Good practices for AI deployment in education and policy guidelines

Date: 31 December 2025

Co-funded by the European Union

Co-funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Grant Agreement n°	101087451
Project acronym	AI4EDU
Project title	Conversational AI assistant for teaching and learning
Funding Scheme	ERASMUS-EDU-2022-PI-FORWARD
Project Duration	01/01/2023 – 31/12/2025 (36 months)
Coordinator	Athina-Erevnitiko Kentro Kainotomias Stis Technologies Tis Pliroforias, Ton epikoinonion Kai Tis Gnosis (ARC)
Associated Beneficiaries	▪ LULEA TEKNISKA UNIVERSITET (LTU) ▪ ELLINOGERMANIKI AGOGI SCHOLI PANAGEA SAVVA AE (EA) ▪ PAIDAGOGIKO INSTITOUTO KYPROU (CPI) ▪ UNIVERSITY OF CYPRUS (UCY) ▪ MANAGEMENT COMMITTEE OF DRUMCONDRA EDUCATION CENTRE (DEC)

Document identifier: D7.1
Version: 2.0
Authors: Dr. Daithí Ó Murchú & Peter Coakley (DEC)
Dissemination status: PU - Public
Reviewers: Theodora Kakouri (CPI), Spyridoula Stamouli (ARC), Hamam Mokayed (LTU), Saleha Haseeb (LTU)

Project no. 101087451
AI4EDU

Conversational AI assistant for teaching and learning

ERASMUS-EDU-2022-PI-FORWARD

Start date of project: 01/01/2023

Duration: 36 months

History Chart				
Issue	**Date**	**Changed page(s)**	**Cause of change**	**Implemented by**
0.1	09/10/2025	-	Draft	Dr.Daithí Ó Murchú
1.0	14/11/2025	ALL	Revisions	Authors & reviewers
1.1	22/11/2025	ALL	Additions	Dr.Daithí Ó Murchú
1.2	23/11/2025	ALL	Review	Theodora Kakouri, Spyridoula Stamouli, Hamam Mokayed, Saleha Haseeb
1.3	21/12/2025	ALL	Final Revisions	Dr.Daithí Ó Murchú
2.0	23/12/2025	ALL	Final editing	Theodora Kakouri Spyridoula Stamouli

Validation			
No.	**Action**	**Beneficiary**	**Date**
1	Prepared	DEC	9/10/2025
2	Approved	CPI and ARC	30/12/2025
3	Released	ARC	31/12/2025

Table of Contents

Executive Summary

D7.1 is the capstone output of WP7. It distils multi-country pilot testing and evaluation results and external evidence into a coherent set of implementation guidelines and policy recommendations for responsible AI adoption in school education. The deliverable speaks to multiple audiences:

- policy-makers and regulators at European, national and regional levels;
- school authorities and leaders responsible for strategy, quality and governance;
- preservice and in-service teacher-education institutions that design and deliver AI-related professional learning;
- teachers, support staff and school-based practitioners who will orchestrate AI tools in everyday practice; and
- EdTech developers and providers interested in aligning solutions with EU values, regulatory requirements and pedagogical expectations.

These guidelines operationalise AI4EDU's overall objectives, with particular emphasis on strengthening teacher and student AI literacy, safeguarding fundamental rights, and ensuring ethical, transparent, inclusive and equitable AI integration.

The deliverable synthesises **classroom-level practices** that proved workable across pilots in Cyprus, Greece, Ireland and Sweden. These focus on curriculum-aligned design and orchestration of AI-enhanced activities that centre teacher agency, student voice and inclusive learning. Conversational assistants (Teacher Mate and Study Buddy) are positioned as assistive tools that support teaching and learning, instruction planning, differentiation, feedback and formative assessment, rather than as replacements for teachers. AI literacy is treated as an integrated competence, combining conceptual knowledge of AI with critical thinking, ethical awareness, data literacy and practical skills for using and interrogating AI systems.

At system level, D7.1 articulates **policy guidelines** for governance and accountability, infrastructure and platforms, data protection and safety, and monitoring and evaluation linked to continuous improvement. These guidelines are aligned with the EU AI Act's risk-based approach, the GDPR and related EU digital regulations, and with emerging European and international AI-in-education frameworks. They provide ministries, agencies and school authorities with concrete levers for steering AI adoption in ways that uphold learner rights, teacher professionalism and institutional autonomy.

Finally, the deliverable draws out **strategic implications** for staged, sustainable roll-out. It argues for phased adoption anchored in teacher agency, robust professional development, clear accountability and an explicit focus on equity and inclusion. Strategic pathways emphasise:

- coherent national and local AI in education policies;
- long-term investment in infrastructure and capacity;
- partnerships between schools, teacher-education institutions, research bodies and EdTech providers; and
- systematic evaluation cycles that connect evidence from pilots to policy revision and scaling decisions.

D7.1 is grounded in multiple evidence streams from within and beyond AI4EDU.

Pilots carried out as part of WP4 activities with the aim to test and assess the **usability and technology acceptance** of the SB and TM prototypes (D4.2): Iterative user-centred evaluations, including scenario-based testing of the available tools and functionalities, observations and teacher/student questionnaires, were used to refine the design of TM and SB. These studies clarified user expectations, surfaced usability issues and guided interface and interaction improvements.

Mixed-methods **evaluations of** the SB and TM applications' **educational impact** combined pre/post surveys, academic achievement tests, motivation and engagement questionnaires, classroom observations, and interviews across diverse school contexts (D4.2). Findings suggest that, when carefully orchestrated, AI4EDU tools can support explanation, practice, feedback and reflection. At the same time, the pilots highlighted pragmatic constraints (time, scheduling, curricular pressures) that shaped uptake and depth of use.

The project's conceptual and practical choices were triangulated with **external validation sources**, including international guidance on AI in education and child-rights-based approaches to digital technologies. This includes UNESCO's work on AI and education, OECD and UNICEF guidelines on trustworthy and human-centred AI, and EU-level frameworks for the responsible and ethical use of AI in education and for digital and AI competences. External validation confirms that AI4EDU's trajectory is consistent with global principles of transparency, safety, inclusion, accountability and human oversight.

Drawing on this evidence and the wider policy landscape, D7.1 formulates high-level recommendations at implementation and system levels.

Implementation (practice): Schools and teachers are encouraged to adopt a "curriculum-first" approach to AI: starting from learning outcomes and assessment, then selecting and configuring AI tools accordingly. Recommended practices include explicit disclosure when AI is used; robust classroom norms for critical engagement with AI outputs; collaborative planning that embeds AI literacy activities into subject teaching; and ongoing reflection on equity, bias and accessibility. Teacher Mate and Study Buddy are proposed as exemplars of human-in-the-loop conversational assistants that can augment, but not automate, core pedagogical work.

Policy (system): At policy level, the deliverable recommends risk-based AI governance with clearly delineated roles between ministries, agencies, local authorities, schools and vendors. Key actions include: establishing AI in education policies that articulate permissible uses, safeguards and red lines; integrating AI literacy into curricula, teacher-competence frameworks and accreditation standards; ensuring that procurement and platform decisions reflect data-protection and child-rights requirements; and resourcing sustained, school-embedded professional development rather than one-off workshops.

International frameworks and educational strategies mapping: Section 3.5 situates AI4EDU's recommendations within a comparative landscape, drawing on international exemplars from Europe and beyond. It maps how UNESCO, OECD, EU and national AI strategies conceptualise AI in education, and identifies convergences and gaps in relation to AI4EDU's practice guidelines. This mapping is used to ensure coherence between global principles and project-level recommendations, and to support national adaptation by partner countries and other education systems

Acronyms and abbreviations

Abbreviation	Description
AI	Artificial Intelligence
AI4EDU	Artificial Intelligence for Education (project short name)
AIEd	Artificial Intelligence in Education
DEIS	Delivering Equality of Opportunity in Schools
GenAI	Generative Artificial Intelligence
MES	Motivation & Engagement Survey
SEN	Special Educational Needs
SB	Study Buddy
TM	Teacher Mate
WPs	Work Packages
DPIA	Data Protection Impact Assessment
ROPA	Record of Processing Activities
UDL	Universal Design for Learning
WCAG	Web Content Accessibility Guidelines
MIL	Media and Information Literacy
HPC	High-Performance Computing
RAG	Retrieval-Augmented Generation
PD	Professional Development
KPI	Key Performance Indicator
EU AI Act	Regulation (EU) 2024/1689 on Artificial Intelligence
CE/DoC	Conformité Européenne / Declaration of Conformity
M&E	Monitoring & Evaluation

1. Introduction

This section sets out the conceptual and empirical background underpinning Deliverable 7.1 (D7.1). It situates Artificial Intelligence in Education (AIEd) within its historical trajectory and the recent acceleration of generative AI and AI Literacy initiatives and frames the AI4EDU conversational AI assistants (Study Buddy for learners; Teacher Mate for teachers) as a targeted response to longstanding classroom needs. Drawing on emerging international policy frameworks (UNESCO, OECD, European Union, UNICEF) and recent large-scale evidence on teachers' working conditions and technology use (OECD, 2019, 2025), the aim is to position D7.1 within established scholarship and current governance debates while foregrounding the project's distinctive contribution to ethical, effective and scalable classroom-aligned practice.

1.1 Background of AIEd

Global policy momentum around AIEd and AI literacy has accelerated in 2024–2025, signalling a shift from exploratory approaches to system-wide AI education strategies. Beijing has introduced compulsory AI instruction across compulsory schooling from September 2025, requiring all primary and secondary students to receive at least eight hours of AI education per year[1]. In the United States, the Executive Order Advancing Artificial Intelligence Education for American Youth establishes a national strategy for AI literacy, a federal task force, and a Presidential AI Challenge, with strong emphasis on educator professional development (The White House, 2025). Korea is explicitly promoting teacher-led, AI-enabled pedagogy, positioning AI as a tool that extends rather than replaces teacher professionalism[2]. Singapore continues platform-level integration via the national Student Learning Space, including AI-enabled authoring and planning tools for teachers[3]. Japan is piloting AI-supported translation and online teaching to better serve learners with foreign-language needs[4]. Australia, through federal and state initiatives, is trialling AI tools specifically to reduce teacher workload and administrative burden (Australian Department of Education, 2024).

In parallel, international organisations are converging on AI-literacy frameworks for both teachers and students. UNESCO's Guidance for Generative AI in Education and Research and its new AI Competency Framework for Teachers define the knowledge, skills and values teachers require to engage with AI in a human-centred, rights-respecting way (UNESCO, 2023, 2024c). Complementing this, the AI Literacy (AILit) Framework for Primary and Secondary Education, a joint initiative of the European Commission and OECD supported by Code.org, structures learner AI literacy around domains such as engaging with, creating with, managing and designing AI (European Commission

[1] 'China's capital city is making AI education mandatory, even for elementary schoolers'. 9 March 2025: https://www.businessinsider.com/china-beijing-ai-education-mandatory-classrooms-elementary-schoolers-2025–3 (Accessed: 21 December 2025).
'China to rely on artificial intelligence in education reform bid', *Reuters*, 17 April. https://www.reuters.com (Accessed: 21 December 2025). https://www.reuters.com/world/asia-pacific/china-rely-artificial-intelligence-education-reform-bid-2025-04-17/ (Accessed: 21 December 2025).

[2] 'Teachers are leading an AI revolution in Korean classrooms', *World Bank Education Blog*, 30 October. https://blogs.worldbank.org https://blogs.worldbank.org/en/education/teachers-are-leading-an-ai-revolution-in-korean-classrooms?utm (Accessed: 21 December 2025).

