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AI competency framework for teachers

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SHORT SUMMARY

Guiding teachers on AI use and misuse in education

AI processes vast information, generates new content, and helps decision-making through predictive analyses. In education, AI has transformed the traditional teacher–student relationship into a teacher–AI–student dynamic.

This shift requires a re-examination of teachers' roles and the competencies they need in the AI era. Yet, few countries have defined these competencies or developed national programmes to train teachers in AI, leaving many educators without proper guidance.

By 2022, **only seven countries** had developed AI frameworks or programmes for teachers

The *AI competency framework for teachers* addresses this gap by defining the knowledge, skills, and values teachers must master in the age of AI. Developed with principles of protecting teachers' rights, enhancing human agency, and promoting sustainability, the publication outlines 15 competencies across five dimensions: Human-centred mindset, Ethics of AI, AI foundations and applications, AI pedagogy, and AI for professional learning. These competencies are categorized into three progression levels: Acquire, Deepen, and Create.

As a global reference, this tool guides the development of national AI competency frameworks, informs teacher training programmes, and helps in designing assessment parameters. It also provides strategies for teachers to build AI knowledge, apply ethical principles, and support their professional growth.

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"Since wars begin in the minds of men and women it is in the minds of men and women that the defences of peace must be constructed"

AI competency framework for teachers

Foreword

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The rapid rise of artificial intelligence (AI) systems is having profound implications for teaching and learning, particularly regarding the role of teachers and the competencies they require to navigate the ever-evolving technological landscape. The use of AI in education is raising fundamental questions about teacher agency and their capacity to determine how and when to make judicious use of this technology.

Teachers urgently need to be empowered to better understand the technical, ethical and pedagogical dimensions of AI. As of 2022, however, only seven countries had developed an AI competency framework or professional development programme for teachers.

This vital new UNESCO AI competency framework for teachers enables countries to fill this gap. The first ever global framework of its kind, it has been designed to inform the development of national AI competency frameworks and professional training programmes for teachers, ensuring that they advance education as a public good.

The framework aligns with UNESCO's mission by advocating for a human-centered approach that integrates AI competencies for teachers with principles of human rights and human accountability. In this way, it responds to the urgent call from the 2021 UNESCO report, *Reimagining our futures together: A new social contract for education*, to help transform humanity's relationship with technology.

The publication builds on UNESCO's previous work in the field, such as the *ICT competency framework for teachers, AI and education: Guidance for policy-makers,* as well as the more recent *Guidance for generative AI in education and research.* It is informed by contributions from a wide range of stakeholders, benefitting from UNESCO Member States' insights on developing and implementing AI school curricula, the expertise of an international working group, four international consultation meetings, and multiple rounds of online consultations.

The AI competency framework for teachers has been developed hand in hand with a competency framework for students. It is my hope that these two frameworks will empower teachers and students to shape the inclusive and sustainable digital futures we want.

In a world characterized by rising complexity and uncertainty, it is our collective responsibility to ensure that education remains the central space for transformation of our shared futures.

Stefania Giannini
UNESCO Assistant Director-General for Education

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List of acronyms and abbreviations

AI	Artificial intelligence
AI4K12	Artificial intelligence for K-12
AI4T	AI for teachers
CFT	Competency framework for teachers
CG	Curricular goal
EI	Education International
EU	European Union
GDPR	General Data Protection Regulation
ICT	Information and communication technology
IT	Information technology
LMS	Learning management system
LO	Learning objective
MOE	Ministry of Education
MOOC	Massive open online course
NETS	National Educational Technology Standard
UNESCO	United Nations Educational, Scientific and Cultural Organization

Chapter 1: Introduction

1.1 Why an AI competency framework?

There are significant implications of artificial intelligence (AI) for education, teaching and learning, and for teachers' roles and competencies. Indeed, AI can process vast amounts of information and text far beyond any human capacity and can produce new content across the range of symbolic representations of human thinking, identify patterns in data presented in various formats, and can facilitate human decision-making by predictive analyses. Emerging practices in the use of AI in education clearly demonstrate the potential of AI to enable new forms of teaching, learning and education management and enhance learning experiences and support teacher tasks.

However, AI can pose significant risks to students, the teaching community, education systems and society at large. AI may threaten human agency, intensify climate change, violate data privacy, deepen long-standing systemic inequalities and exclusion, and lead to new forms of discrimination. In education, AI can reduce teaching and learning processes to calculations and automated tasks in ways that devalue the role and influence of teachers and weaken their relationships with learners. It can narrow education to only that which AI can process, model and deliver. Finally, it can also exacerbate the worldwide shortage of qualified teachers through disproportionate spending on technology at the expense of investment in human capacity development.

The use of AI in education therefore requires careful consideration, including an examination of the evolving roles teachers need to play and the competencies required of teachers to make ethical and effective use of AI. Teachers are the primary users of AI in education, and they are expected to be the designers and facilitators of students' learning with AI, the guardians of safe and ethical practice across AI-rich educational environments, and to act as role models for lifelong learning about AI. To assume these responsibilities, teachers need to be supported to develop their capabilities to leverage the potential benefits of AI while mitigating its risks in education settings and wider society.

National educational authorities need to dynamically review and redefine teachers' roles and required competencies, strengthen teacher-training institutions, and establish appropriate capacity-building programmes to prepare teachers to work with AI in an effective and ethical manner. Yet, according to a recent survey (UNESCO, 2023*a*), only seven countries had developed frameworks or programmes on AI for teachers in 2022. This can be largely explained by the lack of knowledge on how to define teachers' roles and competencies in the context of growing human–AI interactions in educational and pedagogical practices.

This AI competency framework for teachers (AI CFT) is intended to support the development of AI competencies among teachers to empower them to use these technological tools in their teaching practices in a safe, effective and ethical manner. The framework is based on a human-centred approach to the knowledge,

understandings, and skills required to do so. It maintains that while AI offers opportunities to support teachers in both teaching as well as in the management of learning processes, meaningful interactions between teachers and students and human flourishing should remain at the center of the educational experience. Teachers should not and cannot be replaced by technology – it is crucial to safeguard teachers' rights of and ensure adequate working conditions for them in the context of the growing use of AI in the education system, in the workplace and in society at large.

1.2 Purpose and target audience

The AI CFT targets teachers who need to apply AI to facilitate learning in core subject areas. It is not designed for teachers who are specialized and tasked to teach advanced AI knowledge and skills. While the five aspects and three mastery levels of the AI CFT presented below can provide a basis to define AI teachers' competencies, the depth and breadth of these need to be further refined in accordance with the higher-level demands required of teaching AI as a specific subject.

The AI CFT is designed to guide the proactive, continuing professional development and learning of teachers for a human-centred approach to the adoption of AI in education. The specific objectives of the AI CFT are to offer a reference framework that helps shape national, state-level or institutional AI competency frameworks or training programmes for teachers; to provide an operational framework to teacher educators for the design and planning of training courses on AI; and to establish a benchmarking matrix for the assessment of teachers' AI competencies and professional learning regarding the use of AI. As such, the framework is designed for policy-makers, teacher education providers, teachers' unions, school leaders, teachers and educational experts.

1.3 Alignment with the ICT competency framework for teachers

The AI CFT is aligned with, and complements, the 2018 *UNESCO ICT competency Framework for Teachers* (ICT CFT) which remains relevant in supporting teachers to grow their capacities for teaching and professional learning with ICT and digital technologies.

The structure of the AI CFT, as presented in Chapter 3, follows that of the ICT CFT. Both frameworks are underpinned by a vision that aims to empower teachers with the competencies required to appropriately leverage technology in education. The two frameworks share a common architecture with a comprehensive approach to teachers' professional development across the pre-service, in-service and ongoing support stages, thereby ensuring continuous progression and practical integration of ICT and AI tools. By mirroring the holistic approach of the ICT CFT in its organization, the AI CFT also suggests the enabling technology and policy environments needed for effective support of teachers' continuous professional learning. These enabling environments comprise inclusive access to connectivity and content, human-centred policies, conducive curriculum and assessment systems, inter-sectoral support for teachers, and engagement with teaching communities.

1.4 Technological advances in AI and implications for teacher competencies

The AI CFT is aligned with the ICT CFT but goes further by considering the implications for teacher competencies of technological advances that have occurred since previous generations of ICT tools were adopted, manifested by AI technologies.

In its most basic form, what makes AI distinct from other forms of digital technologies is its capacity to mimic human behaviour. This unique feature challenges human agency. Indeed, where previous generations of ICT tools focus more on facilitating routine tasks, AI tools tend to replace human decision-making based on predictions of patterns drawn from the analysis of extensive data of past examples. There is consequently a risk that over-reliance on AI could lead to the atrophy of teachers' essential competencies. This potential of AI to usurp the autonomous decision-making capacity of teachers necessitates a stronger emphasis on teacher agency and on a human-centred mindset that can help ensure that the use of AI serves human capacity development.

The mining of data for training AI systems threatens personal data privacy. The previous generations of ICT tools were designed to transfer or share information and tend to remain responsive to users' manual operation of the tools. In contrast, the data mining behind the design of AI platforms involves actively preying on and exploiting personal data, often without consent. Moreover, the tacit commercial rule behind the providers of AI systems lures users into foregoing a certain degree of their privacy when registering for the 'benefits' of AI services. While the previous generations of ICT tools had raised some ethical concerns around privacy and security, the aggressive approach to the design and provision of AI services has triggered more profound risks and could deepen societal inequalities. This more fundamental and controversial technological advance heightens the urgency of empowering teachers to understand the ethical issues related to interacting with various AI tools in their teaching, in order to ensure safe and responsible use among students.

In its current methods of generating outputs, AI-generated content is more likely to be stochastic. Prior generations of ICT tools tended to be deterministic, with the same inputs always leading to the same outputs. Recent AI tools, on the other hand, are more likely to be stochastic in generating outputs or predictions, as the same inputs may lead to different outputs. The AI-generated content is thus potentially less trustworthy, especially for the teaching of factual and conceptual knowledge. Given the opaqueness of the 'black box' behind the methods used in AI, teachers need both an understanding of how AI is trained and how AI works. They also need the capacity to critically examine the accuracy of AI outputs and to design appropriate pedagogical methodologies to guide the use of AI-synthesized content in teaching and learning.

AI systems are adaptive to diverse problem spaces. As a result, they offer general-purpose foundation models that have the potential to drive transformation across various sectors. Generative AI, in particular, provides foundation models that can support the further training of domain-specific AI models and the customization of personalized tools. As a result of its more dynamic adaptivity, AI technology has the potential to alter business models, as well as social and personal practices. In view of the transformative potentials of AI, it is important to guide teachers to understand its social impact and the responsibilities of citizenship in emerging AI societies, and to motivate and support them through continuous professional learning.

Chapter 2: Key principles

2.1 Ensuring inclusive digital futures

Ensuring equitable and inclusive digital futures in the era of AI must be grounded in a solid human and social foundation. Teachers are the primary users of AI in education and the key mediators in ensuring adequate redefinition and balance in the evolving relationship between humans and technology, in general, and knowledge and learning, in particular. The AI CFT therefore aims to help teachers decipher the multi-layer and multi-perspective foundational values and attitudes towards human–AI interaction, beginning with four main tenets:

- **Debunking AI hype:** The design and use of AI is human led. Those who create AI systems and tools can determine whether, and to what extent, it will be endowed with emancipatory potentials to protect and enhance human capacities or, on the contrary, be embedded with malicious aims and/or unintended biases that violate human rights and undermine human agency and capacity. Teachers need to have the critical capacity to assess the potential positive and negative impacts of AI. They need to be aware that only intentionally ethical design ('ethics by design'), and well-regulated deployment of AI, can genuinely advance human capabilities, inclusivity and sustainability.
- **Understanding threats inherent to the design of AI:** Current algorithmic pathways and models of AI present acute challenges to human rights and privacy. Moreover, AI-generated content has been undermining indigenous knowledge, cultures and languages. Teachers need to understand how AI systems are designed and how AI models work, in order to be able to protect human agency, linguistic and cultural diversity, and indigenous knowledge.
- **Ensuring human and social values prevail:** Profit-driven algorithms also weaken social values and cohesion by promoting isolation of individuals from the real world and from others. Values of empathy, altruism, justice, intercultural compassion and solidarity are essential for social cohesion and to uphold our common humanity. AI and other digital technologies must not discourage people from staying in contact with others and with the real world, as well as from respecting rights to ways of living and knowing beyond digital spaces.
- **Steering AI for human capacity development:** The use of AI in education without appropriate pedagogical guidance may weaken the intellectual development of students. The aim of using AI in education should move beyond merely providing access to information and standardized responses, towards inquiry enrichment, intellectual development and capacity empowerment.

2.2 A human-centred approach to AI

A human-centred approach to AI in education is critical – an approach that promotes key ethical and practical principles to help regulate and guide practices of all stakeholders throughout the entire life cycle of AI systems. These human-centred principles regarding the use of AI in education have been iteratively articulated through UNESCO's *Recommendation on the Ethics of Artificial Intelligence* (2022*a*) as well as various policy guidance tools, including the *Beijing Consensus on Artificial Intelligence and Education* (UNESCO, 2019), *AI and education: Guidance for policy-makers* (UNESCO, 2022*b*), and *Guidance for generative AI in education and research* (UNESCO, 2023*b*). The approach encompasses four core principles: the design and use of AI should be at the service of strengthening human capacities as well as sustainable development; access to, and deployment of AI, should be equitable and inclusive; AI models in use should be explainable, safe and do no harm; and finally, the selection, use and monitoring of the impact of AI should be human controlled and human accountable.

