Han, 2022)
Digital Citizenship	The capacity to participate actively, continuously and responsibly in digital environments (local, national, global, online) at all levels (political, economic, social, cultural and intercultural).	DigComp 3.0 (Cosgrove & Cachia, 2025)
Digital Competence	The confident, critical and responsible use of and engagement with digital technologies for learning, at work and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking.	Council Recommendation on Key Competences for Lifelong Learning 2018 (European Commission, 2018)
Digital Literacy	The ability to access, manage, understand, integrate, communicate, evaluate, create and disseminate information safely and appropriately through digital technologies. It includes competences that are variously referred to as information literacy and media literacy, computer and ICT literacy.	Guidelines for Teachers and Educators on Tackling Disinformation and Promoting Digital Literacy through Education and Training (European Commission, 2026a)
Disinformation	Verifiably false or misleading information that is created, presented and disseminated for economic gain or to intentionally deceive the public. It can cause public harm.	Guidelines for Teachers and Educators on Tackling Disinformation and Promoting Digital Literacy through Education and Training (European Commission, 2026a)

Term	Definition	Source(s)
Filter Bubble	An echo chamber (a bounded, enclosed media space that has the potential to both magnify the messages delivered within it and insulate them from rebuttal) primarily produced by ranking algorithms on digital platforms, such as search engines and social media, which personalise information without any active choice on the part of an individual.	DigComp 3.0 (Cosgrove & Cachia, 2025); Adapted from Echo chambers, Filter Bubbles and Polarisation: a Literature Review (Arguedas et al., 2022)
Generative AI (Gen AI)	AI systems that can generate content from general instructions (e.g. text, images, audio, video, code), process existing content (e.g. translate, correct) or analyse data (e.g. sort, summarise) based on patterns learnt from existing data. These systems generate outputs in response to user instructions, known as prompts, and rely on models trained to predict and produce relevant information.	Guidelines on the Use of AI and Data in Teaching and Learning for Educators (European Commission, 2026b)
Hallucination	Phenomena where AI algorithms invent information that sounds plausible but is not factual.	Generative AI Outlook Report (Abendroth-Dias et al., 2025)
Informatics	A distinct scientific discipline known in many countries as *Computer Science* or computing. It is characterised by its own concepts, methods, body of knowledge and open issues. Informatics covers the foundations of computational structures, processes, artefacts and systems, the design of their software, their applications and their impact on society.	Informatics Education at School in Europe (European Commission, 2022)
Intellectual Property (IP)	Someone's idea, invention, creation, etc., that can be protected by law from being copied by someone else.	Cambridge Dictionary (Cambridge University Press, n.d.)
Large Language Model (LLM)	A neural network trained on massive amounts of text that can be used in a variety of language tasks such as sentence completion, question answering, machine translation and chatbot functions. Large language models are one of the technologies that make up generative AI.	AI Learning Priorities for All K-12 Students (CSTA & AI4K12, 2025)
Machine Learning	The study of algorithms and models that machines use to perform a task without explicit instructions. Machine learning algorithms improve with experience. Advanced machine learning algorithms use neural networks to build a mathematical model based on patterns in sample "training" data. Machine learning algorithms are best used for tasks that cannot be completed with discrete steps, such as natural language processing or facial recognition.	Hands-On AI Projects for the Classroom (Blair Black & Brooks-Young, 2021a-c)

Term	Definition	Source(s)
Media Literacy	The ability to access, comprehend, analyse and create media, while reflecting on its impact on individuals, institutions and society.	Navigating an Evolving World: First Draft of the Media and Artificial Intelligence Literacy (MAIL) Assessment Framework (OECD, 2026b)
Metacognition	Comprises both the ability to be aware of one's cognitive processes (metacognitive knowledge) and the ability to regulate them (metacognitive control). Metacognitive knowledge encompasses knowledge of oneself as a learner (such as strengths, weaknesses, preferred time of day for study, preferred study location) and how the human brain stores, organises and retrieves information as well as effective strategies to complete the task.	Guidelines for Teachers and Educators on Tackling Disinformation and Promoting Digital Literacy through Education and Training (European Commission, 2026a)
Misinformation	Verifiably false information that is spread without the intention to mislead and often shared because the user believes it to be true.	Guidelines for Teachers and Educators on Tackling Disinformation and Promoting Digital Literacy through Education and Training (European Commission, 2026a)
Natural Language Process (NLP)	AI technology used to understand and interact with humans' natural language. Natural language processing powers technologies such as voice experiences and assistants, text predictors, grammar checks, text analysers (such as spam filters) and language translators.	Hands-On AI Projects for the Classroom (Blair Black & Brooks-Young, 2021a-c)
Neural Network	Artificial neural networks are currently modelled after the human brain. While a brain uses neurons and synapses to process data, neural networks use layers of nodes with directed connections. Some of these connections are more important than others, so they have more weight in determining the outcome. Just like people, machines with neural networks learn through experience. As a machine processes a set of data, it recognises patterns, assigns more weight to the most important information, learns to process inputs in order to develop the most accurate outputs and creates a model from which to make future predictions or decisions. There are many types of neural networks, each with different designs, strengths and purposes.	Hands-On AI Projects for the Classroom (Blair Black & Brooks-Young, 2021a-c)