[3] 'AI in education: transforming Singapore's education system with Student Learning Space'. 21 January 2025. https://www.tech.gov.sg/technews/ai-in-education-transforming-singapore-education-system-with-student-learning-space/ (Accessed: 21 December 2025).

[4] *The Straits Times*, 14 August. https://www.straitstimes.com/asia/east-asia/japan-govt-to-use-ai-to-help-teach-japanese-to-kids-with-foreign-roots (Accessed: 21 December 2025).

Co-funded by the European Union

and OECD, 2025). Together, these frameworks explicitly recognise that teachers' AI literacy and students' AI literacy are mutually reinforcing: without confident, well-supported teachers, student-facing AI initiatives risk remaining superficial or unsafe, and without AI-literate students, classroom AI uses cannot fully realise their pedagogical potential.

Recent international evidence reinforces this dual-literacy challenge. The OECD's Results from TALIS 2024: The State of Teaching shows that many teachers already use AI or digital tools in their work, but report wide variation in preparedness, support and professional learning opportunities across systems (OECD, 2025). TALIS 2024 underlines that improving working conditions, professional development, and teachers' sense of professional agency are prerequisites for sustainable AIEd adoption, aligning directly with D7.1's emphasis on teacher-centred, curriculum-aligned implementation.

1.1.1 Brief history of AIEd and the rise of Generative AI

AI in education has evolved from early computer-assisted instruction to sophisticated Intelligent Tutoring Systems (ITS) and, more recently, to generative AI-driven assistants. Pioneering work such as Carbonell's SCHOLAR system (1970), Sleeman and Brown's (1982) edited volume on ITS, Nwana's (1990) overview of ITS architectures, and Woolf's (2009) comprehensive account of intelligent interactive tutors established core AIEd design logics: learner modelling, domain modelling, pedagogical strategies and dialogue management. These traditions continue to inform the design of contemporary AI-mediated learning environments.

The emergence of LLMs and GenAI has dramatically expanded natural-language interaction, content generation and scalable feedback capabilities. Recent reviews of AI in education highlight both the breadth of applications and the rapid escalation in generative AI research, while warning against over-hype and stressing the need for rigorous evaluation (Holmes, Bialik and Fadel, 2019; Wang et al., 2024). UNESCO's 2023 guidance synthesises these emerging opportunities and risks, emphasising human-centred deployment, equity and capacity building (UNESCO, 2023).

1.1.2 Challenges and opportunities in the educational AI landscape

Opportunities associated with AIEd include personalised explanations, adaptive practice, rapid feedback, targeted support for diverse learners and potential productivity gains for teachers (for example, in materials creation and diagnostics). Evidence suggests that impact is strongest when AI use is teacher-facilitated, curriculum-aligned and embedded in sound pedagogy (Holmes, Bialik and Fadel, 2019; OECD, 2019).

However, significant challenges persist. These include privacy and data-minimisation obligations, bias and fairness, transparency and explainability, child-rights safeguards, reliability and "hallucination" risks, and unequal access due to infrastructure, language or disability-related barriers. International policy instruments, such as UNICEF's Policy Guidance on AI for Children and Regulation (EU) 2024/1689 (the EU Artificial Intelligence Act), foreground risk-based governance duties, transparency and AI-literacy obligations, with direct implications for education procurement and implementation (UNICEF, 2021; European Union, 2024; UNESCO, 2023; OECD, 2019). These developments reinforce the need for coherent institutional policies, auditability and robust safeguards.

By late 2025, foundational and multimodal models (for example GPT-5-class, Gemini-class and advanced open models) had shifted to widespread deployment in education and other sectors. These systems offer markedly improved reasoning, mathematical and coding performance, extended context windows and multimodal inputs, and can be combined with retrieval-augmented generation (RAG) over curricular resources to support more reliable conversational assistants. While such advances do not remove the need for human oversight, they significantly change the risk–benefit calculus for classroom-aligned AIEd.

At the same time, education has become one of the fastest-adopting sectors for GenAI. International surveys and reviews report that a majority of education institutions now experiment with GenAI, yet frequently encounter high implementation-failure rates due to under-estimated organisational change requirements, insufficient teacher capacity, unclear governance and inadequate student-safeguard mechanisms (OECD, 2025; Wang et al., 2024). The primary challenge is therefore no longer access to capable models, but the design of safe, equitable and pedagogically grounded implementations.

1.1.3 Motivation and implications for the AI4EDU project

AI4EDU was developed in response to the rapid emergence of GenAI in education and its growing, largely informal use by teachers and students. Across education systems, conversational AI tools are already being used for explanation, revision, content generation and feedback, often outside formal pedagogical frameworks and without shared institutional guidance. This situation has created both opportunities for more personalised and flexible learning and significant challenges related to curriculum alignment, data protection, child safety and the preservation of professional judgement.

Against this background, the AI4EDU project set out to **investigate and document how AI-based educational systems can be responsibly designed, implemented and used to support teaching and learning in school education**. AI4EDU adopted a design-led and evidence-driven approach, combining technical development, **co-design with educators and learners**, and multi-country pilot implementation and evaluation.

The project was motivated by two main needs observed in AI-in-education practice. First, there is a need for **high-quality, personalised and curriculum-aligned learning support for students**, capable of strengthening understanding, metacognitive awareness and study skills without encouraging over-reliance or disengagement. Second, there is a need for **workload-aware AI support for teachers**, particularly in relation to lesson planning, differentiation, assessment and feedback, that enhances efficiency while preserving human oversight and professional judgement (AI4EDU, D2.1).

To address these needs, AI4EDU developed and piloted a **dual-assistant conversational AI educational environment** designed specifically for secondary education contexts. The environment comprises two complementary applications:

- **Study Buddy (SB)**, a student-facing conversational assistant that supports learning through scaffolded explanations, guided practice and revision activities; and
- **Teacher Mate (TM)**, a teacher-facing assistant that supports lesson planning, individualised resource generation, formative assessment design, progress monitoring, and personalized feedback.

TM users retain control over task design, pacing, verification and assessment decisions, while SB users engage with AI as a learning support either individually, during homework time, or within teacher-orchestrated activities. Both tools were designed to operate in multilingual contexts and to comply with data-protection and child-safeguarding requirements, as detailed in the project's technical and design documentation (D3.1, D2.3, D5.1, D5.2).

AI4EDU was implemented through an **iterative project cycle.** Initial needs analysis and pedagogical framing informed the early design of the tools, followed by technical development and prototype refinement in two phases. Teachers and students were involved throughout the process through workshops, usability testing and classroom pilots, providing feedback that directly shaped subsequent iterations. This sequence of **co-design, piloting, evaluation and refinement** enabled the project to progressively align technical development with classroom practice across different national contexts.

This approach shaped the overall design and implementation of the AI4EDU project. The project demonstrates how GenAI can be structured to support both learners and teachers through a participatory, **human-in-the-loop approach** emphasizing pedagogical intent. At the same time, emerging AI literacy frameworks and governance instruments, such as UNESCO's AI competences frameworks, EU AI Act and UNICEF's guidance on AI and children, informed the project's conceptual framework, system design and deployment principles. Finally, the project prioritised iterative piloting, co-design with educators, readiness assessment and continuous monitoring as core elements of responsible AI integration.

Together, these considerations position AI4EDU as a **practice-oriented and evidence-informed project** that responds to current challenges in AI in education. Project evidence throughout its activities, including development cycles, piloting and evaluation phases, provides the foundation for the implementation guidelines and policy recommendations presented in the remainder of this deliverable (Sections 6 and 7).

.

1.2 WP7 overview, objectives and relation to other WPs

WP7 serves as the capstone synthesis and guidance stream of AI4EDU. Led by DEC over Months 31–36, WP7 translates pilot evidence and technical developments into actionable implementation guidelines and policy recommendations. Its deliverable is a public working paper linked with Milestone MS6: Best practices and policy recommendations on AIEd deployment in education. WP7 sits downstream of WP2 (pedagogical framework and technical requirements), WP4 (first pilot cycle for evaluating usability and acceptance), and WP6 (second-cycle educational impact), consolidating these inputs into coherent practice standards and system-level policy. Moreover, WP7 activities also draw on the development cycles insights, corresponding to WP3 and WP5 activities, related to the development of the first and final versions of SB and TM prototypes. The result is a practical, evidence-linked pathway for responsible, scalable AI adoption across diverse educational contexts.

WP7 addresses the following project's Objectives:

Objective O6: To support educational standards for the effective integration of AIEd. This objective is realised through WP7's practice-facing outputs: concise, curriculum-aligned guidance for 'learning with AI' and 'learning about AI', accompanied by checklists, lesson workflows and formative-assessment routines grounded in pilot evidence (D4.2; D6.2).

Objective O7: To deepen our understanding of the ethical implications, as well as of issues of inclusion and equity, in the integration of AI in education. This objective is addressed via policy recommendations that operationalise transparency, privacy, fairness and accessibility, align with the EU AI Act's risk-based duties and child-rights guidance, and embed monitoring and evaluation using D6.2 indicators.

1.3 Scope & structure

D7.1 is a public working paper consolidating evidence from AI4EDU's activities into implementation guidelines for learning with, for and about AI and into policy recommendations for ethical, inclusive and sustainable deployment across education systems.

The deliverable is designed for broad dissemination to educators, school leaders, curriculum bodies, inspectorates, policymakers, regulators and technology partners. Its purpose is to enable responsible adoption by translating pilot-tested practices and impact evidence into clear, country-adaptable guidance and policy levers.

Its scope covers: (i) good practices for classroom implementation; (ii) policy recommendations spanning governance, infrastructure, equity, capacity-building and monitoring and evaluation.

This deliverable is organised into seven main sections. Section 1, Introduction, sets the context for AI in education and summarises WP7's objectives, scope, and intended audiences. Section 2, Methodology, describes how the evidence base was compiled and synthesised, combining AI4EDU project evidence, notably from WP4 usability/technology acceptance and WP6 educational impact evaluation, with external validation sources, including EU and international policy frameworks and relevant research literature. Section 3 presents AI in education frameworks, guidelines, and policies at EU and global level, and includes a dedicated subsection on national policies and strategies for the participating countries (Greece, Cyprus, Ireland, Sweden), highlighting digital education strategies, AI-related initiatives, and contextual factors shaping adoption. Section 4, synthesises recent research evidence relevant to AI4EDU's focus areas, including adoption conditions, governance expectations, AI literacy, and pedagogical implications. Building on these sources, Section 5, Findings and analysis, consolidates the project's empirical findings and interprets what worked, for whom, and under which conditions across the pilot contexts. Section 6 translates this evidence into good practices and implementation guidance for the educational community, including practice-level recommendations for teachers and schools. Finally, Section 7, policy recommendations, sets out evidence-informed recommendations for system-level adoption, covering governance and regulation, infrastructure and architecture, data protection, capacity-building, pedagogical integration, monitoring and evaluation.

2. Methodology

2.1 Overview of sources

This deliverable is grounded in a multi-source evidence base combining primary project data generated within AI4EDU with external policy and research references used for contextualisation and validation. The emphasis is placed on empirical evidence produced by the project itself, complemented by external sources to situate findings within the broader European and international landscape.