The implementation of a human-centred approach requires regulators, providers of AI and institutions to be co-responsible for governance before requiring teachers to apply principles applicable for their profession. In this context, the AI CFT expands on these principles in the following way, emphasizing teacher mindsets and the ethics of AI:

- **Empowering teachers' human-accountable use of AI:** The ethical and legal responsibilities for designing and using AI should be attributed to individuals. In the specific context of AI competencies for teachers, this human-accountable principle implies that AI tools should not replace the legitimate accountability of teachers in education. Teachers should remain accountable for pedagogical decisions in the use of AI in teaching and in facilitating its uses by students. For teachers to be accountable at the practical level, a pre-condition is that policy-makers, teacher education institutions and schools assume responsibility for preparing and supporting teachers in the proper use of AI.
- **Promoting inclusivity:** Structural exclusion and discrimination are often embedded in the design and use of AI. Teachers should be mindful of potential algorithmic biases. Within the scope of their duties, teachers need to ensure that AI is used in an inclusive manner by and for all students, regardless of their gender, ethnicity, abilities or socio-economic or migration status. Teachers should also be supported to promote social inclusion and cultural pluralism when exploiting AI.
- **Recognizing users' right to question the explainability of AI tools:** AI models used to generate responses that appear reliable or convincing may not be explainable and may be riddled with hidden risks. The AI CFT equips teachers with skills and knowledge, appropriate for the scope of their pedagogical responsibilities, to understand and critically evaluate AI tools, including their explainability and safety. This can enable teachers to understand how AI reaches its conclusions, making it possible to critically assess its use and intervene when necessary.

- **Understanding and monitoring the human-controlled impact of AI:** Teachers need to be aware that AI is human-led and the decisions of designers have impacts on human rights, dignity, and social and environmental well-being. The AI CFT is intended to develop teachers' awareness of the design intent behind AI tools, and their ability to harness the benefits of AI while controlling, within the remit of their role, the possible adverse impacts of AI applications on students' learning and well-being.

2.3 Protecting teachers' rights and iteratively (re)defining teachers' roles

To uphold social values and accountability in the AI era, it is also essential to recognize the indispensability of interaction and collaboration between teachers and learners as being at the core of education. AI tools should never be designed to replace the legitimate accountability of teachers in education. When introducing AI in education, legal protections must be established to protect teachers' rights, and long-term financial commitments need to be made to ensure inclusive access by teachers to technological environments and basic AI tools as vital resources for adapting to the AI era.

Given the potential AI holds to transform teaching and learning, policy-makers should urgently review and iteratively (re)define teachers' roles and required competencies. Appropriate capacity-building programmes are needed to prepare teachers to work in increasingly AI-rich settings. With the emerging capabilities of AI tools in assisting decision loops and generating content, the interaction between teachers and students is arguably becoming triangular, as AI systems are increasingly mediating preparation, teaching, learning and assessment. Teachers therefore need to be empowered to act as collaborative knowledge producers and as guides to citizenship in the era of AI. To help teachers explore and take on these new roles, the AI CFT is designed to nurture their human-centred awareness of the social impacts of AI, as well as their capacity to adapt to and accommodate the evolving nature of AI in education.

2.4 Promoting trustworthy and environmentally sustainable AI for education

It is imperative to validate the safety and trustworthiness of AI systems in education before making teachers responsible for compliance with ethical principles. An 'ethics by design' principle should be mandated through strict validation of AI tools at the national and/or institutional levels before they are adopted in educational settings. This prior validation, and the legal whitelisting of trustable AI tools for education, can relieve teachers from being held accountable for ethical governance beyond their role and/or capacities. Aligned with the aforementioned core values, the validation procedure should attach priorities to the following principles:

- **Mandating the 'do no harm' principle:** Validation should mandate the 'do no harm' principle and the requirement that all AI tools used in education have been designed with a clear understanding of their potential impacts on human rights, dignity, safety, social well-being and environmental sustainability.
- **Prioritizing environmentally-friendly AI tools:** The principle of 'do no harm' should emphasize the environmental costs of AI, particularly the way in which its life

cycle and value chain might harm the environment and exacerbate the climate crisis. This understanding of the carbon emissions of AI is crucial for teachers and is instrumental to their students' awareness of climate change.

- **Validating trustworthy AI for educational purposes:** A strict validation mechanism should also be designed to validate AI systems that are inherently reliable and safe for educational purposes, including for students with special needs. Such AI systems should be free from malicious intent and/or harmful consequences, robust and resilient to manipulation, and able to protect learners' privacy and sensitive personal data. The age-appropriateness and pedagogical utility of AI tools should also be examined and validated before being adopted at scale.
- **Human accountable design and development:** educational institutions and technology providers should be held accountable for the transparency and explainability of the performance, outcomes and impacts of AI.

2.5 Ensuring applicability for all teachers and reflecting digital evolution

AI literacy and access may be considered part of basic rights in the AI era and AI competency is becoming one of the prerequisites for the teaching profession. The AI CFT is therefore designed to be inclusive and universally applicable for all teachers, across diverse educational contexts, acknowledging the varying levels of digital expertise they may possess. The framework specifies a progressive approach to the planning of training programmes that can help all teachers – including those without prior knowledge of AI – to grow gradually from basic to more advanced levels of understanding and skill mastery.

The framework is intended to be a universally applicable reference for the specification of national/local AI competencies, as well as for the planning of curricula, training programmes and for ensuring basic enabling environments. These should ensure that all teachers, regardless of their starting point, are afforded the opportunity to advance their understanding and application of locally accessible and affordable technology, from unplugged and low-tech solutions to AI-rich settings.

The dynamic nature of digital technology and the technological leaps from previous generations of ICT tools to AI technology must be accounted for. The framework consequently offers guidance and resources that enable teachers to transition confidently from the use of previous generations of digital technologies to more recent AI systems and tools.

Given the novel ethical issues triggered by AI and the potentially transformative opportunities AI may provide, it is crucial to equip teachers with the human-centred mindset, ethical behaviours, conceptual knowledge and application skills needed to make use of AI to enhance students' learning and their own professional development. The framework is designed to foster transferable competencies across learning contexts, including the capacity to respond effectively to the rapid upgrading of AI technologies and their evolving implications for education.

2.6 Lifelong professional learning for teachers

Teacher development should be considered as a continuous and lifelong journey of professional growth that spans a teacher's entire career and life experiences. The AI CFT advocates the following holistic approach to support teachers' continuous learning:

- **Navigate personal progression through transferable competencies:** Given the rapid expansion of AI technologies, the complexities of corresponding ethical issues, and the challenges of integrating AI in pedagogy, teachers should be assisted to progressively advance their AI competencies. The AI CFT outlines competencies at multiple levels to guide this progression and suggests training methodologies to help teachers remain conversant with the emerging technologies and their broader implications for pedagogy, ethics as well as their societal impact.

- **Guide continuous reflection and improvement of practical performance:** Lifelong learning entails consistent reflection and enhancement of one's own practice. The AI CFT proposes reviews of exemplar lessons, reflection on teachers' own knowledge and practices, and internalization of values and understanding. It further encourages teachers to iterate cycles of lesson design, implementation, reflection and redesign.

- **Streamline training and support programmes:** Lifelong professional learning needs coherent training and support. The AI CFT advocates the institutional streamlining of programmes for pre-service preparation, in-service training and ongoing coaching to facilitate teachers' learning at different stages of their career. It emphasizes the creation and nurturing of professional development communities and organizational capacity-building, champions peer-coaching and agile learning in response to the evolution of AI technologies, and promotes a human-centred approach in education.

- **Adapt policies to support lifelong professional learning:** Conducive policies and incentive strategies are essential to maintain teachers' motivation to undertake lifelong professional learning. Teacher management policies should allocate sufficient time and resources for teachers to engage in training and professional development activities, as well as recognize or reward their performance in making responsible and innovative use of AI. Furthermore, broad curriculum and assessment systems need to be adapted to allow space for teachers' pilot tests of validated AI tools and new pedagogical methodologies. It is also necessary to review whether current assessment methods excessively circumscribe the leveraging of human-centred potentials of AI for education and, if so, determine how they can be reformed.

Chapter 3: Structure of the AI competency framework for teachers

3.1 Dimensions of the AI CFT

The AI competency framework for teachers is presented in a two-dimensional matrix: five aspects of competency which evolve across three progression levels, forming fifteen blocks as shown in **Table 1**.

The first dimension comprises the five aspects of AI competency, shown in the leftmost column of the table. Competency aspects stand for the interlinked key elements of knowledge, skills, values, and attitudes that teachers need to develop in order to integrate AI effectively and ethically into their teaching practices, in the facilitation of learning, and in professional development. These five aspects, which are detailed further in the next section, are a human-centred mindset, ethics of AI, AI foundations and applications, AI pedagogy, and AI for professional development. While each aspect represents a unique constituent element of AI competency, the aspects are related to each other as they are complementary, interdependent and synergistic. Their relatedness contributes to the cohesive growth of AI competence.

- The **Human-centred mindset** aspect defines the values and attitudinal orientation towards human–AI interactions that teachers need to nurture.
- The **Ethics of AI** aspect delineates essential ethical principles, regulations, institutional laws and practical ethical rules that teachers need to understand, apply and help adapt.
- The **AI foundations and applications** aspect specifies conceptual knowledge and transferable skills teachers need to understand and apply in selecting, applying and creatively customizing AI tools to serve student-centred, AI-assisted teaching and learning environments.
- The **AI pedagogy aspect** proposes a set of competencies required for purposeful and effective AI–pedagogy integration. This covers the ability to validate and select proper AI tools and to integrate them into pedagogical strategies to support course preparation, teaching, learning, socialization, social caring and learning assessment.
- The **AI for professional development** aspect outlines competencies teachers need to develop in order to use AI properly in driving their lifelong professional learning, supporting collaborative professional development and exploring professional transformation.

The AI CFT's second dimension, shown along the top of **Table 1**, is the scaffolded progression of competency development. Progression levels represent the levels teachers could possibly develop over time in all five competency aspects as part and parcel of AI competency. The framework recognizes that competence development is

a complex, context-dependent process that is neither hierarchical nor linear. However, the framework serves as a reference pathway for teacher progression, emphasizing and outlining desired outcomes at each level per aspect rather than setting out rigid, prescribed steps that teachers must go through. The three progression levels are: 'Acquire', which defines the essential set of AI competencies all teachers need in order to evaluate, select and use AI tools appropriately in education; 'Deepen', which specifies intermediate competencies that are needed to design meaningful pedagogical strategies that integrate AI; and 'Create', which sets out advanced competencies required for the creative configuration of AI systems and innovative use of AI in education.

By crossing these three levels with the five aspects of competency, the AI CFT defines fifteen competency blocks. These competency blocks are designed to support all teachers – from those with no knowledge at all about AI, to those with a higher degree of competency and experience in AI.

Table 1. The AI competency framework high-level structure: aspects and progression levels

Aspects	Progression		
	Acquire	Deepen	Create
1. Human-centred mindset	Human agency	Human accountability	Social responsibility
2. Ethics of AI	Ethical principles	Safe and responsible use	Co-creating ethical rules
3. AI foundations and applications	Basic AI techniques and applications	Application skills	Creating with AI
4. AI pedagogy	AI-assisted teaching	AI–pedagogy integration	AI-enhanced pedagogical transformation
5. AI for professional development	AI enabling lifelong professional learning	AI to enhance organizational learning	AI to support professional transformation

The AI CFT proposes a set of competencies around which teachers need to be prepared to make proper use of AI in education. However, the effective and ethical use of AI in education depends on various factors including, but not limited to, access to digital infrastructure, and to the internet in particular; availability of AI resources; regulations on data security and privacy; policy guidance and incentives; and professional development opportunities. It is also contingent on the trustworthiness and performance features of the AI tools that are adopted at scale and their implications for teachers' workloads. All of these, and potentially other factors, would likewise affect the extent to which teachers' AI competency can be practised, observed and advanced. The strategies for putting in place relevant enabling conditions are discussed in Chapter 5.

3.2 Aspects of the AI CFT

The five aspects of the AI CFT are intended to cover essential domains of the competencies and reflect their complementary relationships. When training programmes are designed to help teachers progress from 'Acquire' to 'Create', all five aspects should be targeted and integrated as a part of the expected competency development. The main components of the five aspects are summarized below.

3.2.1 Aspect 1: Human-centred mindset

The human-centred mindset defines the values and critical attitudes teachers need to develop towards human–AI interactions based on the aforementioned principles. This aspect encourages teachers to always put human rights and needs for human flourishing as the focus of AI in education. Teachers are encouraged to nurture critical methodologies to evaluate the benefits and risks of AI, while ensuring human agency and human accountability, and understanding AI's societal impact and implications for citizenship in the era of AI.

3.2.2 Aspect 2: Ethics of AI

Ethics of AI delineates the essential ethical values, principles, regulations, institutional laws and practical ethical rules that teachers need to understand and apply, drawn from the rapidly expanding body of knowledge on the ethics of AI and their implications for education. This aspect defines teachers' progressively deeper understanding of fundamental ethics of AI, skills to make safe and responsible use of AI, and comprehensive competencies to participate in the adaptation of ethical rules.

