CONCEPTUAL FRAMEWORK FOR AI IN EDUCATION

2026

Artificial Intelligence in Education

A global vision for quality, inclusive and people-centred education

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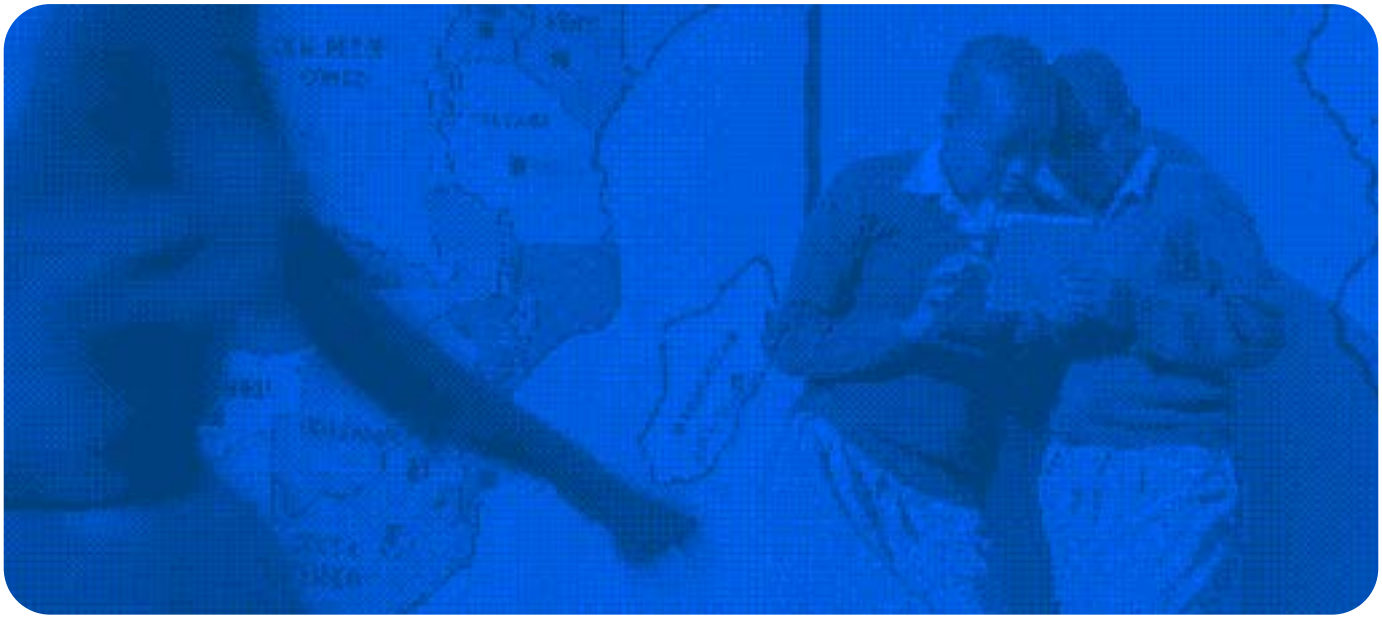
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Introduction

Artificial intelligence (AI) is no longer a promise of the future; it has become a present reality that is transforming everyday life. Its adoption is having an impact on sectors as diverse as the economy, health, culture and the environment, generating open debates about its effects and possibilities. Society is called upon to understand, channel and apply AI responsibly and with a focus on the common good.

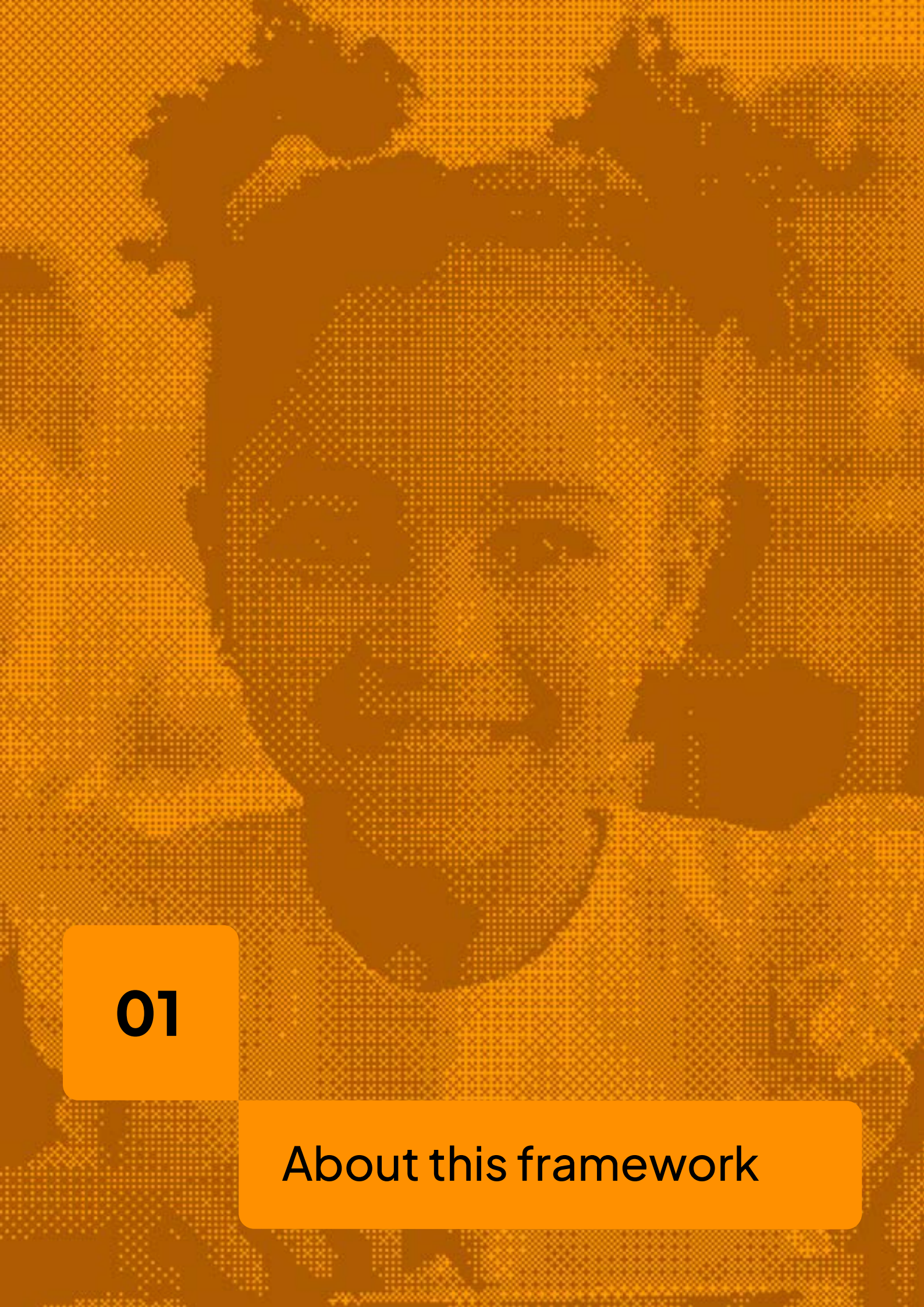
Advances in recent years have established AI as a General-Purpose Technology: a technology capable of profoundly transforming society thanks to its broad applicability and innovative potential. In education, it has the capacity to influence what and how we learn, teach, assess and manage the education system. AI opens up opportunities to personalise learning, support teachers in their pedagogical decisions and reduce inequalities, while at the same time demanding the development of the new knowledge and competencies needed for this century.



In this scenario, rather than attempting to predict the future of education, ProFuturo, the international programme for educational innovation with technology for social transformation, promoted by Fundación Telefónica and Fundación "la Caixa", chooses to start from what is essential and enduring: human relationships remain fundamental to teaching and learning. Technology broadens possibilities, but the human bond remains the driving force behind meaningful learning.

Integrated into the institutional strategy, this document delves into ProFuturo's purpose: to educate in order to transform and to digitalise in order to expand access to quality education. It establishes a common basis to guide work with and on AI in the various contexts in which the programme operates, strengthens the commitment to developing digital competencies and promoting foundational learning in schools in vulnerable situations, and sustains its positioning as a benchmark in knowledge about AI and technologies applied to education.

In doing so, we broaden our capacity to support public policies, guide programmes and generate systemic and sustainable impact. We thus reaffirm our commitment to quality, inclusive and connected education that is prepared for the challenges and opportunities of the future.



01

About this framework



ProFuturo presents the Conceptual Framework on Artificial Intelligence in Education with the aim of guiding its work in the coming years. The document is grounded in the conviction that AI can be a catalyst for change in curricula and a lever for learning, capable of extending the action of teachers and students, provided that it is used ethically, critically and intentionally. It also seeks to guide responsible decisions that reduce, rather than deepen, educational inequalities and gaps.

This document pursues four objectives:

- **To support educational policies and practices that incorporate the ethical,** equitable and pedagogical use of AI, focused on the well-being and holistic development of students and educators.
- **To offer a reference framework to guide ProFuturo's programmes and initiatives,** ensuring the coherence and consistency of its actions.
- **To optimise the role of teachers,** defining where AI should support the human dimensions of pedagogical work — social learning, empathy, ethics, relationship-building and contextual discernment— without replacing them.
- **To contribute to the public debate on the responsible integration of AI in education at a global level,** promoting a discussion based on evidence rather than on technological promises.

This framework is justified by the urgency of preparing students and educators for a future in which AI will permeate every dimension of professional and social life. ProFuturo's commitment is to the critical, creative and responsible appropriation of AI in education: critical with regard to the risks and creative with regard to the possibilities, so that technological innovation serves a purpose of economic and social growth, reducing inequalities and broadening opportunities through the holistic development of students and educators.