2.1.1 Internal project data

The core evidence base derives from AI4EDU's design, testing, and evaluation activities, carried out across four countries (Cyprus, Greece, Ireland, Sweden). More specifically, project evidence includes:

- **Usability and technology acceptance evidence (WP4)**: Evidence from the first evaluation cycle examining the usability and technology acceptance of the early versions of SB and TM prototypes. Data were collected through structured testing sessions in participating schools across the project countries, combining teacher and student questionnaires based on established technology-acceptance constructs with qualitative evidence from observations, facilitated discussions and interviews. Quantitative and qualitative findings are documented in D4.1 (evaluation methodology) and D4.2 (usability and acceptance results).
- **Educational impact evidence (WP6)**: Evidence from the second evaluation cycle examining the educational impact of SB and TM final versions, when integrated into regular classroom practice. Data were collected using a mixed-methods evaluation design combining pre- and post-intervention learning assessments, motivation and engagement surveys for students, post-implementation teacher and student surveys. Moreover, qualitative and descriptive data, including teacher interviews, SWOT analyses and system usage logs from SB and TM, provided insight into patterns of use, pedagogical integration, perceived benefits, and practical constraints in real classroom settings. In general, the WP6 evidence addresses learning processes, teaching practices and contextual factors shaping impact across pilot sites, and is documented in D6.1 (evaluation methodology) and D6.2 (educational impact results).
- **Market validation and stakeholder analysis**: Additional evidence is drawn from a market validation study, conducted in summer 2025 in Sweden, under the supervision of LTU Business, in the framework of the Summer Consultants 2025 programme (Abrahamsson and Henriksson, 2025). The study examined stakeholder value propositions, adoption drivers and barriers, and perceived institutional fit of AI4EDU tools in the Swedish context. This internal report complements the educational evidence by highlighting organisational, economic, and scalability considerations relevant to implementation beyond the pilot phase.

Moreover, AI4EDU generated substantial **implementation-relevant evidence across all work packages**, including those focused on needs analysis, pedagogical design and technical development. WP2 activities, involving structured workshops and interviews with teachers and students, produced early evidence on end users' attitudes towards AI, curricular alignment requirements, desired AI use cases, teacher concerns regarding workload, data protection and academic integrity, and conditions for classroom trust and adoption. These insights directly informed system requirements and use-case selection, as reflected in the pedagogical framework and user requirements deliverables (D2.1, D2.2).

Similarly, WP3 and WP5 generated empirical evidence through iterative technical development and refinement. Design and development cycles surfaced practical constraints and enabling conditions related to data management, role-based access, logging, availability of curriculum-aligned educational resources for AI processing, as well as legal and organisational issues related to copyright and licensing of school textbooks and teaching materials. Development decisions were informed by this evidence, as reported in D3.1, D3.2, D5.1 and D5.2 deliverables.

2.1.2 External references

To contextualise and validate project findings, the analysis is informed by selected policy frameworks and research literature relevant to AI adoption in education. More specifically, external references include **European, global, and national policy documents** addressing AI governance and education, including the EU AI Act, OECD AI Principles, UNESCO guidance on Generative AI in education, and UNICEF guidance on child rights and AI. Moreover, D7.1's knowledge base includes studies and systematic reviews on AI in education, including work on intelligent tutoring systems, learner modelling, AI-supported assessment, and adoption conditions in educational contexts. These sources are used to interpret AI4EDU results and to identify points of convergence and divergence with existing evidence.

2.1.2 Description of methods

We synthesised evidence across two pilot cycles. From WP4, we integrated usability/acceptance metrics, qualitative teacher–student feedback and usage observations to identify classroom integration patterns and workload-aware routines. From WP6, we integrated quantitative/qualitative impact indicators (pre/post-tests, Motivation & Engagement Survey, case studies) to assess learning value under teacher-facilitated, curriculum-aligned use. Convergent themes were coded and mapped to practice and policy levers. Project evidence also was triangulated with international frameworks and academic literature for the identification of convergencies and divergencies.

In addition, market validation evidence was incorporated to examine adoption drivers and barriers beyond the pilot contexts. This analysis focused on stakeholder value propositions, organisational readiness, and perceived institutional constraints, informing recommendations related to scalability, sustainability, and system-level uptake.

We used a cross-case comparative approach across Cyprus, Greece, Ireland and Sweden to explore contextual moderators (curriculum alignment, language support, infrastructure, timetable fit, PD models). Patterns were identified using a 'most-similar systems' logic, highlighting how similar pedagogical approaches played out under different institutional conditions. Findings inform the country-adaptable guidance in D7.1.

3. AI in Education frameworks, guidelines and policies – EU and globally

This section situates AI4EDU within the wider landscape of international, European and national AI AIEd frameworks, policies and regulatory instruments. It provides the policy and governance backdrop against which the project's pilots, evaluation activities and recommendations should be interpreted and implemented. In line with the Introduction, it emphasises human-centred, rights-respecting and teacher-led uses of AI, with AI literacy for teachers and students treated as a core condition for safe and effective deployment (UNESCO, 2021, 2023, 2024a, 2024b; OECD, 2019, 2025; UNICEF, 2021).

The analysis proceeds from global frameworks to EU-level guidance, then to national policies and infrastructures in Cyprus, Greece, Ireland and Sweden. It concludes with a synthesis of convergences and gaps and identifies AI literacy and implementation science as cross-cutting levers that inform the implementation guidelines (Section 6) and policy recommendations (Section 7). Global work by UNESCO, the OECD, and UNICEF provides high-level principles, while EU-level instruments such as the Digital Education Action Plan, DigComp and DigCompEdu, the EU AI Act, the General Data Protection Regulation (GDPR), the Digital Services Act (DSA) and the Council of Europe AI convention translating these into concrete obligations and reference frameworks for education systems.

3.1 Global AI in Education frameworks and guidelines

Global organisations have articulated overarching principles, frameworks and guidelines that strongly shape how AI should be introduced in education systems. UNESCO's AI and education agenda, including *AI and Education: Guidance for Policy-Makers*, *Guidance for Generative AI in Education and Research*, and the AI competency frameworks for students and teachers, anchors AI use in human rights, inclusion, public-good orientation and pedagogical purpose (UNESCO, 2021, 2023, 2024a, 2024b).

The OECD Recommendation on Artificial Intelligence provides cross-sector principles of inclusive growth, human-centred values, transparency, robustness, security and accountability, while OECD education work (including TALIS and PISA) offers empirical evidence on teachers' digital practices, working conditions and learner outcomes (OECD, 2019, 2025).

UNICEF's Policy Guidance on AI for Children foregrounds the protection of children's rights in AI design and use, with explicit attention to data, safety and non-discrimination (UNICEF, 2021).

Emerging regional strategies, such as the African Union's Continental AI Strategy, position AI as a lever for inclusive, sustainable development aligned with Agenda 2063, with education, skills and youth empowerment as central pillars (African Union Commission, 2024).

Finally, Singapore's Model AI Governance Framework for GenAI is one of the first comprehensive, government-endorsed governance frameworks focused specifically on GenAI. It proposes a lifecycle approach covering system development, deployment and use, with expectations around accountability, data governance, testing and assurance, content provenance, transparency, safety, robustness and incident management (IMDA and PDPC, 2024).

3.1.1 Generative AI and the future of education – UNESCO framing

UNESCO's *Guidance for Generative AI in Education and Research* provides a globally recognised framing for GenAI adoption in education. It emphasises alignment with human rights and education as a public good, cautions against risks such as bias, disinformation, erosion of academic integrity and deskilling, and underscores the irreplaceable role of teachers as designers, mediators and evaluators of learning (UNESCO, 2023).

Within D7.1, this framing is used as a normative reference to inform the interpretation of AI4EDU findings and the formulation of implementation guidance, rather than as an empirical evidence source. In particular, it informs recommendations related to:

- prioritising disclosure and verification routines in classroom use of conversational AI;
- strengthening teacher oversight and learner agency in AI-mediated activities; and
- embedding critical reflection on data provenance, linguistic diversity and cultural representation in AI literacy activities.

This perspective aligns with AI4EDU's emphasis on both the pedagogical integration of AI tools (learning with AI) and the development of critical AI literacy (learning about AI), supporting an approach in which GenAI is positioned as a supportive educational resource rather than an autonomous instructional agent (UNESCO, 2023; 2024a; 2024b).

3.1.2 African Union (AU) Continental AI Strategy (education-relevant levers)

The African Union's emerging Continental Strategy on AI positions AI as a tool for inclusive, sustainable development aligned with Agenda 2063, including education, skills, research and youth empowerment as central pillars (African Union Commission, 2024). The strategy emphasises people-centred and rights-respecting AI, data governance and sovereignty, infrastructure and connectivity, and regional cooperation for capacity-building and innovation.

3.1.3 UNESCO AI Competency Frameworks and GenAI Guidance

UNESCO's 2024 AI competency frameworks for students and teachers provide the first global, role-specific articulation of AI-related knowledge, skills, values and attitudes (UNESCO, 2024a, 2024b).

- The AI Competency Framework for Students identifies competencies across dimensions such as understanding AI concepts and data practices, critical evaluation of AI outputs, and participatory, responsible use (UNESCO, 2024a).
- The AI Competency Framework for Teachers defines competencies across human-centred mindset, AI ethics, AI foundations and applications, AI pedagogy and AI for professional learning, with progression levels (Acquire, Deepen, Create) (UNESCO, 2024b).

These frameworks conceptualise AI literacy as multi-dimensional and explicitly build on earlier UNESCO work (UNESCO, 2021, 2023).

AI4EDU uses these frameworks as key references for the teacher-facing recommendations in Sections 5 and 6, particularly regarding professional-learning pathways, assessment integrity and learner empowerment. They also connect to EU frameworks such as DigComp and DigCompEdu, enabling coherent integration of AI literacy into existing digital-competence policies (UNESCO, 2024a, 2024b; European Commission, 2017, 2022b).

3.1.4 OECD Recommendation on AI and related education work

The OECD Recommendation on Artificial Intelligence (OECD, 2019) articulates principles of inclusive growth, human-centred values, transparency, robustness and security, and accountability, alongside recommendations for national policy and international cooperation. Complementary OECD work on digitalisation in education, including TALIS and PISA studies, examines teachers' digital competences, school-level conditions and learners' digital well-being.

The 2025 report *Results from TALIS 2024: The State of Teaching* provides evidence on AI usage and professional learning in schools. It shows that teachers' use of AI varies widely across systems and that in jurisdictions such as Singapore and the United Arab Emirates, where around 75% of teachers report using AI, they are also among the most likely to report having received professional learning on AI (OECD, 2025). This reinforces a key message of D7.1: AI adoption is tightly coupled to teacher professional agency, workload conditions and access to targeted AI-focused professional development, rather than technology availability alone (OECD, 2019, 2025).

3.1.5 UNICEF Policy Guidance on AI for Children

UNICEF's *Policy Guidance on AI for Children* focuses explicitly on AI's implications for children's rights, calling for safety, privacy, fairness, non-discrimination, transparency and participation to be embedded throughout the AI lifecycle (UNICEF, 2021).

For AI4EDU, this guidance reinforces:

- the requirement that children's data are collected and processed lawfully, minimally and with strong safeguards;
- the need to design AI systems that support children's development and autonomy; and
- the role of schools and education authorities as duty-bearers, responsible for protecting learners from exploitative data and business practices.

These child-rights commitments underpin the data-protection and governance recommendations articulated later in Sections 6–7.

3.1.6 Global consensus: Ethics, equity and human-centred AI

Across these global instruments there is a strong convergence: AI in education should be human-centred, equitable, transparent, trustworthy and accountable, with explicit attention to inclusion, diversity, language equity and child-rights. AI is framed as augmenting rather than replacing teachers; AI literacy and media-information literacy are seen as core competences for educators and learners; and robust governance, transparency and risk management are treated as non-negotiable for AI used with children and young people.