3.2.3 Aspect 3: AI foundations and applications

AI foundations and applications specifies the conceptual knowledge and transferable operational skills that teachers need to understand and apply in order to support their selection, application and creative customization of AI tools to build student-centred AI-assisted teaching and learning environments. Teachers are expected to gain appropriate understanding of the definition of AI, basic knowledge about how AI works, as well as about the main categories of AI technologies; the skills necessary to evaluate appropriateness and limitations of AI tools based on specific needs in specific domains and contexts; and the skills to operate validated tools for real-world tasks; progressively, it involves skills to adapt or customize AI tools to build human-centred and age-appropriate learning environments.

3.2.4 Aspect 4: AI pedagogy

AI pedagogy proposes a set of competencies required for purposeful and effective AI–pedagogy integration, covering comprehensive competencies to validate and select appropriate AI tools and integrate them with pedagogical methods to support course preparation, teaching, learning, socialization, social caring and learning assessment. This aspect implies that teachers need to develop the ability to critically assess when and how to use AI in teaching and learning in an ethical and human-centred manner, as well as to plan and implement inclusive AI-assisted teaching and learning practices. Progressively, teachers need to enhance their capacity to critically adapt and creativity explore innovative practices in the context of advancing capabilities of emerging AI iterations.

3.2.5 Aspect 5: AI for professional development

AI for professional development outlines the emerging competencies teachers need to build in order to use AI to drive their own lifelong professional learning and collaborative professional development in view of transforming their teaching practice. In response to the rapid development of AI, teachers need guidance on how to continue their professional development in educational settings characterized by growing human–AI interaction. This includes the ability to leverage AI to assess professional learning needs and nurture motivation for lifelong learning and professional collaboration. Progressively, teachers are expected to enhance their ability to adapt and create when using AI tools and data analytics to support transformative professional development.

These five aspects are intertwined and complementary, not isolated. In general, effective teaching (with or without AI) requires a holistic approach that integrates various competencies. For example, a teacher's ability to apply AI pedagogy is influenced by their understanding of AI foundations, their awareness of AI policy guidance, and their commitment to continuous professional development. Similarly, their ability to navigate the ethical dilemmas of AI is informed by their understanding of AI foundations and their experiences in applying AI in education. Proficiency in one area can enhance proficiency in another. Indeed, a deeper understanding of the foundations of AI can improve a teacher's ability to apply pedagogical and ethical principles related to AI, and continuous professional development builds a teacher's understanding of all of these aspects.

3.3 Progression levels of the AI CFT

The progression levels of the AI CFT are designed to help assess teachers' existing AI competencies and to define expected professional learning objectives. Theoretically, the training and support at the 'Acquire' level targets teachers with limited or no prior AI knowledge or skills. Indeed, all teachers should have opportunities to access this level of training or guidance in order to acquire the most fundamental set of competencies specified in the framework. In other words, the first level aims to foster basic AI literacy for teachers. The 'Deepen' level targets teachers who already have some knowledge of AI and some experience of using it in education. This level aims to support teachers to engage more deeply with AI tools in order to maximize their capacity to enhance teaching and learning practices. The third level, 'Create', is for teachers who have strong AI knowledge and skills as well as rich experience in using AI in education. This level aims to foster expert teachers who have the competencies to explore the ethically and pedagogically sound, transformative application of AI in teaching and learning.

The three progression levels constitute a 'to-be-scaffolded' roadmap of professional development for teachers. It meticulously benchmarks the starting point of teachers and delineates the next level of learning objectives and thereby maps the difficulty and breadth of the training programmes. When using the AI CFT as a reference framework to evaluate teacher competencies, it is worth keeping in mind that each level is cross-cutting with all five competency aspects (as shown in **Table 1**). Progression in one aspect is expected to influence development in another, reflecting the aforementioned complementary, interdependent and synergistic nature of the five aspects. It is to be noted, however, the

teachers' progression will likely not follow a synchronous sequence across all five aspects. For instance, a teacher might demonstrate competence in AI foundations at the 'Deepen' level, while still working on ethics at the 'Acquire' level. Diagnostic tools to assess individual teachers' AI competencies should consequently be designed to map their strengths and weaknesses in each of the aspects and personalize training priorities and learning pathways.

3.3.1 Progression level 1: Acquire

'Acquire' is a rudimentary level of learning and the initial level of practical AI use, encompassing the essential set of AI competencies required by all teachers to evaluate, select and exploit AI tools effectively and ethically in their practice. At this level, teachers embark on acquiring and utilizing the most fundamental knowledge and skills to use AI. They are expected to learn to recognize both the benefits and risks associated with AI in education, underpinned by an understanding of human rights, social justice, and humanistic values. Teachers should also be expected to gain awareness of the essential ethical principles related to AI, acknowledging its human-led nature and the critical role humans play in its development. Additionally, at this stage, teachers should be equipped to apply basic AI techniques and locally accessible applications. In addition, teachers are expected to foster an appreciation of how AI can potentially bolster or diminish the quality of teaching. This foundational level of AI literacy also sets the stage for educators to integrate AI into their professional development.

In general, this level of AI competencies for teachers can be summarized as a set of 'teachers' AI literacy'. Supported by appropriate training and guidance, all teachers are expected to be able to:

1. **Cultivate** a critical understanding that AI is human-led and that the corporate and individual decisions of AI creators have a profound impact on human autonomy and rights. This critical understanding implies an awareness of the importance of human agency when evaluating and using AI tools.
2. **Develop** a basic understanding of typical ethical issues related to AI and to human–AI interactions as they relate to the protection of human rights, personal data, human agency, and linguistic and cultural diversity, and advocate for inclusion and environmental sustainability.
3. **Acquire** basic knowledge about what AI technology is and how AI models are trained, associated knowledge on data and algorithms, the main categories of AI technologies and examples of each, as well as the basic capacity to assess the appropriateness of specific AI tools for education and to use validated AI tools.
4. **Identify** and leverage the pedagogical benefits of AI tools to facilitate subject-specific lesson planning, teaching and assessment while mitigating the risks.
5. **Explore** the use of AI tools to enhance their professional development and reflective practices, assess their learning needs and personalize their learning pathways in the rapidly evolving educational landscape.

3.3.2 Progression level 2: Deepen

At the 'Deepen' level of AI competency, teachers are expected to demonstrate proficiency in integrating AI into educational practices with a focus on human accountability as well as ensuring safe and responsible use of AI tools. This entails adhering to national and local policies, upholding the safety, privacy and rights of stakeholders, and critically assessing AI tools for ethical implications. Teachers are expected to champion equity, inclusion and diversity, and understand how AI design decisions impact ethical use. Furthermore, at this level, teachers should have the skills to identify, evaluate, select and apply AI tools to enhance teaching and learning practices. They must also be adept at incorporating human-centred pedagogical strategies and use AI to enrich their professional development and peer-learning within their organizations.

Teachers who have reached this mastery level of AI competencies at this level are expected to be able to:

1. **Demonstrate** a deepened understanding of human accountability and human determination in the proper deployment and use of AI. This implies a critical mindset of AI's capacity to facilitate human–AI decision loops, as well as of overhyped claims on the use of AI to substitute humans in making high-stakes decisions in education.
2. **Internalize** essential ethical rules for the safe and responsible use of AI including respecting data privacy, intellectual property rights, as well as other legal provisions, and adopt this ethical perspective when assessing and using AI tools, data and AI-generated content in education.
3. **Proficiently** operate AI tools adopted in educational settings, deepening knowledge and understanding – in an ethical perspective – of various categories of AI technologies as well as of data and algorithms as relevant to teaching responsibilities and background competencies.
4. **Adeptly** integrate AI into the design and facilitation of student-centred teaching practices to foster engagement, support differentiated learning and enhance teacher–student interactions, with aims of promoting students' empathy, critical thinking and problem-solving skills.
5. **Confidently** utilize AI tools for tailored participation in collaborative professional learning communities, leveraging them to share resources, engage in peer-to-peer learning, and contribute to dynamic adaptation.

3.3.3 Progression level 3: Create

At the 'Create' level of AI competency, teachers demonstrate a critical understanding of both the social impact of AI and of their citizen responsibilities. They are expected to contribute to the planning of policies on AI in education and/or the co-creation of ethical standards for the use of AI tools. Teachers at this level should be able to combine or modify open-source or customizable AI toolkits to develop tailored solutions to educational challenges in local contexts. This extends to critically assessing AI's role in teaching and learning processes and exploring AI-enhanced pedagogical activities that can potentially enable open learning options for students. Furthermore, teachers should be able to use AI to support their own continuous and/or transformative professional development and synthesize AI tools to meet the evolving needs of their professional communities.

Teachers who have reached this mastery level are expected to be able to:

1. **Actively** participate in and contribute to the building of inclusive AI societies guided by a critical understanding of the implications of AI for societal norms, and to promoting the design and use of AI for the enhancement of human welfare, inclusion and social justice.
2. **Champion** the ethics of AI through critical advocacy and empathy, leading discussions and actions that address ethical, sociocultural and environmental concerns from design to the use of AI and contribute to the co-creation of ethical standards for AI practices in education.
3. **Proficiently** customize or modify AI tools, applying enhanced conceptual knowledge and skills to create AI-assisted inclusive learning environments and address broader challenges in educational contexts.
4. **Critically** assess AI's impact on teaching, learning and assessment; plan and facilitate AI-immersed learning scenarios to support subject-specific or interdisciplinary learning, critical thinking and problem-solving among students; and leverage data and feedback to continuously explore student-centred pedagogical innovation.
5. **Customize** and modify AI tools to enhance their professional development and continuously test and validate strategies on the effective use of AI to meet their own and their communities' transformative professional development needs.

Chapter 4: The AI CFT specifications

This chapter provides detailed specifications on curricular goals and expected learning objectives that teacher training or support programmes can devise for each of the fifteen competency blocks. These goals and objectives are further illustrated by examples of activities teachers are expected to perform in various contexts, including in subject-specific and/or interdisciplinary teaching practices.

4.1 Progression level 1: Acquire

The overall curricular goal in the 'Acquire' level is to support all teachers to reach a basic level of AI competency or literacy required by the teaching profession across varied contexts. The following goals, learning objectives and examples of activities provide clarity as to what each competency block entails:

Table 2. Competency blocks, objectives and examples for progression level 1: Acquire

Progression level 1: Acquire				
	TEACHER COMPETENCY	CURRICULAR GOALS (CG) (Teacher training or support programmes should …)	LEARNING OBJECTIVES (LO) (Teachers can …)	CONTEXTUAL ACTIVITIES (Teachers can demonstrate the following attitudinal or behavioural changes)
Human-centred mindset	**1.1 Human agency:** Teachers have a critical understanding that AI is human-led, and that corporate and individual decisions of AI creators have a profound impact on human autonomy and rights, and are aware of the importance of human agency when evaluating and using AI tools.	CG1.1.1 Foster critical thinking on AI by organizing teachers to discuss and take perspectives on the dilemma of benefits offered by AI versus the risks of diminishing human autonomy and human agency; use specific AI tools as examples to support teachers to critically examine the benefits, limitations and risks of AI in local educational settings and with respect to their own responsibilities. CG1.1.2 Illustrate key steps in the life cycle of AI systems and guide teachers to understand how corporate and individual decisions of creators may affect the impact of AI. CG1.1.3 Highlight how overreliance on AI can undermine thinking skills and human agency. CG1.1.4 Offer practices of writing basic tips to help protect human agency when using AI in education, with a specific focus on students with special needs.	LO1.1.1 Critically reflect on the benefits, limitations and risks of specific AI tools in their local educational settings and the subject areas and grade levels they teach. LO1.1.2 Demonstrate an awareness that AI is human-led and the corporate and individual decisions of AI creators affect the impacts on human rights, human agency, individual lives, and societies. LO1.1.3 Outline the role of humans in the basic steps involved in AI development, from the collection and processing of data to the design of algorithms and functionalities of an AI system, to the deployment and use of AI tools. LO1.1.4 Understand the need to use basic measures to protect human agency in key steps regarding the design and use of AI systems by ensuring respect for data ownership, collection of data with consent, anti-bias data labelling and cleaning, discrimination-free AI algorithms, and user-friendly functions and interfaces.	**Unpack hype around AI:** Critically examine hype around concrete AI tools through basic risk-benefit analysis and by highlighting the central role of humans in using AI tools. **Understand why some AI tools should be banned:** Demonstrate a basic understanding of why some AI tools should be banned given their potential to diminish human agency and threaten human rights. **Spotlight risks**: List the potential ways in which teachers' and students' agency may be undermined by certain AI tools, as is the case, for example, with the use of large language models for essay writing. **Know basic dos and don'ts:** Write daily tips to promote human agency when using AI in teaching and to encourage student agency in harnessing and assessing AI.