02

Defining artificial intelligence

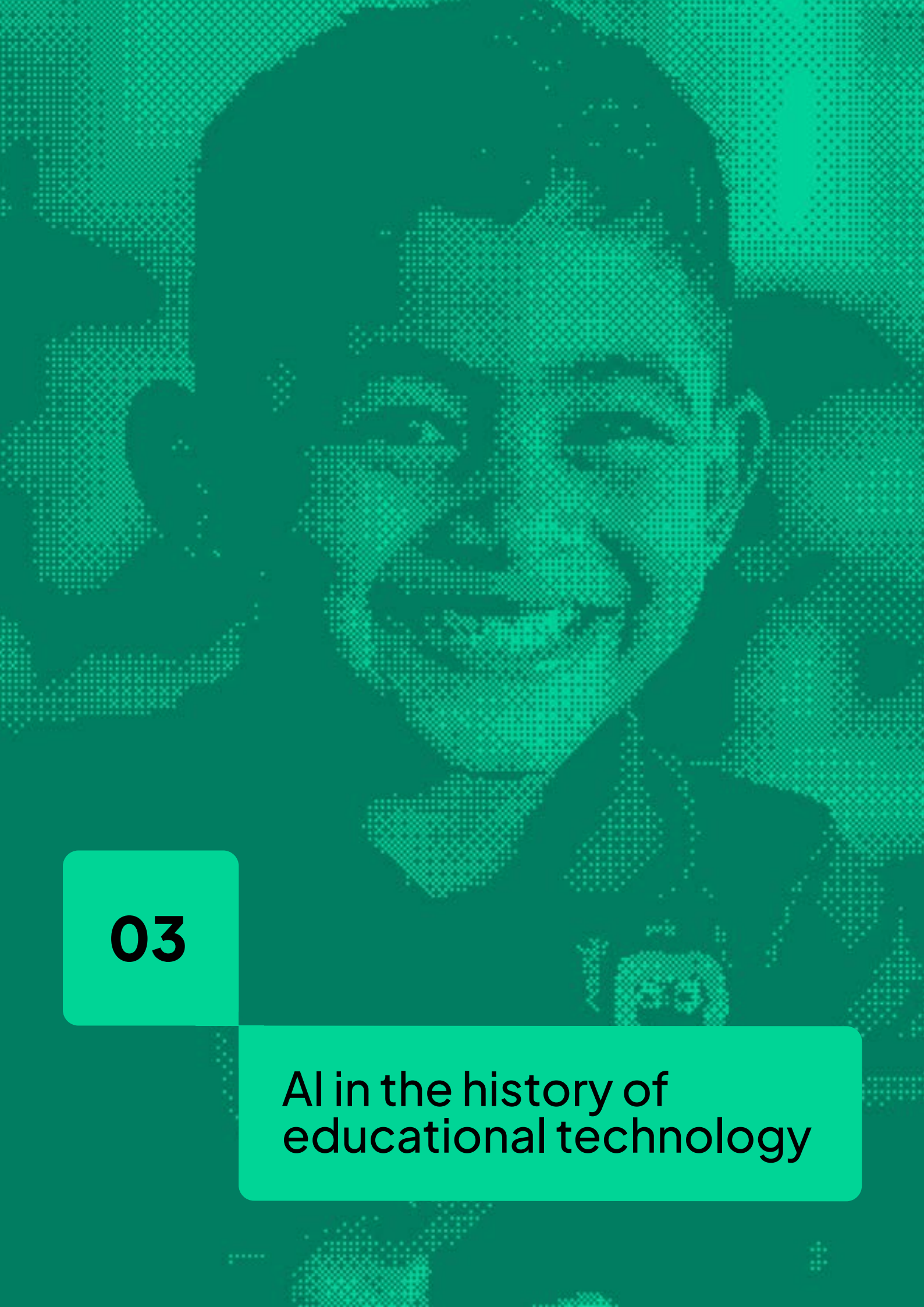
For this framework, ProFuturo adopts the definition of artificial intelligence proposed by UNESCO (2021): computational systems capable of performing tasks that would normally require human intelligence, such as learning from data, recognising patterns, understanding language, making decisions and solving problems.

This definition is not permanent. As technology advances and new use cases emerge, it will need to be revised. Inspired by Charles Fadel's work on education for the age of AI (Fadel et al., 2024).

We recognise four levels of AI evolution:

- **Narrow AI or weak AI:** specialised in specific tasks, such as facial recognition or certain games.
- **Capable AI:** the current stage, represented by large language models such as those that power conversational assistants, capable of performing multiple tasks.
- **General AI:** not yet in existence; hypothetically capable of reproducing the whole of human intelligence.
- **Superintelligence:** a theoretical level that would surpass human intelligence in every respect.

This framework focuses mainly on narrow AI and capable AI, which are the forms already having an impact on the classroom and on educational management. References to more advanced levels are used solely as an ethical and forward-looking horizon.



03

AI in the history of educational technology

The trajectory of technology in education is marked by recurring cycles of enthusiasm and high expectations. Throughout the last century, various innovations were presented as potential revolutions in teaching and learning: from radio in the 1920s to television in the 1950s; from personal computers in the 1980s to the internet and digital platforms from the early 2000s onwards.

At each of these moments, it was believed that the new technology would profoundly transform education, broaden access to knowledge and renew pedagogical practices. However, what was observed in practice were incremental changes, often limited to specific contexts or uses. Technologies broadened possibilities, diversified resources and modified some school dynamics, but they did not produce the systemic transformation that had so often been expected.

The reason for this, as the literature shows, is that technology without pedagogical integration is inert. Several meta-analyses show that technology alone does not improve learning: its positive effects only appear when there is qualified teacher mediation and intentional curricular integration (Hillmayr et al., 2020; OECD, 2026). Teacher-mediated digital interventions show significantly greater effectiveness than interventions without such mediation, which demonstrates that the teacher's role remains the decisive factor in learning.
Artificial intelligence arrives in this context as a new promise of transformation.

The difference this time lies in its capacity to act directly on cognitive processes: generating knowledge, assessing performance, simulating tutoring functions and producing adaptive feedback. This creates unprecedented potential, but also equally unprecedented risks.

Why is this moment different?

Unlike the radio which amplified the voice or the internet which democratised information, AI has the capacity to perform cognitive tasks that were previously restricted to only human beings: marking essays, planning and teaching lessons, offering personalised feedback and even simulating empathy.

In the face of this capacity, ProFuturo embraces a clear principle: AI should be at the service of teachers and their work. AI does not replace the teacher it instead amplifies their capacity to teach and to support learning. This is not a technical decision but an ethical and political one, and it guides every decision on technology adoption within the programme.

In practice, the various uses of AI in education can be placed on a continuum ranging from occasional support for administrative tasks to advanced assistance in tutoring processes, including the personalisation of materials and learning analytics. This continuum does not imply the replacement of the teacher, but rather different levels of support and functional delegation between humans and intelligent systems, conditioned by factors such as the availability and quality of teaching staff, the complexity of the content and the degree of cross-disciplinarity of the subjects.



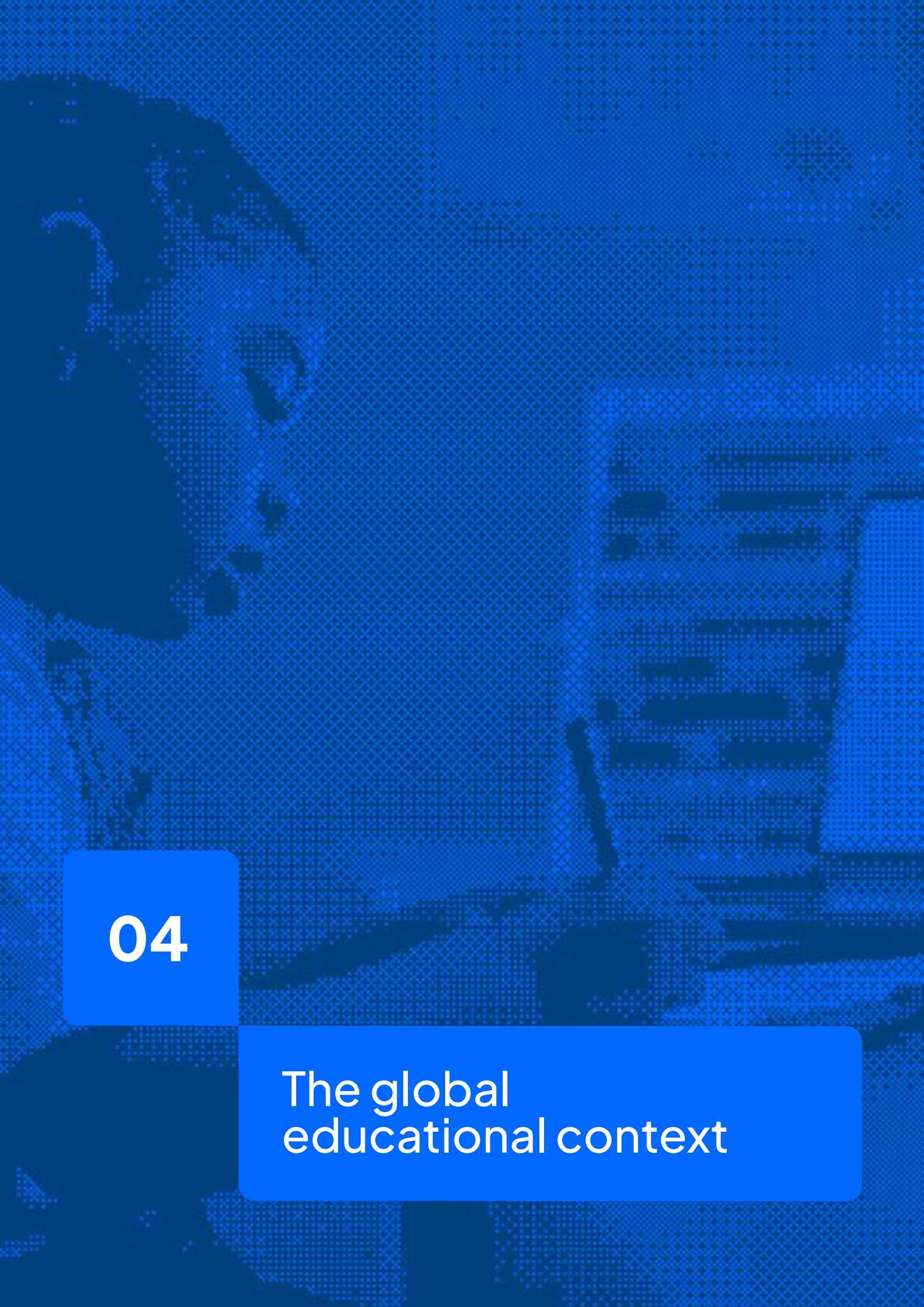
Risks of uncritical adoption

The uncritical adoption of AI can have significant consequences for the teaching profession and for learning. The three main risks identified in the international literature (UNESCO, 2025; Teacher Task Force, 2025) are:

- **Deprofessionalisation and loss of competencies:** excessive dependence on AI for tasks such as planning, assessment and feedback can lead to a progressive loss of teachers' pedagogical competencies and professional autonomy.

- **Decline in critical thinking:** the automation of tasks can reduce opportunities for reflective and creative thinking, among both teachers and students. The intensive use of language models can induce what the literature calls 'metacognitive laziness' and superficiality in pedagogical reasoning (Gerlich, 2025). Recent neuroscientific studies reinforce this concern: in an experiment with students from five US universities who wrote essays under three conditions (unassisted, with a search engine and with generative AI), only 12% of the AI-assisted group were able to quote from memory content from their own text shortly afterwards, compared with 89% in the groups without AI; brain imaging showed lower neural connectivity and a shift in executive activity from 'generating content' to 'supervising AI-generated content' (Kosmyna et al., 2025, in OECD, 2026).

- **Dehumanisation of education:** replacing human interaction with AI systems can compromise the development of socio-emotional competencies, empathy, peer learning and emotional bonds, which are fundamental dimensions of the educational process.



04

The global educational context

The educational context in which ProFuturo operates is marked by simultaneous tensions that AI can accelerate for better or for worse. Understanding it is essential before proposing any technology adoption strategy.

The emergence of generative AI adds an unprecedented dimension to this context: unlike earlier educational technologies, students can now access general-purpose platforms outside the classroom, with or without the mediation of their teachers. Even if education systems did not formally integrate it, its availability at home is already transforming educational processes (OECD, 2026). This shifts the dilemma: the question is no longer whether to introduce AI into education, but how to provide pedagogical support for a use that is already taking place.

Persistent learning gaps

The global learning crisis predates AI and has not been resolved. Before the pandemic, 57% of 10-year-old children in low- and middle-income countries were unable to read and understand a simple text; after the pandemic, this indicator —known as learning poverty— rose to 70% (World Bank et al., 2022). In the poorest countries the figure reaches 89% and in South Asia 78%. This generation of students could lose up to 21 trillion US dollars in lifetime earnings —the equivalent of 17% of current global GDP— as a result of learning losses (World Bank et al., 2022).

The situation is compounded by an equally severe figure: in 2023 there were 272 million children and young people out of school, an increase of 21 million compared with the previous estimate.