Term	Definition	Source(s)
Personalisation	Digital services that are tailored to individual users' interests and preferences, especially through the application of algorithms to the users' online behaviours.	Generative AI Outlook Report (Abendroth-Dias et al., 2025)
Predictive AI	AI trained to detect patterns in existing data and forecast what is likely to happen next. This exists in tools like recommendation engines, spam filters and personalised learning applications.	Generative AI vs. Other AI Types (Microsoft, n.d.)
Programming	The craft of analysing problems and designing, writing, testing and maintaining programs to solve the problems.	K-12 Standards (Computer Science Teachers Association, 2017)
Reinforcement Learning (RL)	A type of machine learning process in which autonomous agents learn to make decisions by interacting with their environment.	What is Reinforcement Learning? (Murel & Kavlakoglu, n.d.)
Source	The starting place or the origin of a piece of information.	Guidelines for Teachers and Educators on Tackling Disinformation and Promoting Digital Literacy through Education and Training (European Commission, 2026a)

06

Annexes

Annex 1: Summary of Feedback

Aims, Format and Participants

Following the launch of the draft framework, a series of consultations was conducted with a broad range of stakeholders to inform content and structural revisions. This stakeholder review process took place from May to October 2025. The purpose of the stakeholder review process was to determine how the framework met target audiences' needs and to identify areas for improvement and additional development. Feedback was collected through two major outlets:

> **An online feedback survey** consisting of Likert-style multiple-choice and open, text-based responses. Survey questions focussed on users' impressions of the framework content and gathered their opinions about what additional materials or structural updates would support implementation in their settings. The survey was launched along with the framework in May 2025 and remained open for responses through 30 October 2025.

> **Focus group consultations** with participants from organisations across the K-12 education ecosystem. Participants were identified and recruited through established partnerships. Consultations took place virtually and in-person. In some cases, individuals planned and carried out their own focus groups using the Facilitation Toolkit launched with the framework in May 2025. Most consultations asked participants to respond to questions about the overall content and structure of the framework, though some were facilitated to address specific questions or themes that arose from survey responses.

In total, more than 2 000 individuals contributed feedback on the draft framework across multiple modalities. The most common stakeholder groups were teachers (41% of survey responses), individuals who did not identify as target audiences of the framework (18% of survey responses) and learning designers (15% of survey responses). Education policymakers (8%), Nongovernmental Organisation (NGO) Representatives (6%) and School and District Leadership (6%) accounted for a further 20% of survey respondents. Responses were also collected from Youth Representatives (3%), Union or Professional Organisation Representatives (2%) and Parents or Caregivers (1%).

Feedback

The feedback provided by stakeholders was analysed by the development team and incorporated into revisions to the framework for the final draft.

Overall, respondents were positive about the framework's content. There was strong support for the information provided in the Knowledge section, the practices included in the Skills section and the relevance of future-ready Attitudes. Stakeholders agreed that the framework drew relevant connections between AI's technical underpinnings and societal implications. They agreed that the Competences reflected realistic interactions with AI and would prove durable as technologies change.

Across feedback channels and stakeholder groups, specific themes emerged. The development team considered how to address each theme – not only in the framework content, but also with supplementary materials and implementation resources.

Metacognition: Stakeholders called for greater emphasis on self-reflection as a core skill. This pertains not only to learning with AI, but also to student interactions with "relational AI" in the form of companion apps, social media or chatbots. The mindsets and strategies stakeholders identified included self-regulation, recognising manipulation, emotional awareness, boundary-setting and refusal to use AI.

Student Agency: Stakeholders identified opportunities for the framework to bolster student agency and to position learners to shape or make decisions about AI itself. They suggested that the framework could introduce more hands-on, sense-making experiences with and about AI, particularly in Competences.