Acquire				
	TEACHER COMPETENCY	CURRICULAR GOALS (CG) (Teacher training or support programmes should …)	LEARNING OBJECTIVES (LO) (Teachers can …)	CONTEXTUAL ACTIVITIES (Teachers can demonstrate the following attitudinal or behavioural changes)
Ethics of AI	**2.1 Ethical principles:** Teachers have a basic understanding of ethical issues surrounding AI and of the principles required for ethical human–AI interactions including protection of human rights, human agency, promotion of linguistic and cultural diversity, inclusion and environmental sustainability.	CG2.1.1 Surface ethical controversies through a critical examination of use cases of AI tools in education. CG2.1.2 Facilitate an understanding of essential ethical principles through an examination of use cases related to each of the core ethical principles. Guide teachers to understand why these principles are essential and how neglecting them may cause harm. These principles are encapsulated in the following six subtopics: 'do no harm'; proportionality; non-discrimination; sustainability; human determination in human–AI interaction; and transparency and explainability. CG2.1.3 Build an association between ethical principles and standards through examples of local, national or international regulations regarding the ethics of AI; discuss the implications for individuals and explain how core ethical principles are contextualized in local or national regulatory frameworks. CG2.1.4 Advocate for inclusivity in the use of AI and guide teachers to discuss the risks that specific AI tools can pose to inclusion and equity, including in educational contexts, and with special attention to learners who have disabilities and/or are from marginalized groups; guide teachers to discuss how these risks can be mitigated at the individual level.	LO2.1.1 Exemplify fundamental ethical controversies in the use of concrete AI tools, and do so from the perspectives of human agency, security, privacy, and linguistic and cultural relevance. LO2.1.2 Explain the core ethical principles (as listed in CG2.1.2) and internalize them through their personal selection and use of AI. LO2.1.3 Match key articles of regulations with ethical principles and understand their implications for education. LO2.1.4 Prioritize actions to minimize the negative impact of AI on equity and inclusion when using AI tools in education, with particular attention to students who have disabilities and/or are from marginalized groups.	**'Perspective taking' in ethical dilemmas:** Adopt an ethical perspective on the use of AI in schools based on an understanding of multiple dilemmas they pose around privacy, human agency, equity, inclusion, local cultures and languages, and climate change. **Knowledge-mapping of ethical principles:** Apply basic knowledge-mapping tools (such as paper-based worksheets or digital concept-mapping applications) to visualize the connections among the different core principles, responses to associated controversies, their correspondence with regulations, and examples of AI tools used in schools. **Personal observation of local regulations:** Observe whether local AI regulations keep pace with iterations of AI technologies and evaluate applicable regulations by matching them with ethical principles and local contexts. **Biases of AI tools:** Be mindful of biases of AI tools used in schools and their potential to exclude or marginalize persons with disabilities and students from vulnerable groups; report the risks to the institutional managers or responsible agencies.

Acquire				
	TEACHER COMPETENCY	CURRICULAR GOALS (CG) (Teacher training or support programmes should …)	LEARNING OBJECTIVES (LO) (Teachers can …)	CONTEXTUAL ACTIVITIES (Teachers can demonstrate the following attitudinal or behavioural changes)
AI foundations and applications	**3.1 Basic AI techniques and applications:** Teachers are expected to acquire basic conceptual knowledge on AI, including: the definition of AI, basic knowledge of how AI models are trained, and associated knowledge on data and algorithms; main categories of AI technologies and examples of each; and the capacity to examine the appropriateness of specific AI tools for education and operate validated AI tools.	CG3.1.1 Adapt the level of difficulty of basic conceptual knowledge on AI according to teachers' responsibilities and prior experience with AI; illustrate how a specific AI tool is developed based on data and algorithms; and explain the basic methods used by AI tools to process data to generate their outputs. CG3.1.2 Support the hands-on operation of AI tools that are relevant to teachers' responsibilities to give a basic understanding of how these tools work; guide them to experience different types of AI tools and help them understand the technological advances of AI from previous generations of ICT tools, as well as the functional features of different categories of AI tools. CG3.1.3 Support users' testing of AI tools by introducing a rudimentary method for analysing the reliability and appropriateness of specific AI tools for local contexts and engaging teachers in trialing of the method. CG3.1.4 Support teachers to establish their own collection of AI tools, starting from recommending basic exemplar tools and guiding them to curate trustable AI relevant to their needs and local contexts with a particular consideration of open-source tools.	LO3.1.1 Demonstrate conceptual knowledge appropriate to their competencies and responsibilities on how AI systems are developed using data, algorithms and computing architecture; acquire relevant understanding and skills on data, algorithms and programming; and exemplify key steps including problem-scoping, design, training, testing, deployment, feedback and iteration. LO3.1.2 Exemplify what AI is and is not, the main categories of AI techniques and AI technologies, the novel capabilities that AI could actualize compared to previous generations of ICT tools, and the core functions of various categories of AI tools. LO3.1.3 Locate and operate AI tools that are necessary for their daily work in local contexts. LO3.1.4 Explain the importance of evaluating AI tools to ensure their accessibility, inclusivity, and reliability; undertake basic analyses of the appropriateness of specific AI tools for education in local contexts with particular attention to the impact on students with special needs. LO3.1.5 Start consolidating a personal collection of trustable AI tools that are necessary for life and work and relevant to the local language and culture. Investigate the extent to which locally relevant open-source AI tools are available or not.	**Conceptual mapping of how AI works:** Start to draw and iteratively update paper-based or digital concept maps showing how AI systems are developed and the workflow of decision-making regarding specific AI tools used in education. **Extension and enhancement of skills:** Extend knowledge on AI tools that are relevant to the teachers' responsibilities. Help them to enhance the fluency and breadth of their existing operational skills or to develop new skills. **'Navigation compass' for selection of AI tools:** Discern which tools are using AI and which ones are not, and the basic comparative advantages and limitations of ICT tools and AI tools used in local contexts. **Collection of appropriate AI tools:** Cooperate with other teachers and school managers to assess the appropriateness of specific tools being used or recommended by AI providers and discuss whether they should be adopted; collect validated AI tools, share open-source tools and start to curate a collection of trustable AI tools.

Acquire				
	TEACHER COMPETENCY	CURRICULAR GOALS (CG) (Teacher training or support programmes should …)	LEARNING OBJECTIVES (LO) (Teachers can …)	CONTEXTUAL ACTIVITIES (Teachers can demonstrate the following attitudinal or behavioural changes)
AI pedagogy	**4.1 AI-assisted teaching:** Teachers are expected to be able to identify and leverage the pedagogical benefits of AI tools to facilitate subject-specific lesson planning, teaching and assessment while mitigating the risks.	CG4.1.1 Organize lesson analyses based on exemplar videos of teachers using AI tools in in the classroom; facilitate teachers' understanding of the appropriateness of these tools, including their efficacy, relationship to pedagogical methods, and effects on inclusion for students with different abilities; additionally, guide teachers' self-reflection on AI-assisted lessons they have designed and implemented. CG4.1.2 Encourage teachers to be mindful of scholarly research on the use of AI to support pedagogical activities by exposing them to selected evidence-based studies and reports on the advantages and disadvantages of AI-assisted teaching activities. CG4.1.3 Facilitate the transferability of foundational knowledge and skills on AI to teaching by presenting locally accessible and validated AI tools that are relevant for teachers' local contexts and responsibilities including institutionally deployed AI systems; use the tools to guide teachers to apply their conceptual knowledge and operational skills to the practical uses of AI tools in teaching; guide teachers to learn how to search for and validate appropriate educational AI tools. CG4.1.4 Facilitate the pedagogical validation of AI and instructional design on AI-assisted teaching; recall and strengthen teachers' understanding of domain-specific pedagogical methodologies and basic instructional design methods (e.g. human-agent interaction proposed by UNESCO's Guidance for generative AI in education and research); guide teachers to conduct hands-on practice of the design-implementation-reflection cycle of lessons, including evaluating the appropriateness of AI to support their subject areas at specific grade levels, making decisions on whether AI should be used and which tools may be appropriate, designing and implementing AI-assisted teaching activities including in preparation of teaching materials, delivery, assessments and support for students with special needs, and conducting reflection on lesson design and implementation in accordance with CG4.1.1.	LO4.1.1 Demonstrate familiarity with a human-centred mindset, ethical principles, domain-appropriate pedagogical methodologies and conceptual knowledge on AI to analyse sample lessons and explain their decisions on whether AI should be used, what tools should be used and why. LO4.1.2 Exemplify the main categories of AI systems and applications designed to assist teaching, learning and assessment demonstrating familiarity with their potential and limitations. LO4.1.3 Demonstrate familiarity with the use of basic instructional design methods to guide decisions on whether and when to use AI, and which tools might be appropriate; confidently prepare and implement AI-assisted teaching and assessment, and support for students with special needs. LO4.1.4 Find and use basic educational AI tools and/or operate institutionally deployed AI systems.	**Starting from basic teaching needs:** Delineate basic needs in the preparation and implementation of teaching and learning assessment. Start from basic needs as the first principle to understand whether a specific AI tool is appropriate – to what extent does it meet these needs, add relevant value, or fit the specific needs in question? **Learning by the iterative cycle of 'design–implementation–reflection':** Learn and gradually improve ability to design and deliver appropriate AI-assisted teaching through an iterative loop of analysing exemplar lessons, designing and implementing their own lesson plans, and assessing/reflecting on implementation. **Evaluating effectiveness against needs:** Gain first-hand experience of the limitations, risks and benefits of AI for teaching and learning, based on the results of actual use of AI to meet teaching needs, and the extent to which AI can achieve the expected outcomes.

Acquire				
	TEACHER COMPETENCY	CURRICULAR GOALS (CG) (Teacher training or support programmes should …)	LEARNING OBJECTIVES (LO) (Teachers can …)	CONTEXTUAL ACTIVITIES (Teachers can demonstrate the following attitudinal or behavioural changes)
AI for professional development	**5.1 Enabling lifelong professional learning:** Teachers are expected to be able to explore the use of AI tools to enhance their professional development and reflective practices, assess their learning needs, and personalize their learning pathways in a rapidly evolving educational landscape.	CG5.1.1 Nurture teachers' motivation for lifelong professional learning in the AI era by engaging teachers in discussion on the educational implications of the rapid development of AI, the new roles teachers need to play in AI-rich settings, and the new competencies they need to develop; support teachers to understand the value in becoming a lifelong professional learner in the AI era while being aware that their rights and agency should be protected. CG5.1.2 Guide self-assessment on teachers' AI readiness and identify competency gaps using paper-based or AI-assisted self-assessment instruments. CG5.1.3 Build awareness of teacher-facing AI by introducing teachers to general and specific AI tools that can be used to support their professional development with special attention to teachers who have disabilities and/or work with students who do; help teachers learn how to find and use AI tools to enrich their professional learning. CG5.1.4 Facilitate the leveraging of AI for professional learning, for example by guiding teachers to understand how content-recommendation platforms identify teachers' interests through their inputs and recommend peer mentors and/or training resources; help teachers to comprehend the risks posed to them by data biases and algorithmic discrimination, and how reliance on cocoons of AI-manipulated information could lead to the atrophy of their competencies.	LO5.1.1 Describe the evolution of teachers' rights, working conditions, qualifications and required competencies in the AI era and in local contexts; explain why it is important to be a lifelong learner on AI and its use in education. LO5.1.2 Exemplify the new knowledge, skills and values required by the teaching profession in local contexts in the AI era and assess the gap between their own knowledge and experience on AI and the required AI competencies. LO5.1.3 List various AI tools including locally relevant open-source tools that can be used or repurposed to support self-assessment, reflective practices and professional learning with special attention to enabling accessibility for teachers with disabilities. LO5.1.4 Locate and apply teacher-facing AI tools that are affordable and relevant to respond to the needs of self-assessment and personal professional learning on subject-matter knowledge, pedagogical skills and peer-learning.	**Awareness of teachers' basic rights and obligations in the AI era:** Delineate the rights that should be protected, the basic working conditions and guidance or training opportunities that should be provided for teachers in the AI era, as well as their main professional development responsibilities to ensure the ethical and effective use of AI in education. **Self-assessment of readiness for teaching in the AI era:** Conduct assessments of their own readiness and competency gaps and devise possible roadmaps for professional development to build their capacity for ethical and effective AI-assisted teaching. **Human-directed use of AI to open professional learning horizons:** Gain experience and skills to use AI-assisted social media to prompt new ideas and recommend peers who share similar professional interests and/or can serve as peer coaches or mentors. Learn how to detect and mitigate the negative effects of AI-manipulated information cocoons.

4.2 Progression Level 2: Deepen

The overall curricular goal in the 'Deepen' level is to support teachers to become fully competent teachers or master teachers in using AI. They should demonstrate human-centred perspectives in their analyses and decisions, ethically sound behaviours, deepened conceptual understanding of AI and capacity to apply AI to support pedagogical activities and professional learning. The following goals, learning objectives and examples of activities specify what essential topics can be covered, how training can be organized, and what behaviours teachers might demonstrate after achieving each block of competency.