Almost three quarters are concentrated in Sub-Saharan Africa (39%) and Central and Southern Asia (34%). In the poorest countries, 36% of primary and secondary education students (including upper secondary) are out of school, compared with 3% in the richest countries (UNESCO, 2025b). The economic cost of inaction is estimated at 10 trillion dollars a year for the global economy (UNESCO, 2025c).

These data are not a backdrop to the problem: they are its core. AI will not solve this crisis on its own, but its adoption must be assessed according to its capacity to contribute to closing these gaps. Any discussion of AI in education that ignores these orders of magnitude runs the risk of optimising the educational experience of the privileged while the excluded continue to be left behind.

Digital and connectivity divide: an inequality that AI is widening

Connectivity remains profoundly unequal and, contrary to public perception, it is not closing at the pace that is assumed. According to the most recent data from the International Telecommunication Union (ITU, 2025), approximately 2.2 billion people —close to a quarter of humanity— remain without internet access. Internet use reached 73.6% of the world's population in 2025, but the distribution is radically unequal: 94% in high-income countries, 35% in Africa, 23% in low-income countries. The dividing line is now no longer only whether people are connected, but the quality and reliability of that connection.

Comparative data on generative AI show that this gap is widening with the new technology, not narrowing. In 2025, high-income countries accounted for 60% of global generative AI use, middle-income countries for 39% and low-income countries for less than 1% (Liu, Huang & Wang, 2025, in OECD, 2026). This disparity reflects an adoption gap that coincides with —and reinforces— structural educational gaps. Any educational AI strategy with a global vocation must be designed on the assumption that a significant proportion of the contexts in which it will be applied have intermittent or non-existent connectivity, and that AI offerings tend to be designed for the opposite contexts.

Teacher preparedness

The world faces a structural global shortage of 50 million teachers in early childhood, primary and secondary education. The Teacher Task Force estimates that at least 44 million new teachers are needed to achieve the targets of the Education 2030 Agenda (UNESCO Teacher Task Force, 2024). The problem is not only quantitative: in 2025 in Global Partnership for Education partner countries, only 63% of pre-primary teachers, 78% of primary teachers and 67% of lower secondary teachers had the minimum required qualifications (GPE, 2025).

The crisis is aggravated by the loss of talent: according to TALIS 2024, one in five teachers under the age of 30 plans to leave the profession within the next five years. And in some education systems this figure reaches half (OECD, 2025; Education International, 2025). The conditions that support retention are well known: pedagogical autonomy, competitive salaries, manageable workloads, funded continuing professional development and a voice in policymaking.

With regard to specific preparation for integrating AI into teaching, the TALIS 2024 data is conclusive. Among teachers who had not used AI in their practice in the 12 months prior to the survey, 75% report not having the knowledge or competencies to do so and 37% report that their school lacks the necessary infrastructure (OECD, 2025; OECD, 2026). Where ProFuturo operates, a majority of teachers report feeling insufficiently prepared (ProFuturo, 2020). Without robust training and adequate material conditions, no technological investment produces improvements in learning.

AI adoption by students: from marginal to majority in three years

Students' adoption of generative AI tools has grown faster than that of any previous educational technology, in many cases without pedagogical support or adult mediation. The comparative figures are conclusive: in Estonia, in 2024, 74% of lower secondary and 90% of upper secondary students reported using AI tools. In seven European countries —Germany, Greece, Portugal, Romania, Spain, Türkiye and the United Kingdom— 48% of young people aged 12-17 stated that they had used ChatGPT in 2024. In the United States, 68% of adolescents aged 15-17 used AI chatbots in 2025. In Switzerland, weekly use rises from 8% in primary school to approximately 50%of upper secondary students (OECD, 2026).

These figures document the transition of generative AI from a marginal technology to a majority tool among adolescents in less than three years. The associated risks are specific: exposure to inappropriate content, undetected biases, cognitive dependence and algorithmic disinformation (Bender et al., 2021). Regulatory frameworks are still under construction and many public education systems lack clear guidance.

Regulatory frameworks and the protection of minors

Various regions are making progress in building regulatory frameworks. The European Union has developed the Artificial Intelligence Act (Regulation (EU) 2024/1689) and the General Data Protection Regulation (Regulation (EU) 2016/679); the United States has the Children's Online Privacy Protection Act (COPPA, 1998) for the protection of minors online; UNESCO published the Recommendation

on the Ethics of AI (UNESCO, 2022) and the Beijing Consensus on AI and Education (UNESCO, 2019). However, in many of the countries where ProFuturo operates there are still no specific AI frameworks for the education sector, which creates a gap that ProFuturo helps to fill through its advocacy work.

Structural educational inequities

Learning gaps are not randomly distributed. They disproportionately affect specific populations:

- **Children with disabilities:** globally, children with disabilities are 2.5 times more likely never to have attended school. The global adult literacy rate for people with disabilities is 3%. And for women with disabilities, just 1% (UNESCO, cited in UNGEI, 2017).
- **Children in conflict and displacement zones:** 234 million children live in countries affected by humanitarian crises, of whom 85 million are out of school. When they do manage to attend, fewer than 1 in 5 crisis-affected children are able to read by the end of primary school (Education Cannot Wait, 2025). In 2023 there were 13 million out-of-school children in conflict zones (UNESCO, 2025b).
- **Girls and women in vulnerable regions:** there are 133 million girls out of school. In at least 20 countries —most of them in Sub-Saharan Africa— virtually no young women living in poverty in rural areas complete secondary education. In Afghanistan, 2.2 million girls are still prohibited from attending school (UNESCO, 2025d).
- **Poverty as a structural barrier:** excluding Europe and North America, only 18% of the poorest young people in the world complete secondary education (UNESCO, 2020).

AI can broaden access to education for these groups —through translation, accessibility and personalisation— or deepen their exclusion if systems are trained while ignoring their existence. This is a design decision, not an inevitable consequence of technology.

Educational infrastructure and school connectivity

Global educational infrastructure presents material conditions that severely limit technological integration. According to the most recent data from the International Telecommunication Union (ITU, 2025), approximately half of the world's six million schools remain unconnected to the internet. Regional disparities are extreme: 94% of people in high-income countries use the internet, compared to 23% in low-income countries. Additionally, 5G coverage reaches 84% of the population in high-income countries and only 4% in low-income countries (ITU, 2025).

The urban-rural divide aggravates this situation: 85% of people living in urban areas use the internet, compared with 58% of those living in rural areas globally. Mobile broadband remains unaffordable in 60% of low- and middle-income countries, while 68% of adults in low-income countries cite the cost of the device as the main reason for not owning a mobile phone (ITU, 2025; World Bank Global Findex, 2024).

Added to this are large class sizes, low per-student investment and high school dropout rates in the contexts where ProFuturo operates. Four out of ten countries spend less than 4% of GDP on education, below the level recommended to achieve the targets of the 2030 Agenda (UNESCO, 2025e). International aid to education fell by 12% in 2024 and could fall by more than 25% between 2023 and 2027 (UNESCO GEM Report Policy Paper 50, 2025). This is the material context in which any solution must operate: not that of the most privileged contexts, but that of the most disadvantaged.

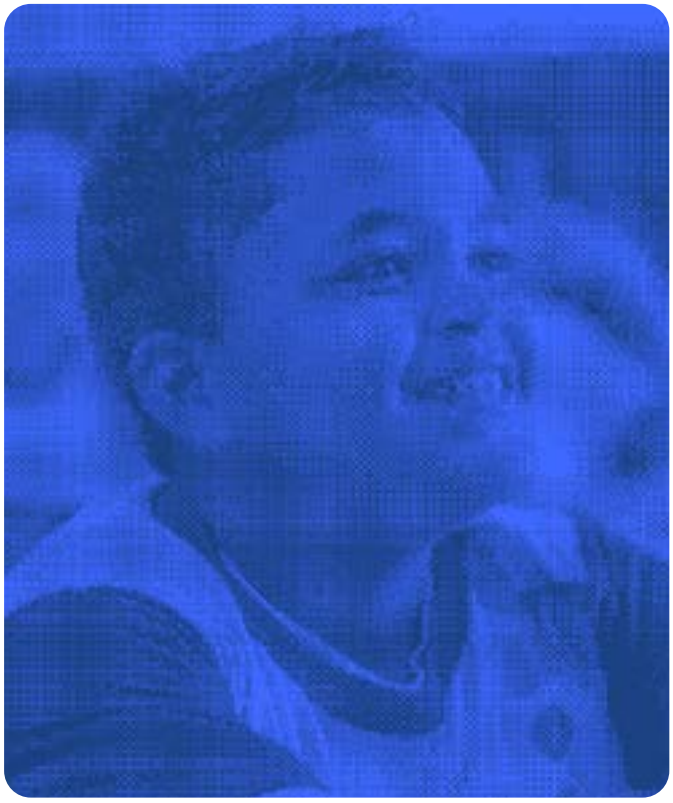
Unplugged AI: learning beyond connectivity

Connectivity gaps are still the structural condition in the contexts where ProFuturo operates, and the condition from which any solution intended to be deployed effectively must be designed. Unplugged artificial intelligence —referred to in the specialised literature as AIED Unplugged— is an approach designed to ensure suitability for operating in conditions of limited or no infrastructure, prioritising solutions that work autonomously without depending on a permanent internet connection or high-end devices (Bittencourt et al., 2026; Isotani et al., 2023). Its architecture responds to five principles: adapting to existing infrastructure (conformity); working without the internet, using it only for updates (disconnection); providing for technological intermediaries when the user does not have their own hardware (proxy); assuming the shared use of devices (multi-user); and designing interfaces that do not require digital skills beyond the basic use of a mobile phone (inexperience) (Bittencourt et al., 2026; Isotani et al., 2023). These principles are not concessions in the face of scarcity, but design decisions that place equity as the starting point.

On the technical side, these solutions rely on Small Language Models (SLMs) and edge computing, which make it possible to run AI algorithms on modest devices without a permanent connection (Isotani et al., 2023). Global implementations show the diversity of possible approaches: in Brazil, applications that digitise handwritten texts and process them on local servers with intermittent synchronisation have reached more than 160,000 students, offering pedagogical feedback without permanent internet (MEC, 2024; Portela et al., 2023); in Colombia, the Colombia Programa programme shows that AI literacy can begin in an entirely analogue way through board games that introduce algorithms without any digital device (Cruz et al., 2013); in China, cloud-edge-device architectures make it possible to deploy lightweight language models directly on local servers, enabling automated grading and personalised exercise recommendations without internet access (Guo & Wang, 2025; Wang, 2025); and in Kenya and Nigeria, platforms such as M-Shule offer adaptive tutoring via text messages on basic phones, operating on the mobile infrastructure already available to 90% of the world's population (Long et al., 2021).

Technologies such as Kolibri or microcomputers such as the Raspberry Pi complement this ecosystem by creating local wireless networks that host educational resources and tutoring systems with zero latency and no internet access (Redding et al., 2026).

In all these contexts, the teacher's role is not diminished: it is expanded. The teacher acts as an intermediary who filters and contextualises the outputs of algorithms, mitigating the biases of models trained on data unrelated to the local reality (Bittencourt et al., 2026). Pedagogically, the approach is anchored in constructivism and embodied cognition: students understand abstract concepts —how neural networks work, model training, algorithmic bias— through physical or analogue activities before transferring these intuitions to digital environments (Darabipourshirazi et al., 2026; Vandenberg et al., 2026). The main barrier to scaling these solutions is not technical but pedagogical: integrating these tools into teachers' daily routines and building datasets that do not reproduce the biases of the Global North (Bittencourt et al., 2026).