3.2 European frameworks, policies and regulations

At European level, a rich ecosystem of frameworks, policies, regulations and practical guidance shapes how AI should be deployed in education. These instruments provide both normative principles and concrete obligations for education systems and technology providers and frame how AI4EDU's pilots and recommendations should be read in EU contexts (European Commission, 2020, 2022, 2022b; European Union, 2016, 2022, 2024; Council of Europe, 2022, 2024; OECD, 2019).

Key elements include: Council of Europe work on AI, democracy and human rights; European Commission ethical guidelines and educator guidance; digital-competence frameworks (DigComp and DigCompEdu); the Digital Education Action Plan; and horizontal regulations such as the EU AI Act, GDPR and DSA.

Co-funded by
the European Union

The **Council of Europe's** AI and education policy toolbox (Council of Europe, 2022, 2024), developed within its broader work on democracy, human rights and the rule of law, emphasises:

- critical engagement with AI-mediated information and platforms;
- the civic and democratic dimensions of AI literacy, including awareness of algorithmic influence on information environments; and
- robust evaluation frameworks for AI deployments in public-sector settings such as schools.

The **European Commission's** *Ethical Guidelines on the Use of Artificial Intelligence (AI) and Data in Teaching and Learning for Educators* (European Commission, 2022a) translate broad AI-ethics principles into practical guidance for classroom practice. The guidelines stress:

- the centrality of teacher agency and professional judgement in selecting and orchestrating AI tools;
- respect for learners' dignity, autonomy and well-being; and
- informed consent, age-appropriateness, transparency and clear communication with learners and parents.

The **EU Artificial Intelligence Act** (Regulation (EU) 2024/1689) establishes a risk-based framework for AI systems, distinguishing between prohibited, high-risk, limited-risk and minimal-risk uses (European Union, 2024). Many AI tools used in education, especially those involving student profiling, assessment, behaviour monitoring or access to educational services, are expected to be treated as high-risk.

For AI in education, the AI Act has several key implications:

- It clarifies the roles and responsibilities of providers, importers, distributors and deployers, explicitly including schools, education authorities and ministries as "deployers" of AI systems.
- It mandates risk-management systems, high-quality datasets, data-governance measures, technical documentation, transparency obligations and human oversight for high-risk systems.
- It requires conformity-assessment and post-market monitoring, influencing procurement processes, contractual arrangements and platform governance in education.

The **Digital Competence Framework for Citizens** (**DigComp**) and its education-specific counterpart **DigCompEdu** provide core reference points for digital-competence policy in Europe. **DigComp 2.2** describes digital skills across domains such as information and data literacy, communication and collaboration, digital content creation, safety and problem-solving, with explicit attention to data protection and responsible use, including AI-driven tools and evolving online risks (European Commission, 2022b; Cosgrove and Cachia, 2025). DigCompEdu specifies competences for educators across professional engagement, digital resources, teaching and learning, assessment, empowering learners and facilitating learners' digital competence (Punie & Redecker, 2017).

Recent European and UNESCO work highlights how AI-related knowledge and skills can be integrated within these frameworks instead of being treated as stand-alone add-ons (European Commission, 2022b; UNESCO, 2024a, 2024b). DigComp and DigCompEdu:

- provide a baseline structure for articulating teacher and learner AI competences;

- support the design of professional-learning pathways and micro-credentials aligned with AI literacy; and
- offer a bridge between AI-specific competency frameworks (e.g. UNESCO AI CFT) and existing national competence-based curricula.

The **Digital Education Action Plan** (DEAP) 2021–2027 sets the overarching EU agenda for high-quality, inclusive and accessible digital education. It focuses on two strategic priorities: (i) fostering a high-performing digital education ecosystem (infrastructure, organisational capacity, data governance) and (ii) enhancing digital skills and competences for the digital transformation (European Commission, 2020). The DEAP explicitly highlights AI as a transformative technology whose use in education must be governed ethically and framed to enhance, not replace, teaching and learning.

AI4EDU's objectives and activities align with DEAP's priorities by providing pilot-tested, human-centred use cases for AI in schools, offering implementation guidelines that support whole-school approaches to digital transformation, and contributing to AI literacy and professional-learning models that can be scaled through EU and national teacher-education infrastructures (European Commission, 2020, 2022a, 2022b).

Finally, several additional European instruments shape the environment for AI in schools. The **General Data Protection Regulation (GDPR)** harmonises data-protection rules across the EU and provides enhanced protection for children's personal data, requiring lawful, fair and transparent processing, data minimisation and robust security safeguards (European Union, 2016). The **Digital Services Act (DSA)** establishes due-diligence, transparency and risk-mitigation obligations for online intermediaries and very large platforms, including requirements to protect minors from harmful content and to assess and mitigate systemic risks (European Union, 2022). The **Council of Europe Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law** sets binding standards to ensure that AI lifecycle activities are consistent with human rights, democracy and rule-of-law principles and calls on parties to adopt graduated measures based on risk (Council of Europe, 2024).

These legal instruments, accessible via EUR-Lex, are integrated into the data-protection and governance guidelines presented in Section 6 and the system-level policy recommendations in Section 7 (European Union, 2016, 2022, 2024; EUR-Lex, n.d.). Together with the EU AI Act, they frame AI in education as operating within a high-standards regulatory environment where privacy, safety, transparency, accountability and child-rights are fundamental design constraints rather than optional enhancements.

The **global and European frameworks** reviewed in this section establish a shared normative and regulatory baseline for the utilization of AI in education. At global level, instruments developed articulate common principles centred on human rights, equity, child protection, teacher agency, transparency and AI literacy. At European level, these principles are translated into binding legal obligations, policy instruments and competence frameworks. Collectively, they define the conditions under which AI systems may be designed, procured, deployed and governed in educational settings, framing AI as a high-responsibility technology rather than a neutral instructional tool.

3.3 Selected European reference cases for AI in Education (2024-2025)

Estonia: AI Leap and nationwide AI accounts for upper-secondary learners

Estonia's *AI Leap 2025* initiative provides AI-powered learning applications to all Grade 10–11 students and teachers in general education schools from September 2025, with expansion to vocational education and younger cohorts planned for 2026–2027 (Eurydice, 2025a; e-Estonia, 2025). The programme, implemented in partnership with OpenAI and Anthropic, aims to reach around 58,000 students and 5,000 teachers by 2027, combining free access to ChatGPT Edu–style tools with teacher training and equity mechanisms such as device subsidies for disadvantaged learners[5].

Finland: National AI recommendations and teacher-oriented guidance across all education levels

In March 2025, the Finnish Ministry of Education and Culture and the Finnish National Agency for Education (EDUFI) issued *Artificial intelligence in education – legislation and recommendations*, a cross-sector guidance set covering early-childhood, basic, upper-secondary and vocational education, as well as liberal adult education (Finnish National Agency for Education, 2025a; Eurydice, 2025b). The material distinguishes legal obligations from pedagogical recommendations and is complemented by an *AI Guide for Teachers*, which explains AI capabilities/limits, ethical challenges and classroom scenarios for critical AI literacy (Finnish National Agency for Education, 2025b; Faktabaari, 2025).

Spain: INTEF national guide on AI in education and regional teacher supports

Spain's National Institute of Educational Technologies and Teacher Training (INTEF), under the Ministry of Education, Vocational Training and Sports, published the *Guía sobre el uso de la inteligencia artificial en el ámbito educativo* in July 2024 (INTEF, 2024). The guide contextualises AI, addresses ethical risks, and provides a "decálogo" (ten-point code) for responsible classroom use, accompanied by examples of practice and an annotated list of national and international resources (INTEF, 2024; INTEF, 2025). Regional initiatives, such as the Canary Islands' *Guía: Recomendaciones para el uso de aplicaciones, plataformas y herramientas de IA en el ámbito educativo*, adapt these principles to local contexts, emphasising GDPR compliance, data-minimisation and school-level checklists (Gobierno de Canarias, 2024).

Netherlands: Kennisnet AI guidelines and school-decision supports

In 2025, the Dutch education organisation Kennisnet published an *AI Guidelines for Schools* package and a *Guide to AI in education* to help schools make "conscious and responsible choices" about AI use (European Schoolnet, 2025; Kennisnet, 2025). The materials offer practical scenarios, decision trees and self-assessment tools for school teams, focusing on data protection, pedagogical value, vendor transparency and governance responsibilities.

---

[5] 'Estonia shuns phone bans and backs AI Leap in schools', *The Guardian*. London. https://www.theguardian.com/education/2025/may/26/estonia-phone-bans-in-schools-ai-artificial-intelligence (Accessed: 21 December 2025).

Italy: National guidelines on the use of AI in schools

Italy has adopted dedicated national *Guidelines on the use of artificial intelligence at schools*, issued by the Ministry of Education and Merit in 2025, to support compliance with AI and data-protection regulations, promote “anthropocentric, secure, reliable, ethical and responsible” AI, and foster uniform, well-governed adoption across schools (Italian Ministry of Education and Merit, 2025). The guidelines link AI opportunities to risks, emphasising teacher training, student awareness and alignment with the EU AI Act.

3.4 Selected international reference cases for AI in Education (APAC, North America and MENA, 2024–2025)

China: Mandatory AI coursework in compulsory education (from Sept 2025)

Beijing has introduced compulsory, comprehensive AI education across primary and secondary schools, with over 1,400 schools required to offer at least eight class hours of AI education per academic year from September 2025. AI lessons span basic concepts, practical applications and ethics, positioning AI as a form of civic literacy rather than a purely technical topic.

United States: Federal initiative on AI education (April 2025)

In April 2025, the Executive Order “Advancing Artificial Intelligence Education for American Youth” (EO 14277) established a federal AI Education Task Force, directed agencies to expand AI-education initiatives, and launched a nationwide AI Education Challenge. America’s AI Action Plan further commits to expanding AI literacy and skills development across K–12 and workforce pathways, while a growing coalition of private and non-profit organisations has pledged support for curricula, resources and teacher training.

Republic of Korea: Teacher-led AI integration

In the Republic of Korea, AI is being introduced in ways that keep teachers at the centre of classroom decision-making. Policy and practice emphasise AI as a tool to support formative feedback, differentiated practice and data-informed instruction, while maintaining robust expectations around source criticism, learning-process visibility and human oversight. AI is framed as augmenting the teacher’s role, not substituting for professional judgement or relational work with students.

Japan: Targeted AI supports for inclusion

Japan is piloting AI tools to assist Japanese-language learning for children with foreign roots. National announcements describe plans to use generative-AI-based supports to help pupils understand classroom Japanese, receive translations and explanations, and access additional practice opportunities, all under teacher supervision and aligned with child-rights safeguards.

Singapore: Platform-level integration via SLS

Singapore’s Student Learning Space (SLS) is a national online learning platform offering curriculum-aligned resources for all subjects from primary to pre-university levels. Recent initiatives under the National AI Strategy and EdTech Masterplan are enhancing SLS with AI-enabled tools for adaptive pathways, real-time feedback and self-paced learning, while keeping the platform government-owned and tightly aligned to official syllabi.

Australia: National GenAI framework and workload-focused pilots

Australia has adopted an Australian Framework for Generative Artificial Intelligence (AI) in Schools, providing national principles and practical guidance for safe, ethical and curriculum-aligned GenAI use. New South Wales has developed NSWEduChat[6], a secure, department-owned generative-AI tool aligned to the NSW curriculum and designed to prompt critical thinking rather than supply completed answers, with staged rollout from teacher-only pilots to students in Years 5–12. In Western Australia, a cross-sector AI pilot co-funded by federal and state authorities is investing around AU$4.7 million to reduce lesson-planning workload in eight schools as part of a broader workload-reduction agenda.