Table 3. Competency blocks, objectives and examples for progression level 2: Deepen

Deepen				
	TEACHER COMPETENCY	CURRICULAR GOALS (Teacher training or support programmes should …)	LEARNING OBJECTIVES (Teachers can …)	CONTEXTUAL ACTIVITIES (Teachers can demonstrate the following attitudinal or behavioural changes)
Human-centred mindset	**1.2 Human accountability:** Teachers can demonstrate both a deepened understanding of human accountability and human determination in the proper deployment and use of AI, as well as a critical capacity to assess AI's capabilities in facilitating human–AI decision loops, as well as overhyped claims on the use of AI to substitute humans in making high-stakes decisions in education.	CG1.2.1 Deepen teachers' understanding of the risks related to the absence of human accountability through examination of use cases of AI for decision loops in educational management, assessment, teaching strategies and student interactions with AI, enriching and consolidating their views on the importance of human accountability as a core part of the entire life cycle of AI. CG1.2.2 Develop the understanding that human accountability is a legal obligation by encouraging teachers to debate whether humans or AI should take accountability in AI-assisted decision loops; guide teachers to conduct reviews on how local and international regulatory frameworks define human accountability in the design of AI and the provision of AI services including in education. CG1.2.3 Build associations between human accountability and teachers' rights by highlighting the changing roles and responsibilities of teachers, while emphasizing that the central role of teachers is not replicable and that their accountabilities and autonomy cannot be usurped by AI; support teachers to review whether local policies protect teachers' rights and accountability in the AI era. CG1.2.4 Uncover risks related to the absence of users' accountability by encouraging teachers to examine explainable limitations of specific AI tools (such as that AI cannot understand the real world or make judgements on values), as well as the unexplainable hallucinations, incorrect answers and misrepresentations of facts in the current generation of AI tools; discuss the risks AI poses to student learning, especially for those with special needs (weakening their intellectual development, critical thinking abilities, human interactions, knowledge constructions and ability to formulate and express independent opinions).	LO1.2.1 Understand that human accountability in human–AI decision loops is a legal obligation. LO1.2.2 Apply local and/or international regulatory frameworks to examine whether the design or use of a specific AI tool diminishes human accountability. LO1.2.3 Make reference to international or local policies to defend teachers' accountability in using AI in education and demonstrate resistance to the use of AI outputs and predictions to usurp human teachers' decisions and students' thinking processes, knowledge construction and self-expression. LO1.2.4 Demonstrate teachers' accountability in the decision loops including when determining the appropriateness of AI tools in teaching, designing age-appropriate pedagogical methodologies and providing necessary human interaction to encourage autonomous learning processes with specific support for those with special needs.	**Human accountability in AI-assisted decision loops is a legal obligation:** Draw a concept map of key duty-bearers and their roles in the design, deployment and use of AI in education, and delineate their human accountabilities. **Teachers' accountability and rights cannot be usurped by AI:** Draft a report on the most relevant regulation(s), responsible institution(s) and procedure(s) that can protect teachers' rights and accountability when adopting AI in education. **Teachers' accountability is a human assurance for ethical and effective uses of AI in education:** Draw a concept map on the feasible roles teachers can play in validating and selecting appropriate AI tools, designing pedagogical methodologies, driving human interaction, facilitating students' use of AI and supporting students with diverse abilities.

Deepen				
	TEACHER COMPETENCY	CURRICULAR GOALS (Teacher training or support programmes should …)	LEARNING OBJECTIVES (Teachers can …)	CONTEXTUAL ACTIVITIES (Teachers can demonstrate the following attitudinal or behavioural changes)
Ethics of AI	2.2 Safe and responsible use: Teachers are expected to be able to internalize essential ethical rules for the safe and responsible use of AI, including respecting data privacy, intellectual property rights and other legal frameworks; and habitually incorporate these ethics into evaluations and utilizations of AI tools, data and AI-generated content in education.	CG2.2.1 Deepen teachers' understanding of main threats to AI safety at the stages of design and use through analysing case scenarios on typical AI safety risks or frequent AI safety incidents from two dimensions: one covering 'safety by design' and 'safety by use', and another covering institutional and personal AI safety. CG2.2.2 Facilitate analyses of typical legal duties when using AI and of the consequences of breaching them – this includes laws that prohibit the use of copyrighted content without consent, violating privacy through the disclosure of personal data, disseminating disinformation or misinformation, promoting hate speech, and engaging in AI-amplified online discrimination or bullying against people with disabilities or vulnerable groups; guide teachers to discuss case studies to deepen their understanding of the social and legal consequences of the irresponsible use of AI. CG2.2.3 Support teachers to build the association between compliance with regulations on the safe and responsible use of AI and their local contexts and work responsibilities; support teachers to search and find examples of international regulations that are relevant to local contexts; and organize teachers to conduct hands-on drafting of their own institutional, classroom, and/or personal rules for the safe and responsible use of AI by adapting international regulations to their particular contexts.	LO2.2.1 Explain typical issues related to AI safety both at institutional and personal levels and demonstrate a deep understanding of the various reasons behind AI safety, including: 'safety by design', 'safety by use', data ownership, data sovereignty, data privacy, rights to decline to forgoing personal privacy to AI service providers, avoiding the disclosure of detailed personal data to prompt AI outputs, and preventing data biases and algorithmic biases. LO2.2.2 Demonstrate familiarity with locally applicable regulations to protect data privacy and ensure AI safety; review the potential ethical risks of specific AI tools in education and suggest mitigation strategies. LO2.2.3 Implement measures for teachers to safeguard their own and their students' data privacy, ensuring their data is collected, used, shared, archived and deleted with their consent; become aware of hidden risks, particularly for students with special needs. LO2.2.4 Apply guidelines to ensure responsible use of AI by teachers and students in compliance with ethical principles such as: respecting others' copyright and protecting their own, mitigating biases, combating deepfakes and AI-amplified hate speech, and protecting themselves and their students, especially those with disabilities, from AI-manipulated bullying and discrimination.	**Personal AI safety tracker:** Draw and update a conceptual map of typical AI safety issues and frequent incidents and their main causes; possible threats to institutions and individuals, especially those with disabilities; and mitigation measures at school and personal levels based on case studies. **Whitelist the personal collections of AI tools for education:** Review the safety of their personal collections of AI tools, looking at the owners, design ethics, data sources, algorithms, inclusive accessibility and functionality choices of each tool to uncover its underlying purposes, potential biases and level of risk. Work with peers and school managers to improve methods for the ethical evaluation of AI tools. **Iteratively update list of dos and don'ts:** Observe and evaluate cases of high-risk and irresponsible AI use in schools, and iteratively update the list of dos and don'ts for teachers and students; explain to students the relevant ethical and legal principles for the responsible use of AI and personal consequences of violating local or international regulations.

Deepen				
	TEACHER COMPETENCY	CURRICULAR GOALS (Teacher training or support programmes should …)	LEARNING OBJECTIVES (Teachers can …)	CONTEXTUAL ACTIVITIES (Teachers can demonstrate the following attitudinal or behavioural changes)
AI foundations and applications	3.2 Application skills: Teachers are expected to be able to proficiently operate AI tools adopted in educational settings; to deepen their knowledge of various categories of AI technologies and their practical skills concerning data and algorithms that are appropriate to teaching responsibilities and background competencies while infusing relevant ethical principles in practice.	CG3.2.1 Enrich 'operation and comparison' experiences of typical AI tools, supporting teachers to gain experience of main functions and learn operational skills of these tools; guide them to analyse the similarities and differences of common AI techniques (e.g. symbolic, predictive and generative AI), as well as their implications for education. CG3.2.2 Scaffold deepened construction of conceptual knowledge by facilitating teachers' research-based learning, including on how a selected AI system (such as a large language model) is trained and tested and what typical models, algorithms and datasets are used for the training. CG3.2.3 Support problem-based learning of operational skills in data, algorithms and coding. Based on teachers' prior knowledge and work responsibilities, design typical problem situations to facilitate teachers' acquisition of knowledge and operational skills with regard to data, algorithms and coding, as well as their capacity to use them to design AI applications. CG3.2.4 Offer hands-on practice to assess the 'ethics by design' of AI tools. Organize teachers to review and modify a specific set of criteria or an instrument used to assess key aspects of 'ethics by design'; and facilitate teachers to use the adapted criteria or instruments to assess selected AI tools in relation to data security, data privacy, safety for users, accessibility for people with different abilities, biases (including gender discrimination) in data and algorithms, and potential harms for vulnerable groups, etc.	LO3.2.1 Proficiently operate commonly used AI tools in daily life and in education; exemplify the typical techniques used by these tools and explain their implications for education. LO3.2.2 Visually represent how selected AI systems work, including how they are trained and tested, as well as the typical models, algorithms, and datasets used. LO3.2.3 Demonstrate transferable knowledge on data, algorithms and coding and apply it to solve problems that are appropriate to their abilities and the remit of their role. LO3.2.3 Critically apply knowledge and skills related to data, training, algorithms and models of AI to assess the ethics rooted in the design of AI tools.	**Skillful uses of AI tools in schools:** Based on a deepened understanding of the advantages and limitations of different categories of AI technologies, skillfully operate widely used AI tools. **Visualized 'know-how' on typical categories of AI tools:** Draw a concept map or visualized workflow to explain how selected AI systems are trained and how they work. **Facilitating students to learn about data, algorithms and coding:** Facilitate students or peer teachers who are at beginner level to acquire knowledge of and skills related to data, algorithms and coding. **Informed whistleblowing in ethics by design:** Apply an understanding of how AI is trained and demonstrate capacity to investigate gender biases and discrimination against people with disabilities or vulnerable groups that may be rooted in datasets, data labelling, algorithms and training methods. Reveal and report any evidence-based findings of biases or ethical risks.

Deepen				
	TEACHER COMPETENCY	CURRICULAR GOALS (CG) (Teacher training or support programmes should …)	LEARNING OBJECTIVES (LO) (Teachers can …)	CONTEXTUAL ACTIVITIES (Teachers can demonstrate the following attitudinal or behavioural changes)
AI pedagogy	4.2 AI–pedagogy integration: Teachers are able to adeptly integrate AI into the design and facilitation of student-centred learning practices to foster engagement, support differentiated learning and enhance teacher–student interactions, with the aims of promoting empathy, as well critical thinking and problem-solving skills among students.	CG4.2.1 Design and organize learning strategies based on videos of exemplar AI-enhanced learning practice; support teachers to analyse the impact of AI on learning processes, teacher–student interactions, academic learning outcomes, as well as on social and emotional learning; develop teachers' understanding of learning design, the appropriateness of AI tools and their uses, and inclusion for students with variable abilities; facilitate teachers' self-reflection on AI-assisted learning activities they have designed or facilitated. CG4.2.2 Deepen understanding of the impact of AI by encouraging teachers to discuss selected research reports or conduct action studies around impacts of AI on students' agency, thinking and learning processes; interactions with teachers; academic outcomes; and on their social-emotional learning, among other key topics; guide teachers to understand the benefits and risks of AI-assisted learning activities. CG4.2.3 Support the integrated deployment of foundational knowledge and skills on AI to meet the needs of teaching, learning and assessment; where applicable, guide teachers to apply pedagogical principles to review the main functions of integrated AI-assisted learning systems adopted by schools. CG4.2.4 Support the transfer from instructional design to learning design in the context of the validation and pedagogical use of AI; organize hands-on practice for teachers to design and facilitate AI-assisted learning activities based on comprehensive consideration of the uses of AI in the preparation of learning resources, thinking and learning processes, human interactions, performance monitoring and assessment; support teachers' practice-based reflection and redesign in iterative cycles of learning design, learning facilitation, reflection and redesign.	LO4.2.1 Adeptly integrate ethical principles, student-centred pedagogical methodologies and interdisciplinary perspectives on learning objectives into their learning design practices; this can range from their evaluation and blending of AI tools and their design of teaching, learning and assessment, to their planning of teacher–student interactions and facilitation of learning. LO4.2.2 Critically evaluate whether various categories of AI or specific tools present advantages in assisting the co-design of micro-curricula or courses, enhancing student-centric teaching, assisting formative assessment, monitoring learning processes, advising on personalized student engagement and facilitating augmented human interaction; where AI advantages can be validated, blend AI tools and resources into student-centred pedagogical practices to enhance students' higher-order thinking, understanding, application of knowledge and skills, appropriate social interactions and value orientation. LO4.2.3 Critically examine the appropriateness of the use of a specific AI application or an integrated AI-assisted learning system (e.g. LMS) in formative learning assessment and high-stake examinations; when it has clear advantages, adeptly blend appropriate tools in facilitating the design and administration of AI-assisted formative assessments and human-accountable decision loops to bolster students' learning outcomes, intellectual development and psychometric progress.	**Mapping of AI tools and application skills:** Update or scale up the concept map of AI tools to reflect key features of various categories of AI tools, evaluate their pedagogical affordance for student-centric pedagogical activities, and reflect on progression and needs for further upskilling. **Insights into pedagogical assumptions behind AI tools:** Cooperate with peers or experts to examine whether the design of general AI systems considers pedagogical implications, and what those pedagogical implications are for different categories of AI; understand and explain the key pedagogic assumptions that underpin a given educational AI tool or system. **Designing and facilitating students' use of AI for higher-order thinking and social-emotional learning:** Design student-centric teaching and learning activities based on validated educational AI tools and facilitate students' use of AI to support higher-order thinking, collaborations, as well as social and emotional learning. **Human-accountable AI-assisted assessments:** Debunk myths around the use of AI to automate the design, administration and grading of assessments by examining the risks of AI in usurping human accountability when providing feedback and making decisions on students' learning outcomes. Consider the limitations in the local education system regarding assessment structures and analyse possible trade-offs between potential benefits and risks of using AI in summative assessment and examinations. Be persistent in ensuring human accountability in decisions on learning outcomes and prevent the use of AI for making judgements and predictions about learners' social, ethical and psychometric development.