05

The school we want: three pillars of a humanist vision

Before defining strategies or choosing tools, ProFuturo asks itself a fundamental question: what do we want AI in education for? Our answer is clear: to amplify the capacity of teachers and students, not to replace it; to broaden opportunities in contexts with limited connectivity, not to widen gaps; and to keep people at the centre of every technological decision. This question is not rhetorical, rather it is the lens through which we assess every tool, partnership and initiative.

The school we aspire to have rests on three interdependent pillars:

- **First pillar** — A school centred on human relationships: meaningful learning is built on qualified human bonds and vibrant educational communities.
- **Second pillar** — Developing competencies for life in the age of AI: preparing students and teachers with the knowledge, skills, character and meta-learning that enable them to act wisely in a world mediated by algorithms.
- **Third pillar** — A school for all, inclusive, equitable and sustainable: an integration of AI that reduces gaps rather than amplifying them, values cultural and linguistic diversity and recognises the planet's material limits.

This chapter develops the three pillars. Owing to the importance and scope it requires, the second pillar is explored in greater depth in chapters 6 and 7 (international frameworks and key competencies for basic education). The third pillar is explored in greater depth in chapter 8 (equity, inclusion and sustainability). This structure makes it possible to maintain a coherent vision while providing the conceptual tools needed for action.

First pillar: a school centred on human relationships

The first pillar of ProFuturo's vision consists of placing human relationships as the structuring element of the educational experience. Technology broadens possibilities, but human relationships remain the driving force of meaningful learning, especially in the vulnerable contexts where the programme operates.

The irreplaceable role of the teacher

The teacher occupies a central position in this vision. As a qualified mediator, the teacher interprets the specific needs of each student and builds the emotional bonds that sustain the motivation to learn. The teacher acts as a curator, selecting and contextualising the appropriate resources; and as an experienced designer, integrating technology, content and active methodologies in an intentional and situated manner.

Although the teacher's role is central and irreplaceable, a significant proportion of professionals do not yet have all the conditions necessary to perform it fully. For this reason, training educators and school managers in the ethical, pedagogical and critical use of AI is essential. This requires investment in continuing professional development, the strengthening of digital and pedagogical competencies, adequate institutional support and professional recognition commensurate with the complexity of the work.

Only with teachers who are prepared, valued and supported will it be possible to transform the opportunities offered by AI into meaningful educational practices.

ProFuturo's Global Framework for Teaching Competence in the Digital Age (MGCDED) (Trujillo Sáez et al., 2020) addresses teachers' competencies through three complementary identities:

- **Citizen identity:** the educator as an active member of society.
- **Teaching identity:** designer, facilitator and assessor of learning experiences.
- **Connective identity:** leader, collaborator and mentor in educational networks.

Reinforcing this approach, UNESCO proposes the concept of teacher-AI complementarity (Miao & Cukurova, 2024a), according to which intelligent systems should extend teachers' capacities in four dimensions:

- **Goal augmentation:** AI supports teachers in defining and monitoring educational goals.
- **Perceptual augmentation:** it extends the capacity to identify patterns in learning processes.
- **Action augmentation:** it enables individualised support at scale.
- **Decision augmentation:** it offers evidence-based teaching recommendations.

What defines the irreplaceable human dimension in the act of educating is the capacity to show genuine and contextualised empathy, offer situated ethical guidance, build emotional bonds and exercise pedagogical judgement that integrates knowledge of the student with an understanding of the sociocultural context.

Valuing collaborative learning

The school we aspire to have recognises learning as a fundamentally social phenomenon. Peer interaction constitutes a privileged space for the development of competencies, the construction of meaning and collective knowledge. The ProFuturo Framework (Trujillo Sáez et al., 2020) calls this dimension Identity for connection, which mobilises the roles of belonging, collaboration and leadership for learning in community, reinforcing the importance of essential competencies for functioning in digital and hybrid environments where the boundary between face-to-face and remote is blurred.

School leadership in the age of AI

The leadership of the school principal is, after classroom teaching, the factor with the greatest influence on students' learning outcomes (Leithwood et al., 2019). In the age of artificial intelligence, this role transcends administrative management and becomes an exercise in ethical, pedagogical and strategic leadership: the principal is the one who ultimately determines whether AI is integrated

into the institution as a tool for genuine improvement or as the uncritical adoption of technological trends. ProFuturo conceives of the school principal not as a passive consumer of innovations, but as a critical mediator who organises, inspires and empowers their educational community to navigate this transition with rigour and a humanist vision (UNESCO, 2023).

This mediating role is structured in four complementary dimensions.

- **As a pedagogical leader**, the principal helps their team overcome the fear of obsolescence, demonstrating in practice how AI can take on routine operational burdens —marking, record-keeping, searching for resources— in order to free up time for emotional support and in-depth instructional design; this involves setting clear expectations, prioritising teachers' continuing professional development and fostering collaborative environments where pedagogical experimentation is possible and safe (UNESCO, 2023).

- **As an architect of governance,** it falls to the principal to design —in co-creation with teachers, families and students— an institutional protocol based on an honest diagnosis: which AI tools are already being used in the school, what teachers know and what ethical risks the community perceives; this protocol is not a bureaucratic document, but a living roadmap that protects the privacy of minors' data and guarantees algorithmic transparency within the institution.

- **As a strategic manager**, the principal can rely on AI-enhanced information systems to move from reactive to proactive management: analysing patterns of attendance, performance and well-being in order to design early interventions targeted at the most vulnerable students, with particular attention to contexts where infrastructure gaps amplify inequalities.

- Finally, **as the person ethically responsible**, it falls to the principal to validate the reliability of each tool before its deployment: demanding transparency from providers, ensuring that systems respect the linguistic and cultural diversity of each community, and guaranteeing that every algorithm-mediated decision is subject to human oversight and validation (UNESCO, 2023; Miao & Holmes, 2023).

The equitable and responsible deployment of AI in schools depends largely on principals who are able to balance innovation with prudence. Only through leadership that places human flourishing —and not technological efficiency— at the centre of every institutional decision will it be possible for artificial intelligence to become a tool of educational justice that leaves no child behind.

Second pillar: developing competencies for life in the age of AI

Developing essential competencies so that students can navigate contemporary complexity wisely is the second pillar of our vision. This involves fostering skills, character traits and meta-learning capacities structured around critical AI literacy.

Critical AI literacy

Critical AI literacy goes beyond technical preparation: it develops students who are able to understand, question and create with technology, fostering intellectual autonomy and ethical responsibility. Teaching with and about AI involves not only using digital tools, but also understanding their mechanisms, limits and social impacts. This approach connects with ProFuturo's Global Framework for Learning Competence in the Digital Age (MGCAED) (Trujillo Sáez et al., 2020), which highlights multiple literacies —mathematical, linguistic, scientific and digital—, socio-emotional and metacognitive competencies and the ability to interact in diverse environments.

Language as a foundation

A critical understanding of AI requires command of language as a cognitive foundation. Students must develop linguistic competencies to interpret information, formulate effective questions and evaluate content generated by intelligent systems. Clear communication is essential for interacting with technologies that use language as their main interface.

This foundation transcends the traditional teaching of grammar and spelling. It involves critical reading, text production and argumentation skills, which enable students to grasp semantic nuances, identify biases and construct contextualised responses. In this context, it is advisable to strengthen specific competencies:

- **Understanding and analysing complex texts:** interpreting reports, explanations and automated responses.
- **Formulating precise commands and questions:** developing prompt engineering strategies to obtain relevant results.
- **Evaluating reliability and ethics:** identifying inconsistencies, ambiguities and social implications in generated content.
- **Producing knowledge:** expressing ideas clearly, arguing effectively and integrating technology with the human context.

Human competencies complementary to AI

As AI automates repetitive tasks and processes information on a large scale, it becomes even more urgent to develop what defines us as human: cognitive, ethical and socio-emotional capacities that no algorithm can replicate. To organise these competencies,



ProFuturo adopts the Four-Dimensional Education (4D) framework developed by Charles Fadel (Fadel et al., 2024):

- **Knowledge**: "What we know" remains essential, but it needs to be continually updated and contextualised.
- **Skills:** "How we use what we know": creativity, critical thinking, communication and collaboration.
- **Character:** "How we behave and engage with the world": curiosity, courage, resilience and ethics.
- **Meta-learning:** "How we reflect, adapt and learn to learn": metacognition and meta-emotion.

These dimensions are integrated to cultivate wisdom: practical discernment in complex contexts, guided by motivation and articulated through identity, agency and purpose.

In the age of AI, certain aspects of skills, character and meta-learning require renewed emphasis (Fadel et al., 2024):

Dimension	Classic competency	Emphasis in the age of AI	Rationale
Skills	Creativity	Imagination	AI is increasingly capable of incremental creativity; what is distinctively human shifts towards imagination, especially the emotional and experiential depth that fuels inspiration and originality.
	Critical thinking	Decision-making	Harnessing AI with discernment requires humans to develop reasoned decision-making, without abdicating their judgement to the algorithm.
	Communication	Dialogue	Active listening and argumentation remain essential, but dialogue is more necessary than ever in a polarised world.
	Collaboration	Leadership	Cooperation and teamwork remain key, but the world needs leaders (and followers) so that initiatives do not fizzle out. Leadership is also essential for managing a diversity of AI agents.
Character	Curiosity	Open-mindedness	Exploration and a sense of wonder are intrinsic to human development. Open-mindedness is increasingly important in the face of polarisation and extremism.
	Courage	Risk-taking	Confidence leads to taking risks, a distinctively human trait and one that is necessary to resist closed-mindedness.
	Resilience	Resourcefulness	In a changing world, the ability to devise unusual solutions with the means available becomes indispensable.
	Ethics	Fairness	Integrity is essential; fairness is the most universally understandable ethical concept and the most comparable across cultures.
Meta-learning	Metacognition and meta-emotion	Adaptability and self-directed learning	Metacognition as presence and meta-emotion as awareness. Adaptability in the face of the unexpected, together with continuous self-directed learning, is key to staying ahead of AI.

This second pillar needs to be anchored in global reference frameworks and in concrete competencies applicable in the classroom. Given the richness and specificity of the analysis, we devote the next two chapters to exploring this in depth: chapter 6 examines the most relevant international frameworks (UNESCO, DigComp 3.0, AI4K12, OECD AILit, PISA 2029 MAIL, Ceibal, COMPETIA-LAC), which enrich our vision and give it global scale; chapter 7 synthesises, on the basis of these frameworks, the six key competencies that ProFuturo prioritises for basic education.

Third pillar: a school for all, inclusive, equitable and sustainable

A humanist vision of AI in education would be incomplete without one further question: for whom? A school centred on human relationships and committed to the development of competencies is only coherent if it reaches all students, especially those who have historically been excluded from technological progress. The third pillar of our vision is structured around three commitments:

- **Equity:** identifying and mitigating the algorithmic biases that may reproduce or amplify inequalities of gender, race, class, language or territory.
- **Inclusion:** using AI to break down barriers to learning and to recognise the linguistic, cultural, cognitive and epistemic diversity of educational communities.
- **Sustainability:** integrating awareness of the material and environmental impact of AI and educating students and teachers in an ethic of digital sobriety.