United Arab Emirates: Mandatory AI subject and generative-AI governance

From the 2025–2026 academic year, the UAE is making AI a mandatory subject across all public schools from kindergarten to Grade 12, positioning AI as a core strand of future-ready education. Public communications indicate that the curriculum covers multiple strands, including data, algorithms, real-world applications, ethics and AI policy, with major investments in teacher training and infrastructure. In parallel, the Green Paper on Generative AI Use in Education in the UAE (Government of the UAE, 2024) provides a multi-level analysis (macro policies, meso institutional practices, micro classroom use) of GenAI opportunities and risks, framing classrooms as civic spaces for ethical deliberation and emphasising academic integrity, transparency and student agency in AI-mediated tasks.

Canada: National AI task force, board-level standards and teacher advocacy

Canada's ecosystem illustrates how national-level thought leadership, provincial standards and teacher-union advocacy can combine to shape AI in K–12 education. The C21 Canada National AI Task Force Report (2025) proposes a pan-Canadian vision for integrating AI into schooling, calling for equity-centred governance, robust data-protection, AI-aligned curricula and system-wide professional learning for educators. Earlier work by the C21 CIO Alliance on the Future of AI in K-12 Education scans emerging practices and recommends guiding principles for boards and ministries on procurement, infrastructure and PD. Provincial organisations such as the Educational Computing Network of Ontario (ECNO) have developed standards and vetting processes for generative-AI tools used in school boards, while the Canadian Teachers' Federation's "Artificial Intelligence in Public Education" campaign urges governments to adopt comprehensive AI policies that prioritise equity, transparency, accountability and teacher voice.

Taken together, the EU, APAC, North American and MENA exemplars reviewed in Sections 3.3 and 3.4 **converge** on a shared vision for AI in education that is human-centred, equitable and trustworthy. Across regions, policy approaches emphasise curriculum alignment, teacher agency, student AI literacy, transparency, data protection and clear accountability for AI systems. This convergence suggests that, despite differences in governance structures and educational

[6] 'NSW public school students to get access to "state-of-the-art" generative AI app', *CyberDaily*, 23 September. https://www.cyberdaily.au/government/12672-nsw-public-school-students-to-get-access-to-state-of-the-art-generative-ai-app (Accessed: 21 December 2025).

traditions, there is growing international agreement on the normative principles that should guide AI adoption in school education.

At the same time, international experience highlights **a persistent gap** between high-level strategies, policy announcements and pilot initiatives, on the one hand, and sustained, classroom-ready implementation on the other. Common challenges across regions include uneven access to devices and connectivity, variability in teacher professional development and support, limited multilingual and inclusive design, uncertainty around data governance and copyright, and a lack of robust, long-term evidence on educational impact in compulsory education. These gaps underscore the importance of implementation-focused guidance, staged adoption and systematic evaluation when translating policy ambitions into everyday practice.

While this global and European baseline provides a common point of reference, its translation into practice is shaped by **national policy priorities and choices**, institutional arrangements and levels of digital competencies and technological maturity. The following section therefore examines **national policies, strategies and AI developments in the four AI4EDU partner countries** (Greece, Cyprus, Ireland and Sweden), providing the contextual grounding necessary to interpret the project's pilot evidence and to formulate implementation guidelines and policy recommendations that are both compliant with shared frameworks and responsive to national conditions.

3.5 National policies, strategies and AI developments (Greece, Cyprus, Ireland, Sweden)

This section examines national policies, strategies and AI developments in the four AI4EDU partner countries (Greece, Cyprus, Ireland and Sweden), focusing on how European frameworks are operationalised within distinct national education systems. It reviews country-specific approaches to digital transformation in education, teacher professional development, AI-related policy initiatives, and the maturity of national AI research, infrastructure and language resources relevant to educational use.

The analysis highlights contextual enablers and constraints, including governance arrangements, institutional capacity, technological readiness and skills ecosystems, that shape how AI can be responsibly developed and adopted in schools. The section provides contextual grounding for interpreting the AI4EDU pilot findings and for formulating implementation guidelines and policy recommendations that are adaptable to different national conditions.

3.3.1 Greece (GR)

3.3.1.1 National Digital Transformation policies and strategies

Greece's national digital transformation agenda is anchored in the **Digital Transformation Strategy**[7], which provides the overarching framework for modernising public administration, expanding digital public services, and improving data governance across sectors, including education. The strategy emphasises transparency, interoperability, and the creation of unified digital infrastructures, which collectively strengthen data availability and digital governance. These priorities prepare the ground

[7] Hellenic Ministry of Digital Governance (2020). Digital Transformation Bible 2020-2025. available at https://digitalstrategy.gov.gr/en/sector/paideia

for large-scale technological adoption, enabling public institutions -including the education sector- to adopt emerging technologies such as AI within a coordinated digital policy environment.

3.3.1.2 National AI strategies and governance frameworks

Greece has articulated a comprehensive strategic vision for AI through the White Paper "**Democratising AI: A National Strategy for Greece**"[8], which positions Greece as a *"laboratory for the sustainable democratisation of AI"* and aims to embed democratic values and human-centric principles into all AI systems. The strategy is closely aligned with the national digital transformation strategy and focuses on building AI skills, expanding research capacity, increasing societal awareness, and developing the legal and infrastructural conditions required for trustworthy AI.

The "**Blueprint for Greece's AI Transformation**"[9] further operationalises these ambitions by identifying "leapfrogging" opportunities for the country, highlighting education, culture, health, and public-service modernisation as priority verticals. It also proposes new governance mechanisms such as a national Data and AI Office to orchestrate data infrastructure and AI initiatives across government.

3.3.1.3 Education-focused digital and AI policies and initiatives

Digital transformation in education has been a national priority in Greece, with policy initiatives focusing on equipping teachers and students with digital competences, expanding school infrastructure, and modernising curricula. Aligned with the national **Digital Transformation Strategy**, Greece promotes digital skills development, responsible technology use, and teacher readiness for emerging technologies, including AI. A total of 36 key projects (24 currently in progress) are being implemented to strengthen K–12 digital education. These include the large-scale deployment of interactive classroom systems (already more than 36,000 interactive whiteboards across 6,899 schools). Schools have also been equipped with 117,121 robotics and STEM kits distributed to over 11,000 schools, and 16,887 assistive learning tools have been delivered to special education schools. The Ministry is also expanding the Digital School and Digital Tutoring initiatives, enriching them with innovative digital tools such as 3D holograms, AI-powered learning assistants, e-books, audiobooks, and updated resources for skill laboratories and psycho-social support centres (ΚΕ.Δ.Α.ΣΥ).

Regarding AI integration in education, Greece has begun taking steps toward developing a national-level intervention. However, the country has not yet operationalised a dedicated program. The Ministry has recently announced the "**AI in Schools**" pilot programme, to be implemented in 20 public high schools in collaboration with OpenAI. The initiative aims to introduce safe, creative, and responsible use of AI within the learning process, marking an important step toward structured AI integration in Greek education.

However, despite reforms and investments underway, Greece continues to face **significant challenges** in developing students' digital competences. According to the European Commission's

[8] Ziouvelou, X., Karkaletsis, V., Giannakopoulos, G., Konstantopoulos, S., & Nousias, A. (2020). Democratising AI: A National Strategy for Greece. Institute of Informatics and Telecommunications (IIT) of the National Centre for Scientific Research Demokritos (NCSR Demokritos). Available at http://democratisingai.gr/assets/DEMOCRATISING_AI_final.pdf

[9] High-Level Advisory Committee on Artificial Intelligence (2024). *A Blueprint for Greece' s AI Transformation*. Hellenic Republic, Presidency of the Government, Special Secretariat of Foresight. Available at https://foresight.gov.gr/en/studies/A-Blueprint-for-Greece-s-AI-Transformation/

Education and Training Monitor 2025[10], 60% of Greek eighth-graders do not reach the basic digital proficiency level (EU: 43%; EU 2030 target: 15%), placing Greece well below the EU average in digital readiness. The proportion of top performers is also among the lowest in Europe, indicating limited advanced digital skills among students. These weaknesses highlight structural gaps in digital literacy development and underscore the need for continued reforms, targeted teacher professional development, and sustained investment to ensure that schools can fully benefit from the ongoing digital and AI transformation.

At the **policy level**, the National Commission for Bioethics & Technoethics has issued a special Opinion on AI in Education, to which the AI4EDU Coordinator contributed as one of the interviewed experts, sharing insights on responsible and ethical AI integration based on the project findings.

The Opinion document emphasises:

- the ethical and pedagogical conditions for responsible AI adoption in schools,
- the need for transparency, explainability, and data protection,
- safeguarding student rights and autonomy,
- teacher training as a prerequisite for safe and effective AI use.

The recommendation produced by the National Commission reflects national priorities for AI-enabled education and aligns with broader ethical frameworks promoted at the European level.

The Hellenic AI Strategy also identifies education as a flagship vertical, emphasising personalised learning, inclusive education, accessibility for learners with disabilities, and curriculum modernisation toward AI literacy and critical digital skills. Teacher professional development is highlighted as a core enabler for integrating AI tools responsibly and effectively across learning environments.

3.3.1.4 National-level initiatives for teachers' capacity building in Generative AI

Greece is taking steps toward preparing educators for the pedagogical and ethical integration of AI, especially Generative AI, into teaching and learning. While a unified national training framework specifically dedicated to AI is still emerging, several initiatives provide opportunities for teacher upskilling. These include:

a. "GenAI Empowered Educators"[11] National Training Programme (Institute of Educational Policy – Ministry of Education)

A dedicated national initiative for teacher training in Generative AI was launched by the Institute of Educational Policy (IEP) of the Ministry of Education, titled "**GenAI Empowered Educators**", in collaboration with private-sector actors. In the first cycle (2024-2025) 535 educators were trained, while 1000 educators will be trained in the second cycle (2025-2026). The programme equips teachers with practical and pedagogical competences related to GenAI, including:

- understanding how GenAI systems work and their limitations,
- using GenAI tools for lesson design, differentiation, assessment, and content creation,
- evaluating GenAI outputs critically and ethically, identifying bias, misinformation, and hallucinations,

---

[10] https://op.europa.eu/webpub/eac/education-and-training-monitor/en/country-reports/greece.html#Section-3
[11] https://www.genaieducation.gr/home-en

Co-funded by the European Union

- guiding students in the safe and effective use of GenAI tools.

During the programme, teachers participate in hands-on activities, explore classroom use cases, and apply GenAI tools under expert guidance. The initiative is widely recognised as a milestone for Greece, marking the first structured national training for teachers focused explicitly on Generative AI and pedagogical innovation.

b. Professional Development initiatives by regional training bodies and Universities (ΚΕΔΙΒΙΜ / ΠΕΚΕΣ)

Since 2023–2024, regional training bodies (ΠΕΚΕΣ) and Lifelong Learning Centres of Greek Universities (ΚΕΔΙΒΙΜ) have organised training programmes for teachers on AI literacy, pedagogical uses of AI, GenAI tools for lesson planning and assessment, risks and digital citizenship etc. These programmes are not led by the Ministry of Education or its agencies, are not free of charge for educators and vary structure, duration and content, but reflect growing national demand for educators' upskilling.

3.3.1.5 National technological infrastructure and AI advancements

Greece has made significant progress in developing the technological foundations necessary for AI innovation. Major national investments include:

- the national supercomputer and research cloud infrastructure managed by GRNET,
- Daedalus pre-exascale supercomputer, providing computational capacity for training and deploying large AI models,
- unified public-sector cloud services and rapidly expanding national high-speed networks,
- substantial investments in data-center infrastructure, enabling Greece to position itself as a regional digital hub.