Deepen				
	TEACHER COMPETENCY	CURRICULAR GOALS (CG) (Teacher training or support programmes should …)	LEARNING OBJECTIVES (LO) (Teachers can …)	CONTEXTUAL ACTIVITIES (Teachers can demonstrate the following attitudinal or behavioural changes)
AI for professional development	5.2 AI to enhance organizational learning: Teachers are able to confidently utilize AI tools for tailored participation in collaborative professional learning communities, leveraging them to share resources, engage in peer-to-peer learning and contribute to dynamic adaptation.	CG5.2.1 Incite continuous motivation for professional learning and collaboration, supporting teachers to conduct research and discuss case studies on how master teachers adapt their roles and pedagogical practices in AI-rich settings, deepening their understanding of the balance between teachers' fundamentally human role and the obligations to develop AI competencies. CG5.2.2 Facilitate knowledge expansion on AI tools for professional development, introducing locally accessible emerging tools and promoting ones that include provisions for teachers who have disabilities and/or work with students who do. CG5.2.3 Deepen teachers' operational skills in the use of data analytics to support professional learning; guide teachers to transfer and upgrade their knowledge and skills in using data to track and analyse the process of professional development including with respect to subject knowledge, pedagogy and practical performance to facilitate data-informed self-diagnoses and tailoring of learning pathways. CG5.2.4 Offer hands-on practice on assessing deeper ethical issues associated with using AI systems for professional learning; support teachers to apply their knowledge and skills on 'ethics by design' to analyse the risks of AI algorithms in social media platforms, content-recommendation platforms and teacher-facing AI tools in terms of doing harm to teachers' human rights, data privacy, and professional learning and collaborations; recommend guidelines for the effective use of AI platforms to find relevant resources and communities of practice to facilitate peer learning.	LO5.2.1 Critically analyse their roles in designing and facilitating students' use of AI in their own pedagogical practices, deepening their understanding of the balance between their fundamentally human role and the obligations of continuously developing AI competencies. LO5.2.2 Apply foundational knowledge and skills on data using AI tools to track and analyse their own professional development including in terms of subject knowledge, pedagogical knowledge and practical abilities to facilitate data-informed self-diagnoses and autonomous planning of their professional trajectory. LO5.2.3 Expand knowledge and skills on the use of AI, especially emerging tools, for their own professional development; promote the use of AI tools that support teachers who have disabilities or work with students who do, including using locally relevant open-source tools that can be repurposed to support teachers' professional development. LO5.2.4 Evaluate the ethical risks of AI algorithms behind social media platforms and specialized tools as they relate to teachers' human rights, data privacy and professional learning; develop and implement guidelines for the effective use of AI platforms to find relevant resources and communities of practice to facilitate peer learning.	**Autonomous upskilling and peer coaching:** Keep pace with emerging AI technologies and their implications for education in local contexts, autonomously upskilling and reskilling themselves and coaching their peers to do the same. **Using data analytics for self-regulated professional development:** Apply their knowledge and skills on data, algorithms and AI models to draw up analytics of teachers' own professional knowledge and skills; accurately identify gaps, and help them regulate their own professional development activities. **Generative AI simulations for professional development:** Utilize existing generative AI tools or customize new ones to create an AI coach that simulates specific professional development scenarios so teachers can practice and get feedback – examples could include dealing with a difficult class, training on local regulations, or a simulation of students having difficulties. **Human-controlled uses of AI for collaborative professional development:** Uncover ethical risks of AI-manipulated platforms and implement preventive measures to avoid negative impacts. Design human-controlled activities to leverage AI platforms or tools to scope resources or provide online coaching in support of collaborative professional development.

4.3 Progression Level 3: Create

The curricular goal at the 'Create' level is to empower teachers who have sound AI knowledge and competency to become expert teachers and agents of change. They should be able to innovatively use AI for education and engage with communities to explore how it might drive the desired transformation of teaching and learning practices. The following specifications underline the exploratory character of the 'Create' level, defining main competencies, measurable learning objectives and exemplar activities.

Table 4. Competency blocks, objectives and examples for progression level 3: Create

Create				
	TEACHER COMPETENCY	CURRICULAR GOALS (Teacher training or support programmes should …)	LEARNING OBJECTIVES (Teachers can …)	CONTEXTUAL ACTIVITIES (Teachers can demonstrate the following attitudinal or behavioural changes)
Human-centred mindset	1.3 Social responsibility: Teachers are able to actively participate in, and contribute to, the building of inclusive AI societies guided by a critical understanding of the implications of AI for societal norms, promoting the design and use of AI for the enhancement of human welfare, inclusion and social justice.	CG1.3.1 Foster a critical understanding of the importance of protecting social and emotional well-being from commercially-driven AI manipulation; organize debates or research-based learning for teachers on how AI companies generate profits by reinforcing individual addiction and isolation, promoting individualism and selfishness, and the ranking of social identities; guide teachers to form dynamic and multifaceted understanding that ensuring human rights for all and promoting social justice are the cornerstones of AI ethics, and motivate them to frame and share critiques on the importance of counterbalancing commercial interests with the social-emotional well-being of humans and the health of non-human species across the planet. CG1.3.2 Offer opportunities to reimagine safe, inclusive and just AI societies; organize workshops, group discussions and collaborative activities for teachers to contemplate what an inclusive, just and climate-friendly social order for the AI era may look like, what threats AI may pose to these social norms, and what compacts or regulations are available or should be developed. CG1.3.3 Encourage the internalization of social responsibilities as citizens in an AI society by organizing hands-on workshops to define citizenship in the era of AI, by encouraging teachers to explore how their legal and social responsibilities may evolve, and by discussing ways to uphold and strengthen the core social rights and obligations that citizens in the era of AI need to assume.	LO1.3.1 Critically evaluate and reflect on the implications of AI for society at large, particularly how it might affect education, work, interpersonal interaction and human connections with each other and with the environment. LO1.3.2 Actively contribute to the formation of policies related to AI in education at the institutional, local and/or national level including how to leverage the benefits of AI and mitigate its social and educational risks. LO1.3.3 Personalize and actualize social and civic responsibilities in the era of AI and promote the development of such citizenship qualities through education.	**Teachers' voices on human and planetary well-being in the AI era:** Write thought pieces, essays or online blog posts about how profit-driven AI providers threaten humans' social and emotional well-being and planetary well-being based on real-world case studies or syntheses of research findings, and the implications for education. **Reflection on and promotion of human-centric social relations and social cohesion:** Write blogs or champion dialogues on what desirable social relations and social cohesion can look like in the AI era, the technological and economic barriers to the building of human relations and social order and list the global and local compacts that are being developed to lead to the societies we want. **Rights, obligations, and responsibilities of citizenship in the era of AI:** Engage in discussing, consulting on, or contributing to the drafting of policies that define the rights, obligations and responsibilities of citizens in the AI era.

Create				
	TEACHER COMPETENCY	CURRICULAR GOALS (CG) (Teacher training or support programmes should …)	LEARNING OBJECTIVES (LO) (Teachers can …)	CONTEXTUAL ACTIVITIES (Teachers can demonstrate the following attitudinal or behavioural changes)
Ethics of AI	2.3 Co-creating ethical rules: Teachers are able to champion the ethics of AI through critical advocacy, leading discussions and actions that address ethical, sociocultural and environmental concerns in the design and use of AI, and contributing to the co-creation of ethical rules for AI practices in education.	CG2.3.1 Foster inquiry into the social impact of AI by organizing teachers' research-based reviews of the social impact of selected AI tools; encourage teachers to take part in and evaluate how these tools affect local economies, social justice and climate change, as well as risk exacerbating discrimination against, and exclusion of, certain linguistic and cultural communities or groups with special needs; organize dialogues or debates based on the findings. CG2.3.2 Enhance critical examination of existing users' guidance published by AI providers by inviting teachers to evaluate selected tools on their potential to risk marginalizing people with disabilities, amplify social discrimination, and threaten linguistic and cultural diversity; compare users' guidance against the likelihood of negative impacts; gather feedback and draft notes of feedback on how to revise the users' guidance. CG2.3.3 Upgrade knowledge on AI ethics and skills to guide further iterations of ethical rules and standards; guide teachers to search for and review multistakeholder negotiations behind the adoption of regulations on AI (such as the negotiation behind Europe's AI Act); simulate multi-stakeholder debates on how to revise a selected regulatory framework from the perspectives of policy-makers, regulatory agencies, lawyers, researchers, AI companies, and the adults, children and institutions who use AI tools; draft a memorandum of shared understanding or dispute.	LO2.3.1 Critically analyse the social impact of AI from both the global and local perspectives and gain insights into the potential impact of emerging AI technologies on social equity, inclusion, linguistic and cultural diversity, institutional and individual safety and security, and the intellectual and social development of children as well as on planetary well-being. LO2.3.2 Assess the appropriateness and sufficiency of guidance for users of a specific AI tool against the ethical risks rooted in its design and the potential social controversies caused by its use, and frame recommendations for remedying or improving the guidance accordingly. LO2.3.3 Solidify the view that regulations on AI ethics must be designed by and for human stakeholders; advocate for and participate in the dialogues, development or further iteration of local or institutional regulatory frameworks or guidelines that promote ethics in the design, validation, adoption, deployment and application of AI.	**Localized global view on the social impact of AI:** Holistically review the social impact of AI on individual human rights and development, economic activity, social justice and planetary well-being; translate the global view into local implications to investigate AI's effects on society. **Spotlighting ethical gaps in users' guidance:** Audit the claims made by the providers of selected AI tools and the terms stated in their users' guidance against a full list of risks and social impacts. Monitor potential threats or harms to users, especially children, students with disabilities and vulnerable groups. Assume responsibility for reporting these and filing complaints with providers and regulators (e.g. data protection authorities). **Master teachers as advocates of AI ethics:** Play active roles in launching awareness campaigns on the ethics of AI, interpreting ethical principles, sharing knowledge on relevant regulations, promoting dialogues on AI safety and work with communities to revise existing regulations and/or develop new ethical standards. **Co-designing ethical prototypes of AI tools for education:** Launch a hypothetical AI development project and invite interdisciplinary collaboration on it, bringing together teachers, students and technologists to co-design an ethical AI tool that addresses a specific educational need.

Create				
	TEACHER COMPETENCY	CURRICULAR GOALS (Teacher training or support programmes should …)	LEARNING OBJECTIVES (Teachers can …)	CONTEXTUAL ACTIVITIES (Teachers can demonstrate the following attitudinal or behavioural changes)
AI foundations and applications	3.3 Creating with AI: Teachers are able to customize or modify AI tools in a proficient manner, applying enhanced conceptual knowledge and operational skills to create AI-assisted inclusive learning environments, and address broader challenges in educational contexts.	CG3.3.1 Nurture adaptability and creativity in customizing AI tools; support teachers to integrate skills on data, algorithms, programming and AI models to customize or design tools to address challenges in education, focusing on the needs of people with different abilities and protecting linguistic and cultural diversity in local contexts. CG3.3.2 Foster critical views on open-source AI by supporting teachers to deepen critical views on the advantages, limitations and risks of open-source in comparison with commercial AI tools; support teachers to learn how to review, adapt and/or iterate open-source AI tools. CG3.3.3 Simulate and practice adaptability and creativity in co-creating AI tools through project-based learning. Design and facilitate project-based learning practices to simulate teachers to learn how to adapt accessible and affordable 'off-the-shelf' commercial AI models/tools, semi-finished tools and/or open-source toolkits to assemble or create new AI tools to address real-world problems based on human-centred and ethical approaches; enhance teachers' adaptability, resilience and ability to clarify ambiguities, overcome obstacles and take risks when solving complex authentic problems. CG3.3.4 Support teachers to embed values, knowledge and skills into existing repositories of educational AI tools; offer hands-on opportunities for teachers to examine the ethical and pedagogical appropriateness of the tools, and iteratively update the repository of AI tools for schools.	LO3.3.1 Demonstrate knowledge and skills on AI system design at the level of expert teachers as well as comprehensive competencies to analyse the limitations of selected AI systems in solving real-world problems in local educational contexts. LO3.3.2 Apply appropriate knowledge and skills on data, algorithms, programming and AI models to customize and/or assemble existing AI tools or semi-finished AI models to create AI tools or fine-tune open-source AI systems to create solutions that are both relevant and affordable for local settings and specific use cases. LO3.3.3 Revise or define criteria for the comprehensive testing of a self-created AI tool and for the purpose of optimization and further iteration of the tool. LO3.3.4 Contribute to a new or existing repository of user-created or tailored AI tools based on personal and institutional needs and promote a focus on only utilizing the most appropriate tools for education.	**Driving the design of AI tools for inclusion:** Collaborate with a community of co-creators to add functions to existing AI tools or design new ones to facilitate accessibility, targeting AI or digital learning platforms for people with disabilities. Design AI tools to support the detection of inclusive accessibility among widely used AI platforms. **Promoting the co-creation of AI tools to support climate-friendly actions:** Co-create AI tools or organize hackathons to facilitate students to design AI tools that promote climate education or climate-friendly actions (e.g. AI tools to track carbon emissions caused by selected AI platforms or the energy consumption of schools). **Coordinating the building and use of repositories of educational AI tools:** Support the creation of a repository of selected trustable and self-created AI tools for education that can be shared through school web spaces or publicly (e.g. on GitHub). Where appropriate, assume the roles of school-based AI coordinators to provide training for other teachers to support their use of the repository.