This pillar is developed in depth in chapter 8 and also permeates ProFuturo's institutional strategy, presented in chapter 11. The unplugged AI approach —teaching fundamental AI concepts through games, activities and manipulative materials, without depending on computers or the internet— is an example of how the third pillar is put into practice in contexts with limited connectivity, ensuring that equity is not built on waiting for technological access.



06

International AI competency frameworks

This chapter develops in depth the second pillar set out in chapter 5: developing competencies for life in the age of AI. In order to do so rigorously and with a global vocation, we start from the most relevant international frameworks.

Defining competencies for the age of AI requires a rigorous analysis of the relevant international frameworks. ProFuturo does not start from scratch: it integrates the knowledge accumulated by multilateral organisations, regional initiatives and research centres, avoiding techno-solutionism and embracing a critical and situated pedagogy. The synthesis presented here seeks to be resilient to resource constraints and applicable to diverse contexts.

UNESCO: Competency frameworks for students and teachers

AI Competency Framework for Students

UNESCO's AI Competency Framework for Students (Miao & Cukurova, 2024a) arises from the need to equip new generations with the capacities required for responsible citizenship in a world influenced by algorithms. Its rationale transcends mere functional literacy, positioning the student not only as an effective user, but as a critical and ethical co-creator of inclusive and sustainable systems. It is aligned with the Beijing Consensus (UNESCO, 2019) and seeks to address disparities in access to technological knowledge, promoting the centrality of human agency and respect for cultural diversity.

The framework organises 12 key competencies into four dimensions, with a progression across three levels of mastery (Understand, Apply and Create):

- **Human-centred mindset:** understanding the impact of AI on society and on one's own decision-making capacity.
- **Ethics of AI:** identifying biases, data privacy and the responsible use of tools.

- **AI techniques and applications:** the technical functioning of models, algorithms, data and natural language processing.
- **AI system design:** the ability to devise and build solutions to solve real problems.

Its main contribution is its focus on student empowerment. By proposing progression levels, it offers a roadmap for education systems to design competency-based assessments that go beyond technical memorisation.



AI Competency Framework for Teachers

Published by UNESCO in September 2024 (Miao & Cukurova, 2024b), this framework represents the first global vision for defining teachers' professional development in the age of AI. It originates in the gap identified in 2022, when only seven countries had specific AI programmes for teachers. It is grounded in the protection of teachers' rights and the promotion of educational sustainability, seeking to ensure that technology acts as a catalyst for improving teaching and not as a replacement for pedagogical judgement.

It sets out 15 cross-cutting competencies in five dimensions, across progression levels (Acquire, Deepen and Create):

- **Human-centred mindset:** strengthening human agency in the face of automation.
- **Ethics of AI:** critically evaluating the ethical impact of tools in the classroom.

- **AI foundations and applications:** the technical mastery needed to understand what happens 'under the hood'.
- **AI pedagogy:** integrating AI into instructional design, tutoring and assessment.
- **AI for professional learning:** using technology for peer collaboration and continuing professional development.

Its greatest contribution is the AI pedagogy dimension, which transforms the teacher's role from transmitter of information to orchestrator of experiences mediated by intelligent technology.

European Union: DigComp 3.0

DigComp 3.0 (Cosgrove & Cachia, 2025) is the fifth edition of the European Digital Competence Framework, designed by the Joint Research Centre. It evolves from version 2.2 to incorporate the technological advances —especially generative AI— that have occurred since 2022 and is grounded in the need for citizens to have the competencies required for daily life, work and learning in a digitally transformed society.

It retains 21 competencies in five traditional areas, integrating AI-specific statements across four proficiency levels (Basic, Intermediate, Advanced and Highly Specialised):

- **Information and data literacy:** critical evaluation of AI-generated content.
- **Communication and collaboration:** interaction with conversational agents.
- **Digital content creation:** co-creation with generative AI tools.
- **Safety:** protection of personal data in model training.
- **Problem solving:** using AI to identify conceptual gaps and propose innovative solutions.

Its great contribution is the granularity of its learning outcomes, which makes it possible to design specific training programmes that connect general digital literacy with the ethical and technical challenges of AI.

AI4K12: The five big ideas in AI

AI4K12 (Touretzky et al., 2019; AI4K12, 2020) is a joint effort by the Association for the Advancement of Artificial Intelligence (AAAI) and the Computer Science Teachers Association (CSTA). It originated in the creation of national guidelines in the United States for teaching AI from pre-school to secondary school, based on the premise that all students should understand how AI systems perceive and understand the world.

It is organised around five big ideas with progression by grade band (K-2, 3-5, 6-8, 9-12):

- **Perception:** computers perceive the world through sensors.
- **Representation and reasoning:** agents maintain models of the world and use them to reason.
- **Learning:** computers can learn from data through algorithms (machine learning).
- **Natural interaction:** AI systems must communicate naturally with humans.
- **Societal impact:** AI can affect society in both positive and negative ways.

AI4K12 has been the technical foundation for many other frameworks. Its main contribution is the demystification of AI through concepts that children can understand, fostering AI-based computational thinking that prepares students to understand the internal logic of systems and their social implications.

OECD: Empowering Learners and PISA 2029

Empowering Learners for the Age of AI (AILit Framework)

This framework, in its 2025/2026 draft version (OECD & European Commission, 2025), is a joint initiative of the OECD and the European Commission that seeks to prepare primary and secondary students for the age of AI. It is based on an extensive review of the international literature and is grounded in student agency: the development of a lasting AI literacy that transcends specific tools or technological fads. It defines competence as a combination of knowledge, skills and attitudes in four domains:

- **Engaging with AI:** understanding what AI is and how it influences daily life.
- **Creating with AI:** collaborating with intelligent systems to generate new products or ideas.
- **Managing AI:** evaluating whether the use of an AI aligns with one's own values and goals.
- **Designing with AI:** understanding and shaping the behaviour of systems.

Its key contribution is interdisciplinary integration: it does not confine AI to the computer science class but offers scenarios for all subjects.

PISA 2029: MAIL Framework (Media and AI Literacy)

PISA 2029 will include, for the first time, media and AI literacy (MAIL) as an innovative domain (OECD, 2026b). It originates in the need to measure how 15-year-olds navigate a complex digital ecosystem, based on the idea that media literacy and AI literacy are inseparable. The model is organised around four strands:

- **Analysing and evaluating:** messages, meanings and veracity of content generated by humans or AI.
- **Creating:** ethical generation of digital content and use of AI tools for expression.

- **Participating and collaborating:** use of digital platforms for social and civic interaction.
- **Reflecting and acting ethically:** considering the impacts of AI on privacy and social well-being.

Its inclusion in PISA gives AI competence unprecedented political and statistical validation.

Ceibal Reference Framework for Teaching Artificial Intelligence (Uruguay)

The Ceibal framework (Ceibal, 2023) is a pioneer in Latin America and arose as a strategic response to integrate AI into the Uruguayan education system. It is grounded in an integrated and multidisciplinary approach that seeks to develop AI literacy by strengthening 21st-century skills such as complex problem solving, creativity and collaboration. Its dimensions connect technical concepts with social practices:

- **Computational approach with AI:** integration of programming and machine learning.
- **Ethical use and social impact:** reflection on biases, transparency and the human role.
- **Interdisciplinarity:** application of AI in various areas of knowledge.
- **Data work process:** understanding how data are collected, analysed and interpreted.

Its fundamental contribution is its operational nature, with clear guidelines for teachers to implement AI projects in the classroom.

COMPETIA-LAC: Emerging competencies in Latin America

COMPETIA-LAC arises from a systematic review carried out by Betti Galasso (2025) on the integration of generative AI in Latin America. It is grounded in the traditions of Latin American critical pedagogy and in the need for frameworks that recognise the region's structural inequalities. It proposes a vision of creative resistance in the face of technological limitations and puts forward non-linear development pathways: a teacher may be an expert in ethics but a beginner in technical matters. Its dimensions include:

- **Pedagogical-didactic competencies:** they rearticulate educational dialogue in AI-mediated environments.
- **Ethical-critical competencies:** they operationalise principles of equity and social justice in educational practice.
- **Assessment competencies:** they reconceptualise the demonstration of learning in co-creation with AI.
- **Collaborative competencies:** they reflect community epistemologies for the collective construction of knowledge.

Its contribution is a critical perspective that avoids techno-solutionism and prioritises social transformation and awareness of the algorithmic biases that can perpetuate historical inequalities.



07

Key competencies for basic education

This chapter concludes the development of the second pillar. Having reviewed the international frameworks (chapter 6), we translate their content into six priority competencies for the basic education contexts where ProFuturo operates.

Based on the synthesis of international and regional frameworks, ProFuturo identifies six key competencies that guide its work in basic education. These competencies are cross-cutting, accessible to contexts with limited resources, and combine technical, ethical and pedagogical dimensions. The central premise is that AI competence must be accessible to all, regardless of the technical infrastructure available.



Human agency and critical judgement in algorithmic environments

The capacity to interact with AI systems while maintaining autonomy in decision-making and understanding that technology is a support, not a substitute for human agency. It involves developing a mindset that actively questions AI suggestions, allowing students and teachers to determine the purpose and scope of the tool in their learning processes, thereby avoiding cognitive dependence.

This dimension is the core of the UNESCO framework (Miao & Cukurova, 2024a), in which a "human-centred mindset" is the first pillar of literacy. The OECD validates it in its AILit framework (OECD & European Commission, 2025), positioning student agency as the lasting skill needed to navigate the age of automation.



For students:

when using a conversational assistant to explore ideas for a local history project, the student does not accept the first answer. They analyse whether the tone is appropriate and whether regional perspectives are missing, and decide which parts to discard. This exercise strengthens their identity and sense of purpose, preventing AI from dictating the final outcome of their thinking.



For teachers:

when using AI for curriculum planning, the teacher assesses whether the suggested activities are aligned with the socioeconomic reality of the classroom and the learning objectives. They adjust an automatically generated teaching sequence to include resources from the immediate environment, demonstrating that pedagogical experience is the indispensable filter for technology to be effective.

Ethics, inclusion and algorithmic awareness

The capacity to identify biases, assess data privacy and reflect on the social impact of AI from a social justice perspective. Students must recognise how intelligent systems can reinforce prejudices or exclude certain groups, developing an ethical sensitivity that prioritises equity and transparency, protecting people's dignity.

The COMPETIA-LAC Framework (Betti Galasso, 2025) contributes a layer of situated awareness, complemented by the technical structure of the European Union's Ethical Guidelines (European Commission, 2022). While the EU provides indicators of reliability and safety, COMPETIA-LAC ensures that ethics is applicable in diverse contexts.



For students:

In a workshop where they use image generators to depict professions, if the AI consistently shows men in scientific roles and women in caring roles, students learn to identify gender bias. This activity —unplugged or assisted— enables them to develop a critical stance by understanding that algorithms inherit the prejudices of the data on which they were trained.



For teachers:

when selecting educational platforms, the teacher analyses whether the tool respects the privacy of minors' data and whether it promotes the inclusion of neurodivergent students. When implementing an intelligent tutoring system, they monitor that its recommendations do not marginalise students with different learning paces, acting as an ethical guarantor.

Data literacy and the logic of AI systems

The ability to understand the fundamental principles behind AI: how sensors perceive the environment, how data are represented and how algorithms learn patterns in order to make predictions. In basic education, this competency seeks to open the black box of technology, transforming an abstract concept into a logical and understandable process.

Its technical foundation lies in the Five Big Ideas of AI4K12 (Touretzky et al., 2019), which underpin the Ceibal framework (Ceibal, 2023) and are aligned with the Information and data literacy area of DigComp 3.0 (Cosgrove & Cachia, 2025).