A key national strength is the rapid advancement in Greek-language LLMs. ARC through its Institute for Language and Speech Processing, the AI4EDU Coordinator, has built two **open LLMs for the Greek language**:

- **Meltemi-7B**[12], the first openly available Greek-centric model, designed to support culturally aligned AI development, and
- **Llama-Krikri-8B**[13], a multilingual Greek LLM integrating local linguistic resources and aligned with national priorities for digital sovereignty

These models serve as examples of how Greece is embedding linguistic and cultural diversity into AI development. This capability is highlighted in the OECD report "Governing with Artificial Intelligence: The State of Play and Way Forward in Core Government Functions"[14]. The report documents 200+ AI applications in the public sector worldwide and stresses the importance of representative datasets for fairness and trust. The report includes Greece as a case example through ARC's Greek-language LLMs, presented as essential for trustworthy, inclusive, and culturally grounded AI systems.

[12] https://huggingface.co/collections/ilsp/meltemi-7b
[13] https://huggingface.co/collections/ilsp/krikri-8b
[14] https://www.oecd.org/en/publications/governing-with-artificial-intelligence_795de142-en.html

Strengthening this ecosystem further, Greece is among the first seven EU countries selected to host AI Factories under the EuroHPC Joint Undertaking. The ***Pharos AI Factory***[15] is the national initiative designed to accelerate AI innovation by providing advanced AI and HPC infrastructure, services, and expertise. Pharos aims to build a technologically advanced and ethically grounded AI ecosystem that connects academia, industry, and the public sector. The initiative focuses on developing trustworthy AI for critical domains such as health, culture & Greek language, and sustainability.

Greece's AI ecosystem is also connected to European initiatives aiming to reinforce European technological autonomy in the AI era by reducing dependency on non-EU infrastructures and to ensure a future of multilingual and culturally aligned AI in Europe, through projects such as **ALT-EDIC4EU**[16], **LLMs4EU**[17], and the **European Language Data Space**[18].

3.3.2 Cyprus (CY)

3.3.2.1 National Digital Transformation policies and strategies

Cyprus pursues an ambitious digital-transformation agenda aligned with the EU Digital Decade and with the twin goals of competitiveness and social cohesion. The **National Digital Strategy 2020-2025**, updated in December 2024, articulates a vision of a sustainable, inclusive and competitive digital society. Its four pillars, i.e. Technology for People, Digital Economy, Open Society and Green Transition, underpin reforms in governance, infrastructure and skills development (Deputy Ministry of Research, Innovation & Digital Policy, 2024). The strategy is coordinated by the Deputy Ministry of Research, Innovation and Digital Policy (DMRID), which also steers implementation of the Digital Decade targets and oversees horizontal initiatives such as the Digital Skills Coalition and National Recovery and Resilience Plan investments.

Progress to date has been strongest in infrastructure and digital public services. By 2022, Cyprus had achieved full gigabit coverage in populated areas and 100% 5G population coverage, with Very High Capacity Networks reaching around 77% of households—figures above the EU average (EC Digital Economy and Society Index, 2024). Investments of approximately €1.55 billion are planned for connectivity and cloud services through 2030 (DMRID, 2024). In the public sector, one-stop platforms such as CY Login and IDme.cy, together with mobile applications like "Digital Citizen" and "Digital Assistant", have simplified access to services; by late 2025 more than 560,000 digital profiles had been created, and processing times for urban-planning approvals and social-benefit applications had fallen significantly (DMRID, 2025). The ICT sector has become an important economic driver, contributing an estimated €3.3 billion (around 13% of GDP) in 2022, with projections of up to €5.6 billion when indirect effects are included. ICT specialists now account for 5.4% of employment, above the EU average, and SME digital-intensity indicators are improving, with AI adoption rising by 69% year-on-year (EC Digital Compass Report, 2025).

At the same time, the digital-strategy review identifies clear challenges. Basic digital skills among adults remain below the EU average: only around half of the adult population have at least basic skills, with a pronounced gap between highly literate youth (16–24) and older adults (55–74).

[15] https://www.pharos-aifactory.eu/
[16] https://www.alt-edic.eu/projects/alt-edic4eu/
[17] https://www.alt-edic.eu/el/projects/llms4eu/
[18] https://language-data-space.ec.europa.eu/

Through Recovery and Resilience Facility (RRF) funded initiatives such as THALIA and a National E-Skills Action Plan, Cyprus aims to train around 20,000 people by 2026, supported by approximately €24 million in dedicated funding (EC Digital Decade Report, 2024). Looking forward, the government's 2025 roadmap sets out 62 measures with a total budget of around €988 million (≈3% of GDP), focused on expanding AI integration in public services, strengthening cybersecurity, and supporting SME competitiveness through measures such as an IP Box regime with an effective 2.5% tax rate for qualifying IP (European Commission, 2025).

3.3.2.2 Education-focused digital and AI policies and initiatives

The Digital Strategy for Education situates schools at the centre of this wider transformation. It is structured around three mutually reinforcing pillars: digitally competent schools, digitally competent teachers and digitally competent students. Together, these pillars provide a framework for modern, inclusive and innovation-ready schooling aligned with European standards (Eurydice, 2025; MoESY, 2024).

Under the "digitally competent schools" pillar, the Ministry of Education, Sport and Youth (MoESY) is implementing a nationwide programme to ensure that every school has robust connectivity and contemporary learning environments. Through the Recovery and Resilience Plan, approximately €13.8 million has been allocated for digital infrastructure, including high-speed internet, interactive boards and smart classrooms (Eurydice, 2025). Two model technical schools in Larnaca and Limassol have received a further €28.8 million in advanced digital equipment and laboratories, setting a benchmark for future upper-secondary provision (MoESY, 2024). A key system-level innovation is the Electronic Education Administration (eDEA) platform, launched in December 2024, which digitises key administrative processes such as enrolment and transfers and is integrated with CY Login for secure authentication (Philenews, 2024). By 2026, the goal is 100% school connectivity and interactive technologies in at least 80% of classrooms (Eurydice, 2025).

Developing "digitally competent teachers" is recognised as a prerequisite for successful integration. MoESY provides a mix of centrally designed CPD programmes, regional training and online resources to build teachers' digital and pedagogical competences (Gov.cy, 2024). The aim is that all teachers are able not only to use digital tools confidently but also to embed them in meaningful learning designs and to guide students' critical engagement with technology (Eurydice, 2025). For students, the "digitally competent learners" pillar emphasises not only basic ICT skills but also computational thinking, creativity and responsible digital citizenship. Since 2024, STEM-oriented curricula and projects have been piloted that foreground coding, problem solving and ethical uses of technology (MoESY, 2024). Under the National E-Skills Action Plan, around €24 million has been earmarked for student digital-skills programmes, with particular attention to rural areas and under-served communities; by 2026, all students are expected to reach core digital-literacy benchmarks comparable to other EU systems (Digital Skills Coalition, 2025; Eurydice, 2025). Progress across these pillars is monitored through Eurydice reporting and EU benchmarking exercises, which track infrastructure roll-out, teacher-training participation and student competence development.

3.3.2.1 AI policies and initiatives in education

Within this broader digital agenda, MoESY has adopted a dedicated AI policy for education. The Ministry's approach is deliberately human-centred and rights-based, seeking to capture the opportunities of AI while safeguarding students and teachers. A **roadmap for AI in education**, launched in June 2024, sets out short- and long-term actions, including the establishment of interdepartmental working group and an expert advisory board, systematic mapping of AI-literacy initiatives and the development of "Policy Text and Guidelines for the Responsible and Ethical Utilization of Artificial Intelligence in Primary and Secondary Education" (Ministry of Education, Sports and Youth, 2025).

Implementation rests on three interlocking principles. First, AI systems in education must be aligned with the curriculum and with recognised frameworks such as DigComp and UNESCO's AI competency guidelines; AI topics are already embedded in Informatics and related courses at all levels, where students engage with algorithmic thinking, programming and contemporary applications of computer science. Second, all AI systems and tools utilization must be governed by strong ethical, legal and child-rights safeguards. The policy emphasises human oversight, protection of human rights and well-being, robust privacy and consent protocols and explicit attention to avoiding discrimination and exclusion (Ministry of Education, Sports and Youth, 2025). Third, AI literacy and critical thinking are treated as essential competences for both teachers and learners. The policy distinguishes between "learning for AI" (developing understanding of AI concepts and impacts), "learning with AI" (using AI as a tool to support teaching and learning) and "learning about AI" within broader digital-competence frameworks; each domain is accompanied by practical recommendations and checklists tailored to teachers, students, parents and caregivers. The Ministry also stresses lifelong learning and is investing in upskilling and reskilling opportunities so that educators and students can adapt to changing labour-market demands while avoiding new forms of social exclusion (Ministry of Education, Sports and Youth, 2025).

3.3.2.2 National-level initiatives for teachers' AI literacy and professional learning

The Cyprus Pedagogical Institute (CPI) plays a central role in building teachers' digital competence and AI literacy. Its mission is to support the continuous professional and personal growth of teachers and to promote innovation in teaching and learning. A flagship initiative is the **Digital Competence Development for Educators programme**, offered since 2019 primarily via online modalities and micro-credential structures. Grounded in adult-learning principles, the programme encourages self-directed learning and reflective practice: teachers set their own goals, engage with online resources, apply new approaches in their classrooms and document evidence of learning. The programme comprises one introductory module and eleven learning areas structured across three levels of difficulty, with recent iterations explicitly introducing AI concepts and classroom uses.

CPI also offers **shorter AI-related training** through seminars, workshops and conference sessions, often co-designed with school leaders and practitioners. Since 2021 these have increasingly addressed practical issues such as how to use AI tools in lesson planning, resource design and formative assessment. National and international collaborations, including partnerships with universities, research centres and European projects, further expand the offer. Under the Ministry's AI Roadmap, a more systematic framework for teacher AI competencies is being prepared, with a **dedicated national programme on AI literacy expected to launch in 2026**. While these initiatives mark important progress, stakeholders note that a comprehensive, system-wide framework for teacher AI competencies is still emerging.

3.3.2.3 National technological infrastructure and AI ecosystem

Cyprus's broader AI ecosystem provides an enabling context for educational uses. The **National Broadband Plan** 2021–2025 seeks universal access to high-speed connections, targeting at least 70% of households with 100 Mbps+ services. By 2024, 5G networks covered the entire population, with multiple operators offering services and typical urban speeds of 200–500 Mbps. Fibre-to-the-premises already reaches around 77% of households, and rural Very High Capacity Network coverage is above 55% (DMRID, 2024). Data-centre and cloud capacity is expanding, backed by government support and Digital Europe funding allocations for gigabit and cloud projects between 2023 and 2030.

The **national AI strategy**, first adopted in 2020 and now under revision, focuses on talent development, improved public services, sectoral competitiveness and trustworthy, ethical AI. It is supported by new AI-focused university programmes, MOOCs and upskilling initiatives, as well as a national Centre of Excellence for AI and accelerator schemes for AI startups. Over 25 AI-oriented startups operate in Cyprus, complemented by strong university research in fields such as natural-language processing, robotics, healthcare and smart cities, and participation in European AI projects, including collaborations like "Experience AI" with Google DeepMind. Business AI adoption is rising, particularly in sectors such as healthcare, energy, shipping and fintech, and is further stimulated by the IP Box regime with its favourable effective tax rate for qualifying IP.