Create				
	TEACHER COMPETENCY	CURRICULAR GOALS (Teacher training or support programmes should …)	LEARNING OBJECTIVES (Teachers can …)	CONTEXTUAL ACTIVITIES (Teachers can demonstrate the following attitudinal or behavioural changes)
AI pedagogy	4.3 AI-enhanced pedagogical innovation: Teachers are able to: critically assess AI's impact on teaching, learning and assessment; plan and facilitate AI-immersed learning scenarios to support students' subject-specific or interdisciplinary learning, critical thinking and problem-solving; and leverage data and feedback to continuously explore student-centred pedagogical innovation.	CG4.3.1 Inspire ideas on possible scenarios where AI is used for students' development; design and organize scenario analyses based on exemplar videos of AI-enhanced open learning options such as co-creation practices and inquiry- and project-based learning; facilitate teachers' review of their readiness in terms of competencies, AI resources and assessment; empower teachers to frame feasible ideas on innovative open and creative learning practices that can be enabled by the use of AI. CG4.3.2 Scaffold teachers' insights into the interplay between pedagogical principles and pedagogical transformations that AI could trigger; facilitate teachers' deliberation on fundamental questions such as what core values in education should not be undermined by the use of AI (e.g. protecting students' human rights, inclusion and social relationships), what basic pedagogical principles should be upheld to guide the use of AI in education (e.g. promoting students' intellectual development, nurturing creativity, encouraging the construction of plural opinions and innovative ideas, and fostering social and emotional skills), and how AI may disrupt or transform pedagogical methodologies. CG4.3.3 Support the improvisation of skills to create new AI tools or expand existing ones; offer teachers opportunities to improve their understanding of validated tools including institutional AI systems for education, and to assemble or co-create AI tools to support and assess students' inquiry- and project-based learning, creativity, innovation, etc. CG4.3.4 Incubate the transfer from learning design to scenario design. Organize hands-on practice where teachers can co-design curricular practices or human–AI interactive scenarios to explore when and how AI could be used to support the cycle of learning—assessment—feedback—adaption; analyse the pros and cons of novel triangular interactions of students, teachers and AI systems, and design strategies to leverage their advantages and mitigate their risks; offer opportunities for teachers to enrich their practical skills in the design and engineering of AI-assisted open learning options for students and nurture students' higher-order intellectual abilities, creativity and curiosity.	LO4.3.1 Critically examine the dynamic interaction between the advancement of AI and the evolution of pedagogical methodologies; utilize the genuine benefits of AI technologies for the achievement of educational aims and identify possible limitations of existing pedagogies for fully leveraging the potentials of emerging AI for education; design and conduct evidence-based tests of open learning options to harness the potential of AI in supporting age-appropriate inquiry based learning, knowledge creation, collaborative project-based learning and agile creativity. LO4.3.2 Assemble AI tools or co-create new AI applications to address needs for inclusive accessibility, linguistic and cultural relevance, ability-appropriate personalized learning needs, social support, inquiry or project-based learning. LO4.3.3 Adeptly design AI augmented learning scenarios that promote students' higher-order inquiry, open exploration, project-based learning, critical thinking and co-creations while ensuring human interactions; engineer and facilitate students' uses of AI in which students have control over their learning paths, make choices on AI tools, and take accountability in making AI-assisted decisions, ensuring embedded time and space for human interactions and reflections. LO4.3.4 Design and appropriately integrate the use of AI to support the collection and use of data to support learning analytics and adjustment of teaching strategies. LO4.3.5 Adeptly use AI to generate content across text, audio and video to support the co-creation of national or school-based textbooks, curricular resources or digital materials which are to be validated by curriculum developers. LO4.3.6 Streamline the use of AI for teachers' administrative tasks, teaching and learning tasks, engagement with parents and local communities.	**Guiding the pedagogical uses of AI while leveraging AI to open new pedagogical horizons:** Uphold human-centred pedagogical principles to guide the design and uses of AI in pedagogical activities (protecting human rights, human agency, students' autonomy and independent thinking, linguistic and cultural diversity, plural opinions and plural expressions). Continue to challenge the limit of existing pedagogies and explore whether existing teaching and learning methodologies are sufficient to fully leverage the potentials of AI for education. Keep abreast of emerging learning scenarios **bein**g enabled by AI and examine whether they are extensions of existing pedagogical methods or represent pedagogical innovations. **Engineering triangular interactions between teachers, students and AI:** Understand and continuously review how AI, and generative AI in particular, interact with teachers and students throughout the teaching and learning processes and the extent to which generative AI can be embedded in thinking processes and knowledge exploration and construction processes. Navigate the teacher–AI–student triangular relations; design and engineer the desirable scenarios of teacher–student, teacher–AI, student–AI and teacher–AI–student interactions. **AI empowering students with special needs:** Promote assistive AI or co-create assistive AI tools and design activities to provide students with disabilities and special needs opportunities for empowerment while protecting their human rights and privacy. **Human–AI hybrid approach to development of curricular resources:** Continuously engage in the use of AI to facilitate the review of existing literature and the production of inclusive and accessible curricular resources that combine text, audio and video materials; co-create and implement a human-accountable validation mechanism for the AI-assisted production of curricular resources.

Create				
	TEACHER COMPETENCY	CURRICULAR GOALS (Teacher training or support programmes should …)	LEARNING OBJECTIVES (Teachers can …)	CONTEXTUAL ACTIVITIES (Teachers can demonstrate the following attitudinal or behavioural changes)
AI for professional development	5.3 AI to support professional development: Teachers are able to customize and modify AI tools to enhance their professional development and to continuously test and validate strategies on the effective use of AI to meet their own, and their communities', professional development needs.	CG5.3.1 Motivate teachers to be agents of change by organizing case studies and/or discussions on how expert teachers could inform and champion the transformation of education that AI may trigger, nurturing the traits of being agents of change with simulating examples and interesting exercises. CG5.3.2 Enhance skills to use AI to support institutional professional learning; provide opportunities of hands-on workshops where teachers co-create AI tools to track professional development of a certain institution or group, with the aim of facilitating data-informed monitoring, diagnosis and recommendations on organizational learning. CG5.3.3 Support teachers to customize or assemble AI tools to enable access to professional development opportunities for peers with disabilities or special needs. CG5.3.4 Nurture the traits of being creative users of AI to foster self-actualization and transformation; convene practical workshops where teachers can build communities for the co-creation of AI tools; encourage teachers to engage with communities of practice on the question of how AI could be leveraged to inspire professional transformation.	LO5.3.1 Show commitment and persistence in the co-creation and usage of AI tools and methods to fulfil their professional and social responsibilities in AI societies, aiming at new iterations of ethical rules, customized AI solutions and transformative pedagogical approaches. LO5.3.2 Blend AI tools and human coaching to facilitate well-informed self-reflection and assessment, goal setting and the mobilization of knowledge and human mentors to support personal and collaborative transformation. LO5.3.3 Where possible, configure or create AI solutions to monitor and critically assess organization-wide professional learning trajectories, and blend AI and other methods to collect and synthesize constructive feedback and actionable recommendations. LO5.3.4 Understand the roles of AI to support self-actualization and to personalize citizenship in the AI era from the perspective of being a teacher; contribute to educational communities' co-creation of AI tools to support the self-actualization and professional transformation of teachers in the era of AI.	**Human–AI hybrid coach for teachers:** Build or utilize existing generative AI toolkits to customize an AI-assisted agent or coach for teachers' professional development to support activities such as self-assessment and diagnosis, as well as to simulate specific scenarios to practice skills and receive feedback (e.g. meeting the needs of students with learning difficulties or solving ethical dilemmas related to the use of AI). Use the agent or coach to help their peers as well. **AI-enhanced design of training programmes:** Leverage AI tools to expand reviews of existing programmes that are relevant to the needs of a specific group of teachers, extend ideas on training content and training methods, and assist the production of inclusively accessible training courses to be validated by human master-trainers or facilitators. **Communities for the co-creation of AI tools, pedagogical innovations, or ethical rules:** Lead or engage in collaborative research teams working on innovative pedagogical methodologies, and/or communities for the co-creation of trustable, accessible, and inclusive AI tools for education or iteratively updated ethical rules on the use of AI.

Chapter 5: Suggested implementation strategies

The AI CFT is a global reference framework for teachers, policy-makers, providers of teacher education programmes and school leaders across the world. This chapter goes beyond articulating competencies to offer guidance on conducive policy environments and other enabling factors that can support the effective use of AI by teachers. It also explores how the AI CFT can be used to achieve the three main objectives of guiding the design of specific AI competency frameworks across diverse contexts, steering the design and provision of teacher professional development in AI, and supporting the articulation of benchmarking specifications for teachers' self-assessment.

5.1 Regulate AI and ensure trustworthy AI tools for education

The precondition for the responsible use of AI in education is the enforcement of regulations to ensure the trustworthiness of AI tools and to safeguard learners and teachers. Given the multiple risks related to the use of AI, there must be mechanisms in place to ensure that any AI tools introduced into educational environments are reliable and trustworthy. It is therefore critically important to validate AI systems or software before they are introduced into education systems at scale.

The provision of trustworthy AI systems requires an enabling regulatory context. National regulatory frameworks for AI should be developed or reinforced to guarantee the security and ethical compliance of general AI systems that are widely used by students, teachers and educational institutions. This requires the establishment of robust data protection laws akin to the General Data Protection Regulation (GDPR) adopted by the European Union (EU) in 2016, and/or specific regulations for the design and provision of AI services, which should address their appropriateness for users at different ages and with varied abilities.

Such regulations also need to be regularly reviewed and adapted to respond to novel ethical issues presented by emerging technologies such as generative AI. The specific official regulation on generative AI issued in China in July 2023, and the EU's AI Act introduced in March 2024, are examples of recent efforts to address the new risks posed by generative AI. Indeed, the EU AI Act identifies four levels of risk that AI systems may pose for citizens, and stipulates legal regulations for each. The first concerns AI systems that entail unacceptable risk and which must be banned. The second comprises AI applications that are considered to pose high risk and which require strict regulation. Most AI applications for education fall into this category. The third category concerns AI systems that pose limited risk and for which specific transparency obligations are required. Finally, the last category comprises minimal-risk AI and which can be freely used. Enforcing regulations based on the level of risk requires independent institutional mechanisms for the validation of AI systems. This is particularly important for education, where most AI applications are considered to be high-risk, requiring strict regulation.

While regulations on general AI systems provide significant legal protection, ensuring trustworthy AI for education requires further

regulations and institutional validation. This applies both to general AI systems being deployed in schools at scale, as well as for educational tools which incorporate AI technology. To prevent AI from causing irreversible harm to students, it is imperative to ensure mechanisms are in place for the validation of these AI systems for use in education. This is particularly true of AI services targeting younger children. Independent validation of educational software and resources that integrate AI tools needs to be ensured before they are used in schools and other educational institutions.

Regulatory agencies should cooperate with educational institutions, teacher unions, and parent associations to define and apply relevant validation methods for AI tools including through trials, simulations and model-centred approaches.

Box 1: Regulations on AI: key elements of accountabilities for multiple stakeholders

UNESCO's 2023 Guidance for generative AI in education and research recommends that to properly regulate AI to ensure the realization of its benefits in education and other development contexts, regulations need to specify the responsibilities of: (1) governmental regulatory agencies, (2) providers of AI systems and AI services, (3) institutional users, and (4) individual users.

(1) Governmental regulatory agencies

These agencies should be responsible for the following seven key elements and actions: intersectoral coordination through a national body to lead on a whole-of-government approach to AI; alignment of national/local regulations on AI with relevant legislative and regulatory provisions; ensuring balance between the necessary regulation of generative AI and the promotion of AI innovation; identification of levels of potential risk of AI and specifying regulations accordingly (see the EU AI Act for an example of this approach); protection of data privacy; definition and enforcement of age limit for engaging in unsupervised chat with AI platforms or applications; and enhancing national data ownership and containing the risk of data poverty.

(2) Providers of AI systems and AI services

The providers of AI systems and services should be held to account for the following legal and social responsibilities: guaranteeing human accountability for AI incidents and legal issues; ensuring trustworthy data and models; adopting algorithms and methods towards non-discriminatory content generation; promoting the explainability and transparency of AI models; labelling AI-generated content properly; complying with security and safety principles; providing specifications on appropriate access to and use of AI systems; acknowledging limitations and preventing predictable risks; establishment of mechanisms for complaints and remedies; and monitoring and reporting unlawful use.

(3) Institutional users

Educational authorities and institutions with responsibilities for determining whether AI should be adopted and which types of AI tools should be procured should be accountable for: institutional auditing of AI algorithms, data and outputs; validating proportionality and protecting users' well-being; reviewing and responding to long-term impacts; and monitoring age-appropriateness.

(4) Individual users

Individual teachers and students have the following responsibilities: being aware of terms of reference for the use of AI; complying with ethical principles when using AI tools; and taking personal responsibility for monitoring and reporting any unlawful application of AI systems or services.

Source: UNESCO, 2023*b*

At a minimum, validation criteria should cover the following aspects of AI systems and their usage:

- security;
- bias;
- accuracy of outputs;
- human accountability for the protection of data privacy and legal data ownership;
- explainability of AI models;
- linguistic and cultural representativeness of data used to train the AI models for target users;
- appropriateness for users at different ages and with different abilities;
- collection and exploitation of users' data;
- intended business models; and
- impact on teachers' rights and human agency.

The regulations also require the engagement of multiple stakeholders to consider the long-term implications of AI on education, promoting a human-centred approach through inclusive debates, multistakeholder policy dialogues, and participatory drafting.

5.2 Build enabling policies and conditions for the use of AI in education

While a necessary pre-condition, the definition of AI competencies required by teachers, alone, is not sufficient to ensure the adoption of AI-assisted practices in teaching and learning on a large scale. Indeed, various barriers prevent teachers from finding and using AI, becoming familiar with trustable AI tools, understanding how to make responsible use of AI, and incorporating them into teaching and learning based on relevance and applicability for subject areas and grade levels.

While the framework presented here considers some of these issues, it is beyond the scope of the AI CFT to address the subjective barrier of teachers' personal interest and motivation. It is also beyond the scope of this framework to address the economic and structural barriers of AI affordability and access, as it is to help resolve the challenge of balancing AI among other policy priorities. To address the challenges and overcome these barriers, national AI competency frameworks for teachers need to be supported by conducive policy contexts that provide enabling conditions for the use of AI in education.