For students:

through playful activities on model training, they can manually classify images of fruit to understand how a computer learns to tell an apple from an orange, or experiment with educational platforms that allow them to train simple models to recognise images, sounds and postures. By understanding that AI is based on probabilities and data, they stop seeing it as magic and can diagnose why a system fails when the data are incomplete or erroneous.

For teachers:

data literacy is vital for interpreting learning analytics. A teacher who understands the logic of data can analyse a progress report and discern whether a group's low performance is due to a conceptual difficulty, an error in the design of the assessment or the particular circumstances of the group, enabling informed decisions for pedagogical adaptation.

Critical curation and evaluation of veracity

The capacity to verify the quality, origin and neutrality of AI-generated content, distinguishing between fact-based information and 'hallucinations' or algorithmic disinformation. In an ecosystem saturated with synthetic media, students must master source-checking and content analysis techniques in order to be informed and responsible consumers.

It is the cornerstone of the new MAIL domain of OECD PISA 2029 (OECD, 2026b). UNESCO also identifies it as an indispensable prerequisite competency for protecting democracy and the integrity of knowledge (UNESCO, 2022).



For students:

in a fact-checking exercise on an AI-generated essay, students receive a natural science text produced by a language model and must look for evidence in primary sources or textbooks to validate each piece of information. They learn that AI can invent information persuasively, strengthening their research skills.



For teachers:

before presenting an AI-generated video or text, the teacher carries out expert curation to ensure scientific and pedagogical accuracy, filtering materials to avoid the conceptual errors that AI tends to make on complex topics.

Ethical collaboration and co-creation with AI

The capacity to use AI tools creatively to solve problems, generate original content or improve existing projects, while respecting copyright and the principles of academic honesty. The focus is not only on using AI, but on knowing how to collaborate with it to expand the possibilities of expression and design, always maintaining human authorship.

UNESCO, in its AI system design dimension (Miao & Cukurova, 2024a), and DigComp 3.0 (Cosgrove & Cachia, 2025) are the main references. DigComp specifically integrates co-creation with generative AI, ensuring that citizens develop innovative and ethically responsible skills.



For students:

in assisted creative writing, they can use AI to suggest different endings to a story or improve the grammar of a poem, but always as directors of the process. They learn to write effective prompts that guide the AI to generate drafts that the student then polishes and personalises, maintaining their original voice.



For teachers:

in the co-design of assessment instruments, a teacher can collaborate with AI to generate detailed rubrics for a science fair, saving administrative time that they reinvest in direct qualitative feedback with their students.

Problem solving and computational thinking

The ability to break down complex problems, identify patterns and use the logic of AI to model solutions in various disciplines. It is not limited to computer science: it uses the principles of AI —such as pattern recognition and prediction— to enhance scientific research, art or the resolution of social challenges, fostering an innovative designer mindset.

The proposals of ISTE (2023) and the Ceibal framework (Ceibal, 2023) reinforce this competency with a multidisciplinary approach, aligned with AI4K12 (Touretzky et al., 2019). These frameworks demonstrate how computational thinking evolves with AI, enabling students from all contexts —including the most vulnerable— to develop technological solutions with local impact.



For students:

in a sustainability project, they can use a simple computer vision tool to classify types of waste at their school. They identify the problem, collect data, train a basic model and evaluate its effectiveness, learning to use AI to solve real-world challenges.



For teachers:

it makes it possible to design project-based learning experiences that include AI as a variable. A social sciences teacher can guide their students in using AI simulators to predict the impact of a change in public transport in their community, preparing them to think systemically.



08

A school for all: equity, inclusion and sustainability

This chapter develops the third pillar set This chapter develops the third pillar set out in chapter 5: an integration of AI that reaches everyone, values diversity and recognises the planet's limits. The chapter is structured around the three commitments that underpin this pillar —equity, inclusion and sustainability— and close with the concept and approach of Unplugged AI in Education as a practical expression of all three.

The integration of AI into education systems is usually presented under a narrative of efficiency, personalisation and inevitable technical progress. The school to which ProFuturo aspires to have has a responsibility to make visible the deeper dimensions of these technologies: AI is not a neutral tool, but a human product laden with intentions, values and material consequences that affect social equity, people's dignity and the health of the planet.

Commitment to equity: identifying and mitigating algorithmic biases

One of the pillars of this critical awareness is the recognition of algorithmic biases. AI feeds on data that are historical records of society, with its lights and its shadows. When a system is trained on databases that reflect prejudices, the algorithm tends to systematise them under the appearance of mathematical objectivity (Bender et al., 2021). These biases manifest themselves in forms of discrimination based on gender, race, class, language and geography, turning AI systems into black boxes that can perpetuate exclusion.

In the school environment, this is particularly critical. Intelligent tutoring systems trained on data that do not represent diversity can marginalise students who do not fit the standard profile. Equity implies an active commitment: ProFuturo educates people to understand that AI is not a neutral entity, but a mirror of the data that feed it.

An equitable school trains its students' critical eye so that they do not accept the outputs of AI as absolute truths, but as probabilities that must be audited. The struggle for equity is a struggle for transparency and for the right to explanation.

Schools must develop students' capacity to recognise and question these assumptions: it is not enough to be effective users; the goal is for learners to become co-creators of a more inclusive AI (Miao & Cukurova, 2024a). This analytical capacity makes it possible to defend social justice in the field of data.

Commitment to equity: ensuring that everyone can benefit

A school for all does not wait for connectivity to get started. Implementation models and alternatives must be organised to ensure suitability for operating in conditions of limited or no infrastructure, prioritising solutions that work autonomously without depending on a permanent internet connection or high-end devices (Bittencourt et al., 2026; Isotani et al., 2023). According to the unplugged AI approach discussed earlier, effectiveness rests on five design premises:

- **adapting to existing infrastructure and pedagogical practices** (conformity);
- **operating without the internet**, using connectivity only when it is available (disconnection);
- **providing for intermediaries when the user does not have their own hardware or when they need support or intermediation to reach the technology** (proxy);
- **assuming the simultaneous and shared use of devices** (multi-user);
- **and designing interfaces that do not require digital skills beyond the basic use of a mobile phone** (inexperience).

Commitment to inclusion: breaking down barriers and diversifying voices

An inclusive school uses AI to break down barriers to learning, adapting to native languages, diverse cognitive abilities and local cultural contexts, ensuring that a child's origin does not dictate their destiny in an automated world. Inclusion is not exhausted by the provision of connectivity or devices; it is achieved when we enable every student, especially in contexts of vulnerability, to develop the capacity to learn and the judgement needed to challenge the systems that attempt to categorise them.

Inclusion also requires epistemic plurality. Current models are trained mainly on data in English and from countries of the Global North (Reimers, 2025), which can render the narratives, languages and experiences of other regions invisible. ProFuturo understands inclusion as a deliberate effort to ensure that the realities, languages and knowledge of the communities where it operates are represented in the AI tools that are used. This involves working with local partners, fostering the development of models in minority languages and the training of models with robust and diverse knowledge bases, and training teachers to detect and correct biases in the classroom.

To put these reflections into practice, the school must become a laboratory for citizen auditing. According to the OECD's AILit Framework (OECD & European Commission, 2025), AI literacy must be lasting and transcend specific tools, focusing on concepts that enable students to critically assess the impact of technology on their communities. This includes investigating where data come from and who owns the infrastructures that shape their access to information. Critical awareness enables educators to ask fundamental questions: who really benefits from this technology? Which voices have been silenced in its training?

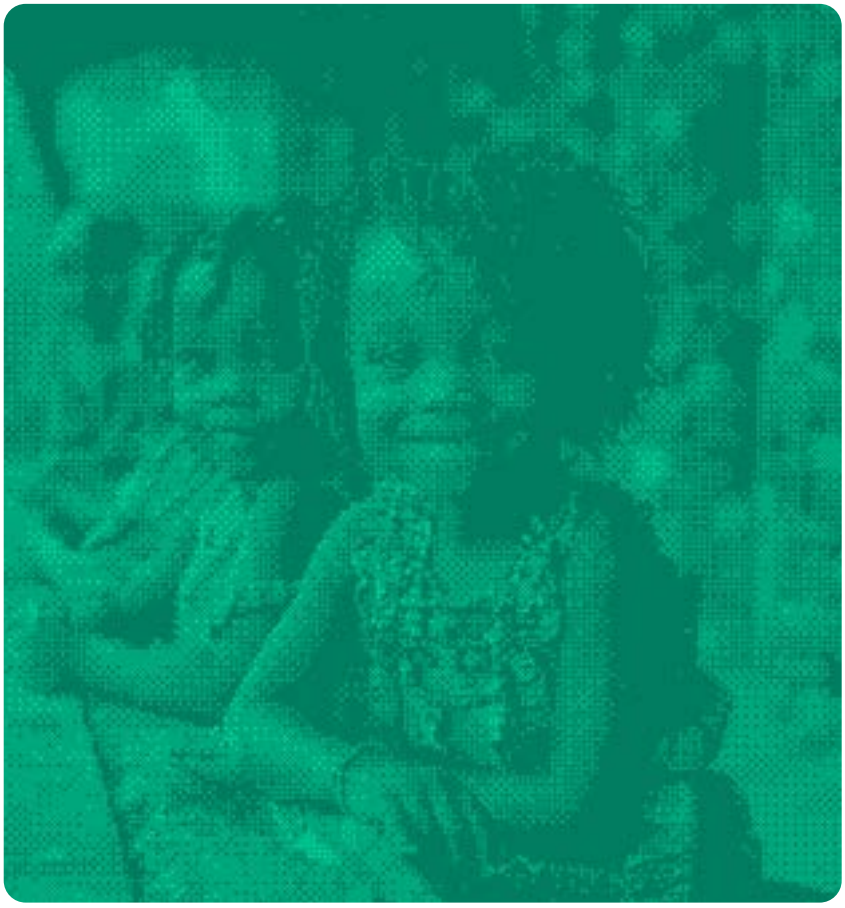
Commitment to sustainability: the physical reality of AI