From a regulatory standpoint, Cyprus is actively aligning its legal framework with the EU AI Act, strengthening the capacities of national authorities and preparing detailed national legislation and guidance for enforcement. Strategic investments in digital-skills training, including the €24 million package for 2023–2026, and in AI-enabled public services point towards a continued policy focus on digital transformation. For the AI4EDU project, this combination of strong infrastructure, a maturing AI-policy framework and growing teacher-development initiatives creates favourable conditions for piloting and scaling Study Buddy and Teacher Mate, while the remaining gaps in adult digital skills and in systematic AI-competence frameworks highlight the importance of targeted support and careful implementation.

3.3.3 Ireland (IE)

3.3.3.1 National Digital Transformation policies and strategies

Ireland's national digital transformation agenda is framed by Harnessing Digital: **The Digital Ireland Framework**, which sets out a whole-of-government vision for how digital technologies will drive inclusive economic growth, better public services and social cohesion. The framework identifies four pillars – digital transformation of business, digital infrastructure, digital skills, and digitalisation of public services – and commits to achieving the EU Digital Decade targets on connectivity, digital skills and public-service digitalisation. Education is explicitly positioned as a key enabler of this agenda, both in terms of building the future talent pipeline and ensuring that all learners can participate fully in a digital society.

Within school education, the **Digital Strategy for Schools to 2027**: Enhancing Teaching, Learning and Assessment provides the sector-specific roadmap for integrating digital technologies in primary and post-primary schools. It emphasises whole-school digital learning planning, the Digital Learning Framework, provision of infrastructure and technical support, and a strong focus on teacher professional learning. Together, the Digital Ireland Framework and the Digital Strategy for Schools create the policy conditions for AI-enabled innovation by prioritising digital inclusion, infrastructure, leadership and teacher capacity as prerequisites for any large-scale AI deployment in schools.

3.3.3.2 National AI strategies and governance frameworks

In parallel, Ireland has developed a comprehensive national AI strategy, AI – Here for Good: National Artificial Intelligence Strategy for Ireland, which articulates a human-centred, trustworthy approach to AI across the economy and public services. The strategy stresses the importance of ethics, fundamental-rights protection, transparency and public trust, while also promoting innovation, skills development and research. A subsequent progress report and refresh updated the strategy to reflect rapid developments in generative AI, highlighting the need for clear guidance for public-sector organisations, including schools, on safe and responsible use of AI systems.

The national AI governance framework is complemented by the establishment of an AI Advisory Council, which provides independent, expert advice to government on the opportunities and risks associated with AI. The Council's advice paper on AI and Education emphasises that AI tools should augment rather than replace teachers, calls for strong safeguards for children's rights and data protection, and recommends national guidance and professional development for educators as core enablers of trustworthy AI in schools.

Ireland's AI policy landscape is further shaped by EU-level regulation and guidance, particularly the Artificial Intelligence Act, which classifies many education-related AI systems as high-risk, and the EU Digital Education Action Plan 2021–2027, which calls on Member States to strengthen digital and AI literacy, teacher capacity and data-informed innovation in education. Ireland's participation in these EU frameworks reinforces the need to align national practice with European standards on risk management, transparency, human oversight and equity.

3.3.3.3 Education-focused digital and AI policies and initiatives

Within the school sector, the Digital Strategy for Schools to 2027 sets out a series of actions to support infrastructure, whole-school digital learning planning, leadership and teacher professional development. It builds on earlier investments in broadband, devices and school-level digital learning plans, and integrates digital technologies into broader school self-evaluation processes and leadership frameworks. Digital skills, safe and ethical use of technology, and student wellbeing are cross-cutting themes.

In 2025, the Department of Education, in collaboration with Oide, issued Guidance on Artificial Intelligence in Schools, providing the first dedicated national guidance on AI use in primary and post-primary education. The guidance emphasises safe, ethical and pedagogically sound use of AI, clarifies that AI tools should not replace teachers' professional judgement, and situates AI firmly within existing legal and policy frameworks, including GDPR, child protection, data-protection guidance and school self-evaluation. It also encourages schools to develop local AI policies, in consultation with boards of management, staff, students and parents, aligned with national principles.

In addition to formal guidance, Irish schools are starting to explore AI-enabled tools for lesson planning, differentiation and administrative tasks, often supported by local initiatives from education and training boards, school networks and professional associations. The AI4EDU pilots in Irish schools illustrate how AI assistants such as Study Buddy and Teacher Mate can support formative assessment, feedback and Sustainability Citizenship-oriented inquiry when deployed within a clear pedagogical and governance frame.

Despite these advances, challenges remain. Recent European monitoring reports highlight persistent skills gaps and equity concerns across Europe, including Ireland, and emphasise the need to ensure that AI-enabled innovation does not exacerbate existing inequalities between schools and students. Access to devices, connectivity, time for teacher collaboration and clarity of expectations are ongoing constraints for many schools.

3.3.3.4 National-level initiatives for teachers' capacity building in Generative AI

Ireland is taking initial steps towards preparing educators for the pedagogical and ethical integration of AI, including Generative AI, into teaching and learning. While a fully unified national training framework dedicated specifically to AI is still emerging, a number of initiatives provide opportunities for teacher upskilling within the broader digital-learning agenda.

a. Department of Education and Oide AI-related professional development

Building on the Digital Strategy for Schools to 2027, Oide has developed and delivered professional development opportunities that address AI within the wider context of digital learning. These include webinars, workshops and online modules on topics such as understanding generative AI, using AI-enabled tools to support planning, differentiation and assessment, evaluating AI outputs critically and ethically, and supporting students to use AI responsibly. AI is also being integrated into existing digital-learning CPD strands, enabling teachers to explore AI in relation to digital citizenship, wellbeing and assessment for learning.

These centrally supported CPD offerings are complemented by resources and exemplars provided through the national AI guidance, helping school leaders and digital-learning teams to align local practice with national expectations and legal requirements.

b. Professional development initiatives by higher-education institutions and other actors

Universities, research centres and professional networks in Ireland have begun to offer short courses, micro-credentials and workshops on AI in education. These initiatives, often developed in partnership with schools, focus on pedagogical innovation, critical AI literacy, ethics and data protection, and provide opportunities for teachers to engage with cutting-edge research and practice. While currently uneven in coverage and not always free of charge, they reflect growing demand from educators for structured upskilling in AI and Generative AI.

3.3.3.5 National technological infrastructure and AI advancements

Ireland has significantly strengthened its digital infrastructure for education over the past decade. The national schools broadband programme, national connectivity initiatives and device-grant schemes have improved access to high-speed internet and digital devices for many schools, although gaps remain, particularly for smaller rural schools and schools serving disadvantaged communities. The Digital Strategy for Schools emphasises ongoing investment in reliable infrastructure, technical support and cybersecurity as essential enablers of digital and AI-enhanced teaching and learning.

Beyond schools, Ireland hosts a strong AI and data-analytics research and innovation ecosystem, including research centres focused on AI, data science and software, as well as national digital-innovation hubs and testbeds. These centres play an important role in advancing AI methods, exploring applications in education and other public-service domains, and contributing to the development of trustworthy AI aligned with European values and regulatory requirements.

Ireland's participation in EU-level digital and AI programmes, together with its domestic policy frameworks and research capacity, positions it well to experiment with AI-enabled education in a way that is cautious, rights-respecting and evidence-informed. However, to realise this potential fully, continued investment in infrastructure, capacity building, governance and evaluation – such as those explored in AI4EDU – will be required.

Finally, in 2025 the Irish Department of Education and Youth published *Guidance on Artificial Intelligence (AI) in Schools* as a national, "living" resource that will be reviewed and updated regularly, positioning AI as a tool to be used safely, ethically and in alignment with the Digital Strategy for Schools to 2027 (Department of Education and Youth, 2025; Department of Education, 2025). The guidance, informed by the AI Advisory Council's February 2025 advice paper on AI and education, foregrounds privacy, data protection, equity and AI literacy, and explicitly promotes authentic assessment, critical thinking and the transparent acknowledgement of AI-generated material, rather than over-reliance on AI-detection tools (AI Advisory Council, 2025). Ireland has also been among the early movers in implementing the EU AI Act, becoming one of the first six Member States to designate 15 national competent authorities for AI oversight and committing to establish a National AI Office as the central coordinating authority by 2026 (Department of Enterprise, Trade and Employment, 2025). For AI4EDU, this means that project-level evidence and tools must align with a relatively mature national policy and regulatory environment in which schools are expected to demonstrate both innovation and compliance.

3.3.4 Sweden (SE)

3.3.4.1 National Digital Transformation policies and strategies

Sweden's digital education agenda is embedded in the **National Digitalisation Strategy for the School System** (2023), which provides an overarching framework to enhance digital competence, equitable access, and strategic use of digital tools across all levels of schooling. The strategy emphasises that children, pupils, and young people should develop robust digital skills; school leaders and staff (pre-school, primary, secondary) must be equipped to lead and implement digital development; and educational institutions should have the capacity to select and use digital tools purposefully and responsibly. [19]

3.3.4.2 National AI strategies and governance frameworks

Sweden's general AI-governance and strategic orientation is currently defined by the **AI Sweden (the national centre for applied AI)** through its An AI Strategy for Sweden, a forward-looking, adoption-oriented strategy that urges cross-sector collaboration, scaling AI usage across private and public sectors, and leveraging Sweden's democratic values, welfare model, and social stability [20]. In parallel, the technical and institutional groundwork laid by the Vinnova (Sweden's innovation agency) supports research, innovation and use, as well as infrastructure and frameworks for AI deployment, in line with the four pillars defined in the 2018 national AI approach: education &

[19] https://digital-skills-jobs.europa.eu/en/actions/national-initiatives/national-strategies/sweden-national-digitalisation-strategy-school-0

[20] https://strategy.ai.se/

training; research; innovation & use; framework & infrastructure [21]. More recently, the Swedish government has launched the **Swedish AI Commission**, which is tasked with developing a dedicated, updated national AI strategy. Their roadmap (issued late 2024) aims to ensure sustainable and safe AI development, including in public administration, welfare, and potentially education[22].

3.3.4.3 Education-focused digital and AI policies and initiatives

At the education-sector level, **Skolverket (the Swedish National Agency for Education)** has begun to articulate guidance for the introduction and use of AI/AI-tools in schools. Its December 2024 report Artificiell intelligens i undervisningen provides a "status picture" of how teachers currently handle and use AI in elementary schools, preschool classes, and after-school institutions [23].

Skolverket's public guidance on "**AI, chatbots and similar tools**" notes that AI in schools is still under development, encourages cautious, pedagogically driven adoption, emphasises ethical considerations, source criticism (källkritik), and reflection. Moreover, from autumn 2024, AI has been formally introduced as a subject in upper secondary school ("gymnasiet") and adult education (komvux)[24]. These developments indicate that Sweden is moving beyond experimentation, starting to embed AI literacy, responsible use, and awareness of AI's implications across the school system.

The decentralised, loosely regulated nature of AI deployment in Swedish schools raises concerns about equity, fairness, and consistent quality of AI-enabled education across different socio-economic and regional contexts. As documented in recent research, using AI in compulsory education without central coordination or equity safeguards may exacerbate existing inequalities [25]. Moreover, some critics argue that the ongoing national AI strategy (2025–2030) currently being developed does not explicitly include the school system, thereby leaving AI education to fragmented local initiatives.

These gaps underscore the need for more coordinated national-level policies to ensure responsible, inclusive and equitable AI adoption in education, especially to provide all students with a baseline AI literacy, critical digital competences, and to support teachers with proper training and resources.