One of the primary functions of policies on AI in education is to help institutions to weigh the option of AI against other existing options and priorities, before promoting its use to teachers. A common starting point for this is to conduct a cost–benefit analysis to determine the trade-offs between the forward-looking yet unproven value of AI for education, versus the urgent need to ensure/improve other conditions for learners, independent of technology. It is fair to argue that, despite media hype, AI is unlikely to solve any of the major problems confronting education systems around the world, such as inadequate school infrastructure or teacher shortages. As strategic policy choices about AI in education have significant implications for financial and human resource investment, decisions must be informed by rigorous evidence-based research and multistakeholder dialogue. If large-scale adoption of AI technology in education is seen as a means to address key challenges, human agency, creativity and ingenuity of teachers must remain at the core. As part and parcel of their AI competency, teachers should be able to choose to apply affordable

AI tools or co-create relevant solutions only after determining that benefits clearly outweigh the risks.

A second function of policies on AI in education is to support and motivate teachers to use AI in a responsible manner. Strategies to motivate teachers could include such actions as: reaffirming the importance of developing teachers' AI competencies in professional qualification frameworks; introducing measures to mitigate the negative impact of AI use on teachers' workloads and well-being; providing well-funded relevant training on AI and school-based support programmes grounded in needs assessments; recognizing and promoting forerunner teachers for their efforts in making pedagogically-appropriate use of AI in their practice; and recognizing teachers' innovative practice in using AI as part of teaching performance evaluation criteria.

The third function of policy frameworks can be to support teachers to address the barrier of AI access and affordability. To help ensure inclusive access to AI resources, and to enable teachers and students in diverse local contexts to use AI, policy measures include ensuring inclusive access to the internet as well as to validated, trustworthy and affordable AI tools and other resources; upgrading of obsolete or dysfunctional digital infrastructure; and ensuring free

Box 2: The Republic of Korea's National Strategy for Artificial Intelligence

The National Strategy for AI (Ministry of Science and ICT, Republic of Korea, 2019) has three main focus areas: (1) establish reliable AI infrastructure, including to support human talent and improve technology; (2) expand the utilization of AI throughout the industrial and social sectors; and (3) respond proactively to social changes, including labour market needs. To support the achievement of these objectives, the strategy prioritizes two key elements: strengthening teachers' software and AI capabilities and securing school infrastructure.

Under the key task of Strengthening Teachers' Software/AI Capabilities launched in 2020, the Republic of Korea has been supporting teachers to complete courses on AI as part of initial training and recruitment. To this end, institutions with responsibilities for teacher preparation have been supported to enhance their programmes: universities of education have revised the standard for the qualification of teachers to complete AI-related courses; colleges of education have been supported to add and integrate AI-related contents into teaching and related majors; and post-graduate schools of education have established new majors focusing on AI-integrated education and on supporting participating teachers. The parallel Revamping Teacher Training System initiative aims to make rigid qualification requirements for elementary and secondary teachers more flexible. In doing so, the initiative hopes to incentivize teachers to explore future-proofing innovative practices in their schools and beyond.

Since 2020, governmental agencies and partners have, within the Securing School Infrastructures framework, been establishing high-speed wireless networks in at least four classrooms in each elementary and middle school across the country. Additionally, strategies have been implemented to promote the provision of AI-related educational opportunities at various levels and locations beyond schools, and to launch initiatives both to find and nurture AI-gifted students and to ensure educational opportunities for vulnerable groups and rural communities.

Source: Ministry of Science and ICT, Republic of Korea, 2019

or affordable access to applications and hardware, including through engagement with academia and the private sector.

5.3 Formulate and adopt local AI competency frameworks for teachers

The AI CFT is designed to be instrumental in guiding the design of national or institutional AI competency frameworks for teachers. Its structure and specifications are intended to be localized and tailored to the specific degree of digital readiness and existing levels of competency among teachers in a country, locality or organization.

The formulation of these localized frameworks requires a holistic approach involving multiple stages. The starting point is a thorough assessment of AI readiness in terms of both the tools available for students and teachers, as well as current median competency levels in AI among teachers. This would be followed by an assessment of gaps between definition of AI competencies that the government or institutions intend to develop for all teachers and what is proposed in existing teacher training and support programmes. Finally, the key aspects and main mastery levels for localized AI competency frameworks would need to be articulated.

These localized frameworks should be designed in alignment with existing digital competency and/or general professional

Box 3: Examples of non-governmental AI competency frameworks for teachers

AI4T[1] is a European Commission-funded Erasmus+ K3 project, developed in collaboration with France, Ireland, Italy, Luxembourg, and Slovenia. Launched in 2021, it aims to contribute to training on AI in education based on three categories of AI competences: (1) 'Teaching for AI' covers AI competencies relevant to all citizens, mainly drawn from the existing EU digital competence framework, DigComp2.2; (2) 'Teaching with AI' covers AI competencies specifically for teachers, and draws guidance from the European Commission's 2022 Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators; and (3) 'Teaching about AI' covers competencies to guide the training of students on the fundamentals of AI, including basic digital skills, computational thinking, mathematical skills, and AI applications and which are mainly drawn from the framework of AI4K12, 'Five Big Ideas for AIEducation' (European Union, 2023).

In the Republic of Korea, the efforts made by the AI Education Alliance and Policy Lab provides another example of a framework to enhance teachers' AI and digital competencies. This framework covers three domains: AI and digital fundamentals, implementation of AI and digital education, and professional development.[2] These three domains are divided into the following eight competencies: utilization of AI and digital technologies, practice of AI and digital ethics, educational context analysis utilizing AI and digital technologies, instructional design utilizing AI and digital technologies, development of educational resources using AI and digital technologies, implementation of lessons using AI and digital technologies, educational evaluation and reflection using AI and digital technologies, and professional development. Behavioural indicators are defined for each of these competencies, to aid the design of assessment tools that can help to measure levels of AI and digital competency among teachers.

1 See https://www.ai4t.eu/
2 Further information on the AI Education Alliance and Policy Lab (AIEDAP) project is available at https://aiedap.or.kr

qualification frameworks for teachers. Where appropriate, the local AI frameworks should have certain binding effects for national or institutional certifications. To maximize the relevance of the national/local AI competency frameworks for teachers, the design and implementation of the frameworks and associated programmes should build on a coordinated governmental approach. This is seldom the case at present, where the development of AI competency frameworks for teachers is often driven by academic institutes, commercial companies and regional or international organizations. If we are to ensure effective, meaningful and sustainable use of AI in education, teacher competency frameworks need to be developed and endorsed by governmental agencies.

5.4 Design and streamline training and support programmes on AI competencies

The AI CFT provides an operational framework for the design and planning of training courses and support programmes for teachers. More specifically, the detailed specifications of 'curricular goals' presented in Chapter 4 are intended to frame the main elements of knowledge, skills and values that the training programmes of each competency block may cover, to suggest training methods that are relevant to the domains and levels of trainees, and to suggest practical approaches for the organization of the training and coaching programmes.

Box 4: Examples of training and support programmes on AI for teachers

The EU's AI4T programme has a specific massive open online course (MOOC) designed to improve teachers' AI competencies.[3] This MOOC has four modules: (1) 'AI in education' provides a general introduction; (2) 'What is meant by AI' offers content on AI foundations and applications; (3) 'How does AI work' explores the technical aspects of AI and ethics; and (4) 'AI at our service as teachers' presents material on the human-centred mindset and ethics of AI. While the main focus of the MOOC is AI foundations, it also addresses issues of human agency by covering the risks of AI-based decision-making, the importance of keeping teachers in the loop, as well as ethical issues. As a MOOC, it is naturally limited in terms of active learning opportunities for teachers and is not tailored to their specific needs.

Singapore's approach involves offering a dedicated platform for AI competency development. The Government of Singapore launched the initiative 'AI Singapore' in 2017, bringing together Singapore-based research institutions and AI companies to carry out research, generate knowledge, create tools, and develop talent in the field of AI. The platform[4] enables teachers to access AI tools and models, allowing them to develop competencies relevant to their educational contexts. It also provides MOOC-style courses with a strong emphasis on community engagement. The content is centred mainly on AI foundations and applications, and technical issues such as prompts, data science and the usage of specific tools.

3. See https://www.ai4t.eu/teacher-training
4. See https://learn.aisingapore.org/educators

These programmes and associated guidance for teachers need to be planned throughout the key steps of teachers' careers and lifelong professional development journeys. This includes pre-service preparation, in-service training, school-based support, and engagement with peer mentorship and communities of practice. The AI CFT can inform design at of all these stages, ensuring that they are consistent with the required competencies, while also being flexible enough to adapt to the unique needs and contexts of specific educational environments. The AI CFT can, for instance, guide the development, review and updating of pre-service programmes at teacher-training institutions and universities to ensure that newly trained teachers are well-prepared to deploy AI tools and relevant pedagogical methodologies. The planning or adaptation of in-service teacher programmes should naturally build on pre-service training programmes. School-based support programmes can also use the framework to tailor continuous learning and development opportunities that are directly relevant to the specific needs of particular groups of teachers. Furthermore, peer-coaching initiatives, including both offline and online communities of practices, can utilize the AI CFT to plan learning outcomes and monitor progress in a collaborative professional learning environment.

5.5 Develop contextual performance-based assessment tools

The AI CFT can also serve as a guide to craft contextually-relevant criteria to support the institutional assessment of teachers' AI competencies or the design of self-assessment tools. The detailed specification of AI competencies in Chapter 4 serves to inform the construction of assessment tools by providing a structured profiling of teachers' AI skills, attitudinal orientations and behavioural performances in educational settings across various levels – from 'Acquire' to 'Create'. These tables of specifications can be adapted for assessment purposes. More specifically, concrete examples of training methodologies and expected outputs are embedded in the curricular goals and learning objectives within the specifications, and they can be referenced to design assessment methods and assessment items that are relevant to the domain-specific nature and the target cohort of teachers. **Table 5** illustrates how the specification for the competency 'Human-centred mindset' at the first progression level can be referenced to design assessment tools.

Table 5. An example of designing assessment tools based on the AI CFT

Example of the design of an assessment on the 'Human-centred mindset' competency at the 'Acquire' level			
TEACHER COMPETENCY	Adapt the following learning objectives according to the prior knowledge and work responsibilities of the target group of teachers	Design assessment methods and items relevant to the domain of competency and the expected mastery level	Grading criteria for performance and latent competencies
Human agency: Teachers have a critical understanding that AI is human-led and that decisions of AI creators, whether corporate or individual, have a profound impact on human autonomy and rights; teachers are aware of the importance of human agency when evaluating and using AI tools.	LO1.1.1 Critically reflect on the benefits, limitations and risks of specific AI tools in their local educational settings, subject areas and teaching grade levels. LO1.1.2 Demonstrate an awareness that AI is human-led and the corporate or individual decisions of AI creators can impact human rights, human agency, individual lives, and societies. LO1.1.3 Outline the role of humans in the basic steps involved in AI development, from the collection and processing of data to the design of algorithms and functionalities of an AI system, to the deployment and use of AI tools. LO1.1.4 Understand the need to use basic measures to protect human agency in key steps regarding the design and use of AI systems by ensuring respect for data ownership, consent as the basis of data collection, anti-bias data labelling and cleaning, discrimination-free AI algorithms, and user-friendly functions and interfaces.	Write an essay to present your views on the benefits, limitations and risks of using facial recognition (or the auto-correct function of generative AI, or another common AI tool) in education. Design a poster or digital presentation on how the individual and corporate decisions of AI creators may affect teachers' rights, and the agency of both teachers and students. Exemplify an AI tool that should be banned according to the EU AI Act and explain why. Draft a list of daily tips to promote teachers' autonomous use of AI and to encourage student agency.	(To be specified in accordance with the adapted learning objectives and the type of the assessment items)

5.6 Conclusion

The AI CFT is intended to affirm the critical roles of teachers in ensuring the ethical and effective adoption of AI in education. It also aims to inform policy-makers, providers of teacher education programmes, personnel of teacher education institutions, school leaders and teachers themselves of the dynamic evolution of competencies that the transition of education in the AI era may require. Through the launch of the AI CFT, UNESCO calls on its Member States to accelerate the development of national AI competency frameworks and the provision of teacher training programmes in support of lifelong professional learning.

Given the nature of AI as a general-purpose technology with the potential to dramatically transform business models across multiple economic sectors and its rapid advancement at exponential pace, it is likely that the further development of AI and its impact on education will outpace the iterations of the AI CFT. Meanwhile, the surging interest in, and trials of, AI in education will generate a multitude of approaches to the use of AI in education and to the application of the AI CFT in particular. In response to these challenges, UNESCO considers the AI CFT as a 'master framework', rather than a prescriptive blueprint of AI knowledge and skills. It is designed to help frame national, state-level and/or institutional frameworks that can reflect the technological advances over time and changing needs across diverse and varied local contexts. UNESCO therefore recommends that the AI CFT can be used as an overarching framing tool and open-ended roadmap by policy-makers and developers of training programmes to continuously fine-tune the definition of AI competencies and inspire innovative capacity development methodologies.

This is the first edition of the AI competency framework for teachers. It is expected to be updated based on a participatory approach. Stakeholders involved in teacher professional development are encouraged to engage and share their experiences with peer trainers and UNESCO, with a view to co-creating subsequent iterations of this framework.

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AI competency framework for teachers

The *AI competency framework for teachers* presents the first ever global vision of how AI competencies can be defined and developed for the ethical and effective use of artificial intelligence in teaching, learning and assessment.

The framework provides a blueprint on what concrete AI ethical principles, knowledge and skills should be covered and how domain-specific methodologies can be leveraged when developing teacher training programmes.

It emphasizes that preparing teachers' AI competencies is a requirement for the effective use of AI in education and must be based on principles of inclusivity, the centrality of human agency, non-discrimination, and respect for linguistic and cultural diversity.

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4 QUALITY EDUCATION

Sustainable Development Goals