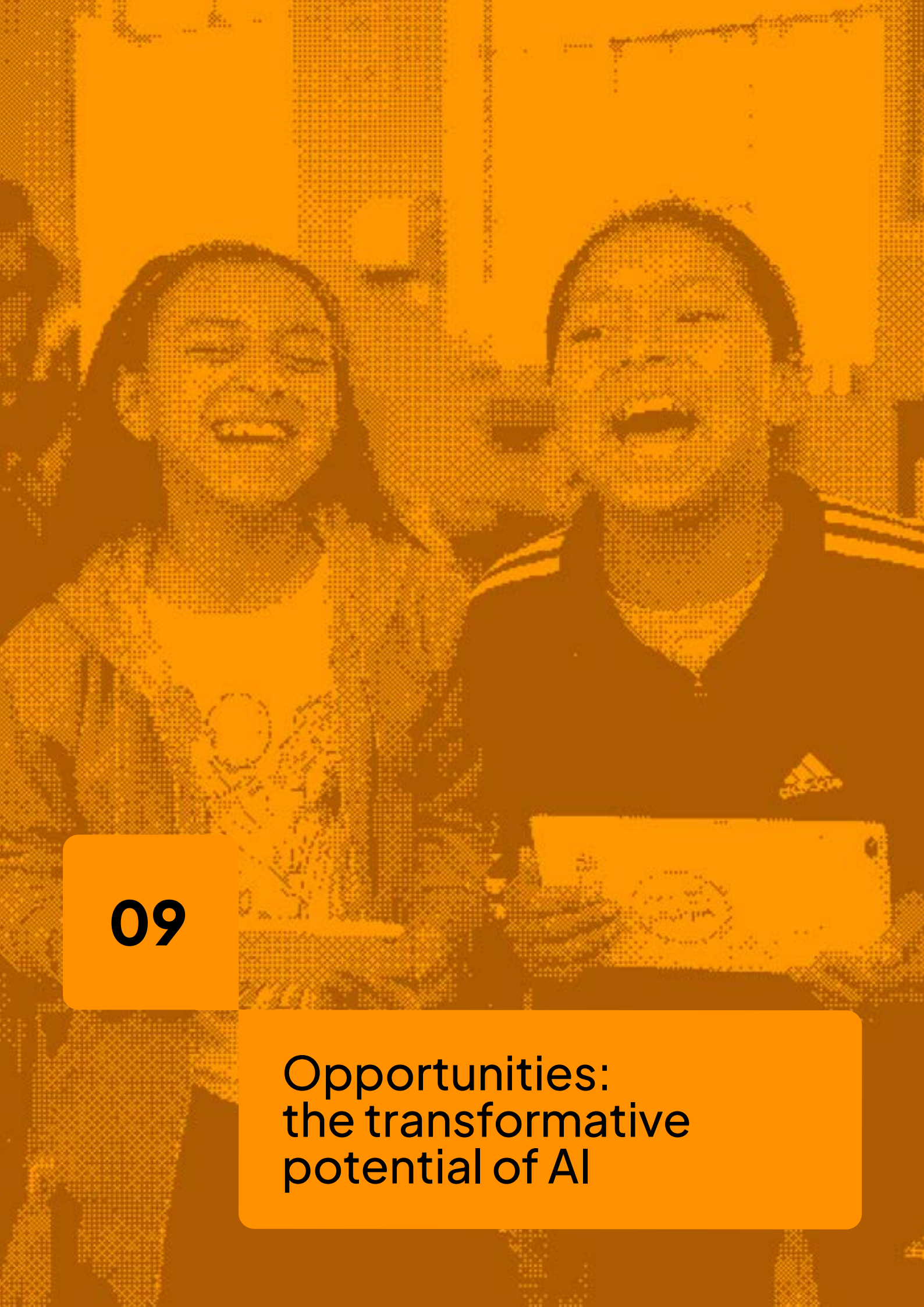
In parallel with the social and cultural dimensions, it is urgent for education to address the environmental impact of AI. There is a tendency to perceive the digital as something ethereal, symbolised by the metaphor of the cloud.

However, AI has a massive physical footprint: sustaining the computing infrastructure requires significant energy consumption and large quantities of water for cooling servers (IEA, 2024; Luccioni et al., 2023). In addition, dependence on the extraction of critical minerals often degrades ecosystems in vulnerable regions (Crawford, 2021), generating an ecological debt that schools cannot ignore.

Educating for the ethical use of AI involves educating for sustainability. Students must understand that every query to a language model has a tangible planetary cost. Innovation with purpose means acting responsibly, fostering an ethic of digital sobriety (INTEF, 2024). The goal is for the educational community to understand that technology must be at the service of life, promoting social and environmental well-being as prerequisites for any technological advance.







09

Opportunities: the transformative potential of AI

ProFuturo believes that advances in artificial intelligence, especially with the emergence of large language models, are opening new frontiers for learning. If the internet democratised access to information, AI —used ethically, consciously and intentionally— broadens the capacity to understand, apply and transform knowledge. This transition from passive consumption to active and personalised learning represents a fundamental step, aligned with ProFuturo's vision of preparing students to act wisely in an increasingly complex world.

How AI can transform learning

Education systems have always faced a central challenge: managing limited resources in the face of the diversity of students' needs. In an ideal world, every student would have enough time to develop within their zone of proximal development —following Vygotsky's concept (1978)—, that point of balance where challenges are appropriate and favour the acquisition of new competencies. However, traditional education cannot always offer individualised support to everyone.

AI, although still in a phase of constant improvement, is emerging as an ally in overcoming these limitations. Its potential lies in reducing barriers and creating more personalised, effective and equitable learning opportunities, bringing each student closer to their best way of learning. ProFuturo identifies three fundamental areas of opportunity.

Designing high-quality lesson plans supported by the science of learning

Artificial intelligence promises to bring the best of what we know about how people learn —the science of learning (Brown et al., 2014; Deans for Impact, 2015)— into everyday teaching, and to identify new frontiers for educational research.

When properly designed and implemented, AI systems can incorporate proven principles such as stimulating active participation, encouraging intensive practice and review, and integrating the benefits of spaced repetition (Brown et al., 2014).

For educators, these tools can ease the burden of implementation, making teaching strategies more accessible and achievable in less time. For students, AI moves them from passive consumption to active application, becoming a catalyst for curiosity and more meaningful learning.

Personalising teaching and tutoring

Since 1984, we have known that one-to-one tutoring produces extraordinary results. Benjamin Bloom's study, known as the 2-sigma problem (Bloom, 1984), showed that students who receive personalised one-to-one tutoring perform two standard deviations above the average, equivalent to placing an average student in the 98th percentile. The problem has always been scale: individual human tutoring is unfeasible in mass public education systems.

Although there is not yet abundant evidence on the impact of AI-powered tutors (Intelligent Tutoring Systems, or ITS), there is consensus that they can offer a cost-effective way of approximating this experience at scale (Kasneci et al., 2023). An intelligent tutoring system is a program that simulates a human tutor to offer personalised instruction, adapting content and learning pace to each student's performance and needs.

Three recent randomised controlled trials (RCTs) provide experimental evidence of particular value for the contexts where ProFuturo operates:

- **United States — Tutor CoPilot (Stanford).** A generative AI trained on ethnographic observations of good teacher feedback provided real-time assistance to 900 tutors working with 1,800 students in vulnerable contexts. The intervention raised students' pass rates by 4% on average, with gains of up to 9% among the least experienced tutors (Wang et al., 2024, in OECD, 2026). The finding is decisive: AI acts as a lever for equity when it supports teachers with fewer qualifications or less experience.

- **United States — Harvard, university physics.** Students who learned with an AI tutor configured to implement active learning principles learned significantly more in less time than their peers in the face-to-face class, reporting greater motivation and engagement (Kestin et al., 2025). What was decisive is that the difference came from the configured pedagogical design, not from the tool itself.

- **Nigeria — secondary school.** An after-school programme in nine secondary schools provided guided access to Microsoft Copilot, with explicit pedagogical instruction and work in pairs. The study found a medium-sized positive impact on learning (De Simone et al., 2025, in OECD, 2026). This RCT, conducted in Sub-Saharan Africa, shows that the benefits are achievable in low-resource contexts when there is pedagogical support.

These results converge on one conclusion: generative AI improves learning when it is accompanied by explicit pedagogical design and teacher training. The tool alone, without such mediation, does not produce the expected effects.

For teachers, AI-based ITS can offer a twofold benefit. As support for pedagogical practice, they make it possible to identify patterns of student difficulty in real time, provide diagnoses of learning gaps and suggest evidence-based teaching interventions. As a tutor for educators themselves, AI can accelerate continuing professional development by explaining pedagogical concepts, illustrating teaching strategies adapted to the school context and offering feedback on planning.

Tutoring teachers is a valid and effective strategy for developing competencies at scale, freeing up precious time for them to act where they are irreplaceable: human mediation, emotional bonds and ethical guidance.



Increasing students' interest and motivation

Historically, new educational technologies have tended to benefit those students who are already curious and motivated, leaving behind precisely those who most need support. Recent research shows that students learn better when materials are adapted to their interests and contexts (Gomes et al., 2025). AI has the potential to reverse this logic, making personalisation at scale viable by adjusting content, language and formats to each student's profile.

International experimental initiatives have shown how AI can adapt textbooks in real time, adjusting explanations, terminology and structure according to each student's level of knowledge, context and interests, without compromising the integrity or pedagogical quality of the content (Gomes et al., 2025).



10

Challenges: priority areas for attention

ProFuturo understands that these issues require collective responses, built through dialogue among educational networks, educators, researchers and civil society, with the aim of ensuring that AI contributes to more equitable, safe and transformative education.

CHALLENGE 1

Cultural and linguistic diversity

Ensuring the reliability and diversity of the information generated by AI systems is one of the central challenges. These models can still 'hallucinate' by producing incorrect or misleading answers (Bender et al., 2021). Compounding this difficulty is a structural problem: most systems are trained on datasets in English and from countries of the Global North (Bender et al., 2021; Reimers, 2025).

This bias tends to reproduce culturally dominant perspectives and to render the narratives and experiences of other regions invisible. When a student looks for information on the history, literature or social realities of their surroundings, they may receive answers that reinforce stereotypes or ignore the cultural richness of their community.

ProFuturo (2025) considers that promoting linguistic, cultural and epistemic diversity in models and pedagogical practices is essential for AI to reflect and value plurality. This involves working with local partners, fostering the development of models in minority languages and training teachers to detect and correct these biases in the classroom.

CHALLENGE 2

Safety and data protection

The protection of girls, boys and adolescents is a priority. The accelerated adoption of AI tools by minors —often without mediation or supervision— increases the risks of exposure to inappropriate con-

tent and the improper disclosure of personal information (Common Sense Media, 2024).

Although frameworks such as the European General Data Protection Regulation (Regulation (EU) 2016/679), the EU Artificial Intelligence Act (Regulation (EU) 2024/1689), COPPA in the United States (1998) and UNESCO's Recommendation on the Ethics of AI (2022) offer international references, their application in public education systems faces obstacles: lack of infrastructure, absence of specialists and insufficient preparation of educators to guide students in digital and media education.

ProFuturo advocates strengthening digital safety policies and digital citizenship training, in coordination with education authorities and child protection bodies.

CHALLENGE 3

Critical thinking and deep learning

The rapid spread of AI in schools can lead students to use these tools superficially, delegating to technology the cognitive effort needed for deep learning (Gerlich, 2025). This tendency intensifies in high-pressure contexts, as is the case with students who combine their studies with work and family responsibilities.

A randomised controlled trial in Türkiye with 1,000 secondary school students documents this risk with concrete data: those who practised mathematics with a general-purpose chatbot obtained better results during practice, but in the closed-book exam they scored 17% lower than the group without AI (Bastani et al., 2024, in OECD, 2026). The finding confirms a critical distinction that performance on a task with AI does not imply real learning. When the tool is withdrawn, the knowledge does not remain. Students who used a version of AI pedagogically configured not to give direct answers obtained results similar to those of the control group, without the 17% drop, which shows that the problem is not AI, but its use without pedagogical mediation.

For ProFuturo, the challenge is to make AI an ally of autonomous thinking, developing pedagogical practices that foster analysis, reflection and creation, and not merely the consumption of ready-made answers.

CHALLENGE 4

Academic integrity and assessment redesign

The misuse of AI by students highlights a long-standing fragility of many education systems, which are still centred on examinations and memorisation. Banning the use of AI is insufficient and, in practice, unfair, since it increases inequalities in access.

The way forward lies in rethinking what and how we assess, adopting formats that value students' process, authorship and reasoning: projects, portfolios, oral presentations, competency-based assessments.

ProFuturo recognises that education systems face concrete limitations of infrastructure, connectivity and teacher time, and advocates designing viable and contextualised solutions for this transformation.