Discerning Capabilities: Stakeholders felt that the framework painted an overly positive picture of AI's role in learners' everyday lives. They advocated for revisions to include healthy skepticism about AI, with more scaffolding for learners to interrogate AI systems' design and use. Stakeholders felt that the framework could improve in its support for learners' discerning capabilities.

The Environment: Stakeholders felt that the framework could better describe the environmental costs of AI use. They identified opportunities for the framework to delineate ways for learners to consider the environmental cost of AI and to make decisions about it accordingly.

Levels of Progression and Realistic Implementation: Stakeholders appreciated the content of the framework but noted that additional resources would be required to implement and localise the material. They introduced a number of suggestions for how this might take shape, most commonly in the form of including learning progressions for the framework's competences.

Each of these themes was discussed by the development team and expert group members to identify the best way to incorporate stakeholder feedback into revisions to the final framework. While it is not possible to incorporate every suggestion or to create multiple versions of the framework tailored to each audience group, the development team carefully considered options that would satisfy as many stakeholders as possible. This was done alongside considerations of learning science, best educational practices and of regional guidelines and laws regarding the use of AI.

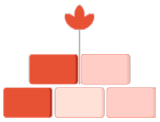
Annex 2: Developing the AILit Framework

Development Principles

The AILit Framework's design is guided by a set of core development principles that reflect a purposeful, collaborative and globally-minded approach to defining AI literacy for the next generation.

Interdisciplinary

Integrate AI literacy into a wide range of subjects and educational settings.



Foundational

Define a core set of competences needed to demonstrate proficiency in AI literacy.

Illustrative

Include scenarios and exemplars that bring AI literacy to life.

Global

Incorporate insights from educators, researchers and AI experts worldwide.

Practical

Make AI literacy manageable and attainable in various classroom contexts.

Durable

Identify knowledge and skills that will remain relevant as AI evolves.

Building on Existing Frameworks

The AILit Framework builds on ideas and practices from previous digital competence and AI literacy frameworks. Collectively, these frameworks ensured that the AILit Framework is internationally informed, relevant to educators and grounded in the ethical, technical and social dimensions of AI literacy.

The European Commission's Digital Competence Framework (DigComp) competence categorisation and emphasis on learner agency in its knowledge, skills and attitudes influenced the content of the AILit Framework, while its realistic employment and learning use cases informed the AILit Framework's structure.

UNESCO's AI Competencies for Students and AI Competencies for Teachers influenced the AILit Framework's focus on global relevance and implementation. UNESCO's work also prompted consideration for clear distinctions between learner-specific AI literacy outcomes and ways that educators can support these experiences in the classroom.

The Digital Promise AI Literacy Framework's interconnected modes of engagement, with cross-cutting AI literacy practices and enumerated types of use, provided a foundation for how the AILit Framework defines competences and frames learners' specific interactions with emerging technologies.

The ETS Preparing K–12 Students With AI Literacy report's progressions guided the development and scaffolding of Learner Expectations and Learning Scenarios across competences.

The AI4K12 5 Big Ideas in AI informed the technical aspects of the framework, including the nature of AI and role of data in the AI training process.

The aiEDU AI Readiness Framework influenced the AILit Framework's emphasis on cultivating durable skills for an age of AI and fostering future-ready attitudes.

Research Process and Themes

The AILit Framework is informed by research that included literature reviews, interviews, focus group consultations and expert group discussions. Existing frameworks on digital competence, media literacy and AI literacy were reviewed, along with curricula in computer science, data science, social sciences and career education. Since the launch of the draft framework in 2025, new research has been published about a number of topics related to AI, including student learning outcomes, educator sentiment and use trends and implications for youth mental health and well-being. As with the 2025 draft, key themes and research questions focussed on technical knowledge about how AI works, human skills needed for effective collaboration with AI and ethical considerations about its impacts. This work informed updates to the Knowledge, Skills and Attitudes sections, as well as Competences, Learner Expectations and Learning Scenarios.

Theme 1: *How AI and Machine Learning Work*

Understanding AI helps learners dispel misconceptions about the technology and enables a more informed evaluation of its implications. AI is not magic or all-knowing: it processes data using statistical inferences and logic to produce outputs (Allen & Kendeou, 2023; Touretzky & Gardner-McCune, 2022). It has been trained by data that comes from publicly available information, user-generated content, databases and real-time interactions collected through sensors and digital systems (AI4K12, 2022; aiEDU, 2025). AI models "learn" not through authentic understanding, but by adjusting statistical weights based on these datasets (Touretzky & Gardner-McCune, 2022). This produces sophisticated outputs but makes AI vulnerable to replicating the harmful and statistical biases embedded in its training data or introduced during development (AI4K12, 2022; aiEDU, 2024; Sparks et al., 2024). The AILit Framework emphasises that learners must develop a strong understanding of AI's technical foundations, including its reliance on data, probabilities and inputs. By demystifying these technical underpinnings, learners develop a comprehensive understanding of both AI's capabilities and limitations. Ultimately, they draw connections between how AI works and the ways it might impact themselves or others.