CHALLENGE 5

Equity and access in contexts of structural inequality

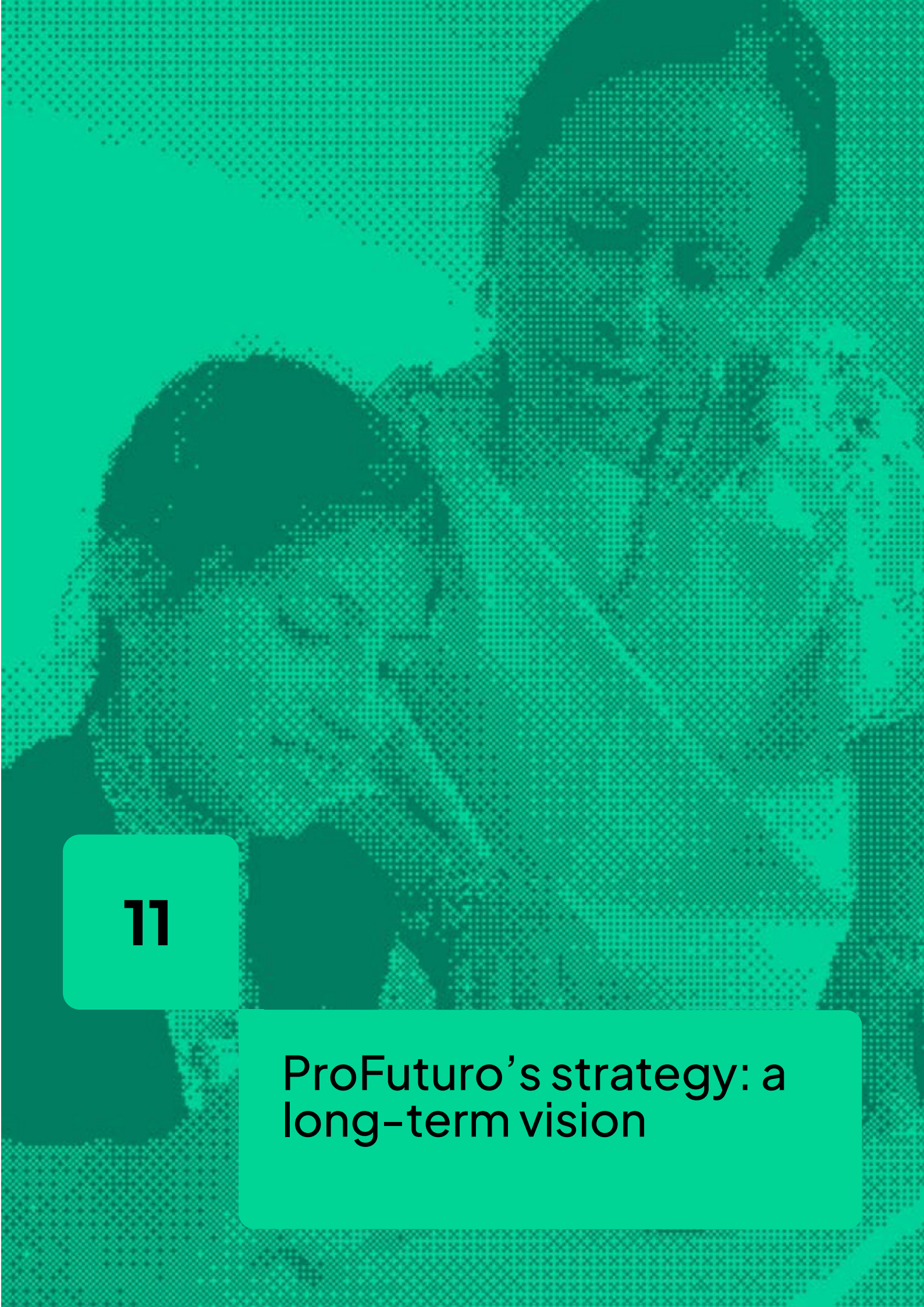
The democratisation of AI in education depends on addressing global digital divides. Consolidated data from UNESCO, the OECD and the Teacher Task Force (UNESCO Teacher Task Force, 2024; OECD, 2026; ITU, 2025) show consistent patterns in the contexts where ProFuturo operates: a high proportion of teachers reporting inadequate infrastructure for teaching with technology, significant gaps in teachers' digital competencies (ProFuturo, 2020) and an absence of stable technical and pedagogical support.

These inequalities manifest themselves in four dimensions: limited connectivity, shortage of equipment, training gaps and absence of technical and pedagogical support. Without deliberate action, there is a risk of consolidating a two-tier system: students in privileged contexts with access to advanced tools, while those studying in vulnerable public systems remain limited to pre-AI methodologies.

ProFuturo reaffirms its commitment to reducing digital inequalities, supporting policies and initiatives that guarantee real technology-mediated learning opportunities for all students, with particular emphasis on solutions designed for low-connectivity contexts.







11

ProFuturo's strategy: a long-term vision

> *"The challenge for education policymakers is to ensure that generative AI is a learning companion, not a shortcut to learning"*
>
> -(OECD, 2026).

This formulation precisely captures the filter that ProFuturo applies to every decision on AI in its strategy.

ProFuturo's pedagogical and technological innovation strategy involves developing an integrated and accessible digital ecosystem that maximises educational impact, as well as creating inclusive, personalised and effective learning experiences. The use of AI at ProFuturo is not a one-off initiative, but part of a long-term strategic vision structured around five interdependent strands.

Innovation with purpose

The use of AI at ProFuturo is governed by clear principles that act as a filter for every technological decision:

- **People at the centre:** every solution is designed to amplify human capacity, not to replace it.
- **Ethical and transparent use of technology:** traceability, explainability and accountability are requirements, not options.
- **Data protection and regulatory compliance:** alignment with global and local regulatory frameworks such as the GDPR (Regulation (EU) 2016/679), the EU Artificial Intelligence Act (Regulation (EU) 2024/1689), COPPA (1998) and UNESCO's recommendations (2022).
- **Priority for open innovation and open source where viable:** avoiding technological dependencies that compromise the educational sovereignty of communities.
- **Design for environments with limited connectivity:** offline-first solutions with low computational demands as a principle, not as an exception.

- **Commitment to equity, inclusion and sustainability:** always considering the social and environmental impact of technological decisions.

Artificial intelligence does not replace the teacher: it amplifies their capacity to teach and to support learning. This principle underpins the five strands of the strategy and guides every partnership, development and training activity.

Educational agents and learning support

One of ProFuturo's key lines of innovation is the development and integration of educational agents and virtual assistants, aimed at strengthening both pedagogical support and the user experience in digital environments.

These agents are not limited to direct support for students but are designed to support the educational ecosystem as a whole. On the one hand, they help to enhance the role of tutors, coaches and teachers, facilitating learning guidance, personalised monitoring and pedagogical decision-making. On the other, they act as an accessible and immediate layer of support for platform users, resolving operational needs such as access, navigation or incident management, which makes it possible to reduce friction and improve continuity in the use of educational resources.

This integrated approach recognises that educational impact does not depend solely on access to content, but on the quality of support and of the user experience. In this sense, artificial intelligence is incorporated as a support infrastructure for the learning ecosystem, extending people's capacity to intervene and facilitating effective access to educational opportunities.

Knowledge and training

ProFuturo promotes teacher training in AI applied to education through a diversified offering that includes structured courses, workshops with international experts and virtual learning communities. The training is aligned with ProFuturo's Global Framework for Teaching Competence in the Digital Age and with the UNESCO, OECD and European Union international frameworks described in this document.

The training strategy prioritises pedagogical reflection over instrumental training: it is not only a matter of learning to use an application, but of learning to integrate technology in the service of the purposes of a liberating, critical and quality education. Professional learning communities, where interdisciplinarity is the norm, are one of the central vehicles for scaling local innovations.

Practical educational application

ProFuturo explores and integrates AI-based solutions into its educational portfolio, developing and evolving virtual agents, platforms with personalisation models and offline-first solutions for contexts without connectivity. The design premise is clear: solutions must work in the most challenging contexts, not only in the most privileged ones, ensuring that the reach of innovation is truly global.

Each solution in the portfolio is evaluated on the basis of its real educational impact, its operational sustainability and its capacity to adapt to the linguistic, cultural and infrastructural realities of the communities where it is applied.

Research, development and open innovation

ProFuturo participates in international initiatives focused on the ethics, equity and sustainability of educational AI. This participation takes shape through four instruments:

- **Trends observatory:** systematic monitoring of the evolution of educational AI globally.
- **Experimentation sandboxes:** controlled environments for testing solutions before deployment.
- **Presence in specialised forums:** active contribution to the global debate on AI and education.
- **Open innovation spaces:** collaboration with universities, research centres, ministries of education and other foundations to develop shared knowledge.

ProFuturo's internal digital transformation

The integration of AI at ProFuturo is not limited to its educational portfolio: it also extends to the organisation's internal processes, seeking efficiency and better decision-making. This includes data-driven management for strategic decision-making and the development of an internal regulatory framework governing the adoption, use and governance of AI across all areas of the organisation. Consistency between what ProFuturo recommends externally and what it practises internally is a condition of credibility.

A long-term vision

Innovating with AI involves learning, experimenting rigorously, collaborating with the educational ecosystem and making evidence-informed decisions, while always keeping the focus on real educational impact. ProFuturo accepts that this transformation is not linear: it requires tolerance of error, capacity for organisational learning and a willingness to review its own practices in the light of results.

Only in this way can technology contribute to a more fair, quality education with opportunities for all. This is the commitment of Fundación Telefónica and Fundación “la Caixa”, through their ProFuturo programme in the age of artificial intelligence: innovation with purpose that puts people at the centre and recognises that the success of education in the age of AI will be measured not by the sophistication of the tools, but by our capacity to ensure that technology is always a bridge to a more dignified and just life.



12. Glossary

The definitions below cover the key terms used in this framework. They are offered in brief form to facilitate consultation and dissemination.

AI literacy: a set of competencies that make it possible to understand what AI is and how it works, identify biases and social impacts, and use AI tools ethically and in an informed manner.

Teacher–AI complementarity: cooperation between human pedagogical judgement and algorithmic support in four dimensions: goals, perception, action and decision.

Four-Dimensional Education (4D): a framework developed by Charles Fadel that integrates four essential dimensions —Knowledge, Skills, Character and Meta-learning— and culminates in Wisdom.

Educational equity: a commitment to justice that recognises different starting points and offers differentiated treatment, taking into account the specific needs of each student.

Unplugged AI: An approach in which the application of AI and the learning of its concepts take place in contexts with limited or no connectivity. It combines analogue activities with technological solutions that operate with little or no internet, synchronising data only when a signal is available.

Generative AI: artificial intelligence systems capable of generating new content —text, images, audio— based on patterns learned from large datasets.

Computational thinking: the ability to break down complex problems, recognise patterns, abstract essential elements and formulate algorithmic solutions.

Algorithmic bias: the reproduction or amplification of social inequalities —of gender, race, territory, class, language— in AI systems, resulting from unrepresentative or historically biased training data.

Intelligent Tutoring System (ITS): a computer program that simulates a human tutor to offer personalised instruction, adapting content and learning pace to each student's performance and needs.

General-Purpose Technology: a technology with the potential for systemic transformation across multiple sectors, as electricity and the internet were in their time, and as AI is today.

Zone of proximal development: Vygotsky's concept describing the space between what a learner can do alone and what they can do with support; the optimal point for learning.

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CONCEPTUAL FRAMEWORK FOR AI IN EDUCATION

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