Theme 2: *Human Skills to Emphasise for Successful Collaboration with AI Tools*

The AILit Framework emphasises several skills and attitudes that support learners' successful collaboration with AI. Traditional learning competences such as metacognition and critical thinking remain highly relevant to interactions with AI. Communication, questioning and perspective-taking skills assume new importance in interactions with AI and in broader discussions about its implementation (Thoman & Jolls, 2008; Kafai et al., 2019; aiEDU, 2025). Traditional computational thinking skills, such as abstraction, decomposition and problem formulation, assume additional relevance beyond the computer science classroom, as learners encounter technological challenges in their diverse everyday contexts (Allen & Kendeou, 2023; Dasgupta & Hill, 2021). This framework incorporates theories of creative learning, particularly the "Imagine-Create-Play-Share-Reflect" framework, to better align constructionist theory with the use of emerging technology (Resnick, 2024). Between the publication of the draft framework and its revisions, additional resources shed light on how learners' own AI literacy development might progress, as well as particular workforce skills and behaviours that support effective AI use (Chakraburty, Ober and Liu, 2025; Butler et. al., 2025). This framework deliberately centres human capabilities within AI-specific competences, ensuring learners can effectively leverage AI while maintaining qualities that technology cannot replicate.

Theme 3: *AI's Effects on Individuals, Society and the Environment*

Learners must think critically about how AI already affects them and how it will continue to shape their futures. Rather than treating ethics as a supplement to technical concepts, this framework emphasises that values, context and accountability are inseparable from learning with and about AI. This approach aligns with international research and existing policy recommendations and initiatives (European Commission, 2020; Miao et al., 2024; Cosgrove & Cachia, 2025). Learners must understand that AI exists within social and political systems and that algorithmic outputs can reinforce existing patterns of unfairness if not critically examined. This also includes considerations about the ethics of how training data was collected and classified (Buolamwini & Gebru, 2018; Noble, 2018; TeachAI & Computer Science Teachers Association, 2024). Throughout their interactions with AI, learners must reflect on its real-world implications: who can benefit or be harmed by AI systems; what perspectives are represented and excluded in both training data and AI-generated outputs; and how AI systems influence personal autonomy, ownership and access to information (White & Scott, 2024; Miao et al., 2024). The AILit Framework reinforces ethical consideration through practical competences, mirroring calls to treat ethical evaluation as a core skill in one's digital life. Cultivating AI literacy helps learners navigate a world where technological decisions are deeply intertwined with power, equity and accountability. It equips them to ask not only what AI can do, but also what it should do and whom it serves.

Between the launch of the draft framework and its revision for publication in 2026, additional research, news coverage and advocacy highlighted the growing ways young people are using AI for academic tasks, emotional support and mental health–related needs (American Psychological Association, 2025; Gerlich, 2025; Moore et al., 2025; Robb & Mann, 2025). In response, the framework placed greater emphasis on prioritising young people's mental and emotional well-being by strengthening elements that support healthy cognitive development and increase awareness of the risks and limitations of AI. This includes explicit reference that AI is not human and should not be treated as such, as well as opportunities to bolster student agency throughout the publication. Revisions also supplemented the framework content with ongoing research about the effects of AI on cognitive development. These refinements reflect a commitment to ensuring that AI literacy remains responsive to emerging evidence about the opportunities and risks of AI use and represents the real experiences of young people.

Additionally, the AILit Framework compels learners to weigh the environmental cost of using AI systems with AI's relevance to specific tasks. At the time of publication, AI systems require significant amounts of energy, materials and water, while contributing to global carbon emissions (Bashir et al., 2024; Luccioni et al., 2025; Zewe, 2025). Ongoing efforts to improve sustainability in computing focus on AI's potential to increase energy efficiency or address unique climate-related problems that other technologies cannot (Bashir et al., 2024). AI's long-term effects on natural resources have yet to be fully realised and now is the time for learners to think more broadly about the relationship between the digital and physical worlds.

Empowering Learners for the Age of AI

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