3.3.4.4 National-level initiatives for teachers' capacity building in AI

Sweden invests in building competence and capacity for AI through the **AI Competence for Sweden**, a national cooperation initiative launched in 2018, aimed at promoting AI-related education and development for professionals, through courses, events, and collaboration among universities.

This complements traditional academic research and innovation channels, helping to feed a pipeline of skilled professionals and educators who could support future AI-based educational initiatives. At higher-education level and in vocational education, early studies show that students

[21] https://ai-watch.ec.europa.eu/countries/sweden/sweden-ai-strategy-report_en
[22] https://www.sou.gov.se/globalassets/the-ai-commissions-roadmap-for-sweden.pdf
[23] https://www.skolverket.se/download/18.6957b350193addf830f35/1733845119982/pdf13183.pdf
[24] https://www.skolverket.se/kompetensutveckling/stod-i-arbetet/rad-om-ai-chattbottar-och-liknande-verktyg
[25] Utterberg Modén, M., Ponti, M., Lundin, J., & Tallvid, M. (2025). When fairness is an abstraction: equity and AI in Swedish compulsory education. *Scandinavian Journal of Educational Research*, *69*(4), 790-804.

find AI tools useful for information retrieval, summarisation and elaboration of academic concepts; but there are also ethical concerns, especially regarding academic integrity and fairness.

3.3.4.5 National technological infrastructure and AI advancements

Sweden has developed several high-quality Swedish-language BERT models over the last few years, driven primarily by:

- AI Sweden
- RISE (Research Institutes of Sweden)
- KB Lab (the National Library of Sweden)
- Swedish universities (e.g., Uppsala, Chalmers)

These models support Sweden's broader goal of strengthening digital sovereignty, improving NLP for Swedish, and enabling culturally aligned AI systems.

3.3.5 Conclusions: Convergence, gaps and implications

The national analyses presented above indicate both **convergence in direction and divergence in readiness** across Greece, Cyprus, Ireland and Sweden with regard to AI integration in education. All four systems are aligning, to varying degrees, with global and European frameworks that frame AI as a high-responsibility technology in educational settings, emphasising human-centred design, learner protection, transparency, and the central role of teachers. AI is consistently positioned as a supportive resource for teaching and learning, rather than as a substitute for curricular structures or professional judgement.

At the same time, national pathways towards this shared direction differ. Countries vary in the maturity of AI-specific education policies, the coherence of professional-development ecosystems, the availability of digital and AI infrastructure, and the strength of local AI research and language resources. Differences in baseline digital skills, institutional capacity and governance arrangements further condition how quickly and equitably AI can be adopted in schools. These variations suggest that while policy intent is broadly aligned, implementation conditions are uneven.

Across national contexts, several **common challenges** emerge. These include translating high-level policy principles into actionable guidance for schools, ensuring assessment integrity in AI-supported learning environments. Although teacher professional development is widely recognised as a critical enabler, AI-specific learning opportunities are often fragmented or pilot-based, rather than embedded within sustained, system-level professional-learning pathways aligned with existing competence frameworks. The large-scale implementation of AI literacy programmes for teachers and students, as well as the alignment of new AI tools with established curricula and pedagogical practices, also remain significant challenges. In addition, limitations in interoperability and data-governance readiness remain a cross-cutting concern, particularly in light of emerging regulatory requirements at EU level.

The analysis also points to **shared enabling conditions** across the four countries. Investment in public digital infrastructure, national or regional AI research ecosystems and language resources create more favourable conditions for educational AI that is culturally and linguistically aligned. In parallel, growing attention to AI literacy, understood as a combination of technical understanding, critical evaluation and ethical awareness, signals a shift towards preparing both teachers and learners to engage with AI as informed and reflective users rather than passive consumers.

Moreover, these national-level insights **mirror the convergences and gaps identified in the EU and international exemplars reviewed in Sections 3.3 and 3.4**. Across both European and non-European contexts, there is strong alignment on normative principles for AI in education, including human-centred design, teacher agency, learner protection and transparency, combined with persistent challenges in translating policy intent into sustained, classroom-ready practice.

The above convergences and gaps highlight the importance of **context-sensitive implementation approaches.** They suggest that effective AI adoption in education depends on technology availability and readiness as well as on the alignment of pedagogy, governance, professional learning and infrastructure within specific national and institutional settings. This insight provides the contextual foundation for the implementation guidelines and policy recommendations developed in the Sections 6 and 7, which seek to translate shared policy orientations into practical, adaptable pathways for schools and education systems.

4. Literature Review on Generative AI in Education

This Section provides a December 2025 "snapshot" of the state of knowledge on GenAI in education. It integrates empirical studies and reviews of GenAI uses on the use of GenAI in education, with a focus on patterns of use, adoption enablers and barriers, pedagogical implications, and systemic risks and constraints. Rather than providing an exhaustive account of individual studies, the section adopts a thematic synthesis approach, drawing out convergent findings and points of debate that are most relevant to secondary education.

Within these limits, the review complements the policy and governance context presented in Section 3 by focusing on how GenAI is used and experienced in practice, and on the conditions under which it supports or undermines educational aims. It provides an interpretive framework for understanding and contextualising the AI4EDU project findings presented in Section 5.

4.1 Patterns and trends of GenAI use in education

The literature indicates that the uptake of GenAI in education is rapid, uneven and largely practice-driven, with use frequently emerging ahead of formal institutional guidance or regulation (UNESCO, 2023; U.S. Department of Education, 2023; OECD, 2023). Across both K–12 and higher education contexts, GenAI is predominantly used as an assistive technology, supporting existing educational practices rather than functioning as an autonomous instructional agent.

For teachers, reported patterns of use focus primarily on preparatory and supportive activities, including lesson planning, content adaptation, generation of examples and explanations, differentiation of materials, and drafting formative feedback (Mhlanga, 2023; Zhang et al., 2024; Albadarin et al., 2024). These uses are generally perceived as lower risk, as they remain under direct teacher control and align with established pedagogical workflows. Teacher uptake is consistently associated with perceived workload reduction and the ability to verify and contextualise AI-generated outputs (OECD, 2023; UNESCO, 2023).

Students' use of GenAI is more varied and frequently informal or unsanctioned, particularly in the absence of clear school-level guidance (UNESCO, 2023). Common student use cases include brainstorming, summarising, language support, concept explanation and feedback on drafts. While students value the immediacy and flexibility of GenAI tools, studies report widespread uncertainty regarding acceptable use, especially in relation to assessed work, contributing to anxiety and inconsistent practices rather than deliberate misconduct (UNESCO, 2023; U.S. Department of Education, 2023).

Across the literature, teacher-mediated, curriculum-aligned use emerges as a recurring condition for constructive engagement. GenAI use that is embedded within explicitly designed tasks, e.g. requiring comparison, verification, interpretation or reflection, appears more pedagogically productive than unstructured, individualised use (Zhang et al., 2024; UNESCO, 2023). Evidence from higher education, while not directly transferable to compulsory schooling, suggests that coherent institutional approaches reduce confusion and inequity compared to fragmented, faculty-level responses (Mhlanga, 2023; Albadarin et al., 2024).

4.2 Adoption enablers, barriers and trust

Research consistently characterises attitudes towards GenAI in education as pragmatic but ambivalent. Surveys and consultations show that teachers, parents and students recognise potential benefits—particularly workload reduction, improved feedback and accessibility—while simultaneously expressing concerns about accuracy, surveillance, concentration of power, job displacement and inequality (KPMG International, 2023; OECD, 2023; UNESCO, 2023).

Adoption is strongly influenced by trust and perceived legitimacy. Teachers are more likely to engage with GenAI when institutional guidance clarifies acceptable use, data protection responsibilities and assessment expectations, thereby reducing professional risk (U.S. Department of Education, 2023; OECD, 2023). Conversely, uncertainty about accountability, explainability and legal compliance acts as a significant barrier, even when technical access is available (UNESCO, 2023).

Organisational psychology and change-management literature emphasises that AI adoption is a social and organisational process, not merely a technical one. Perceptions of autonomy, fairness, role clarity and leadership support shape whether educators adopt, adapt or resist GenAI tools (OECD, 2023; Aspen Institute, 2023). Where AI is framed as surveillance or imposed without consultation, it is perceived as an additional burden; where educators are involved as co-designers and provided with time to experiment, trust and uptake increase.

4.3 Pedagogical implications and learning outcomes

Evidence on the pedagogical impact of GenAI suggests modest to moderate learning gains, highly contingent on task design, teacher mediation and alignment with learning objectives (Mhlanga, 2023; Zhang et al., 2024; Albadarin et al., 2024). Reported benefits are most consistent in areas such as formative feedback, drafting and revision, retrieval practice and explanation, particularly when GenAI is embedded within structured learning designs.

Discipline-specific case studies document constructive uses in domains such as health professions education, language learning and business education, where GenAI supports preparation, reflection and feedback rather than replacing core learning activities (Zhang et al., 2024). However, the literature cautions against overgeneralisation, noting that evidence remains uneven across subjects, age groups and educational levels.

Pedagogical research increasingly frames prompting and interaction with AI as a form of critical literacy, rather than a purely technical skill. When learners are encouraged to iteratively refine prompts, request explanations, and cross-check AI outputs against trusted sources, studies report gains in metacognitive awareness and epistemic judgement (UNESCO, 2023). Conversely, unstructured reliance on GenAI risks superficial learning and reduced engagement with underlying concepts.

4.4 Assessment integrity, wellbeing and equity

Assessment integrity emerges as one of the most significant challenges associated with GenAI in education. A growing body of literature highlights the limitations and risks of AI-detection tools, including high false-positive and false-negative rates and disproportionate impacts on second-language learners (UNESCO, 2023; U.S. Department of Education, 2023). As a result, researchers increasingly recommend shifting away from detection-led approaches towards assessment redesign, disclosure practices and process-based evidence of learning.

Concerns about student wellbeing and equitable participation are also prominent. Cross-national analyses indicate that moderate, purposeful use of digital technologies can support engagement and access, while excessive or unstructured use—particularly via personal devices—can be associated with anxiety, distraction and reduced wellbeing (OECD, 2023; European Commission, 2025a). These risks are amplified where digitalisation initiatives lack clear pedagogical aims or underestimate teacher workload and support needs (UNESCO, 2023).

Equity considerations cut across these issues. The literature documents risks of bias, uneven performance across languages and dialects, and the marginalisation of low-resource languages in AI systems (UNESCO, 2023; OECD, 2019). Ethical guidance therefore emphasises inclusive design, multilingual support, data minimisation and child-rights safeguards as foundational requirements for any educational AI deployment (UNICEF, 2021; UNESCO, 2023).

4.5 Organisational and system-level conditions for adoption

Beyond classroom practices, the literature highlights organisational readiness and system-level capacity as decisive factors in whether GenAI deployments generate sustainable value. Common constraints include fragmented professional-development provision, limited time for experimentation, uneven device and connectivity baselines, and weak interoperability between learning platforms and information systems (UNESCO, 2023; European Commission, 2025a).

Teacher professional development is widely recognised as a critical enabler, yet AI Literacy opportunities are often pilot-based or ad hoc, rather than embedded within coherent, multi-year pathways aligned with existing competence frameworks (OECD, 2023; UNESCO, 2023). Studies suggest that informal experimentation by teachers frequently outpaces formal CPD and policy, creating both innovation and risk.

System-level analyses further emphasise that siloed digital ecosystems complicate governance, analytics and compliance with emerging regulatory requirements, increasing the risk of vendor lock-in and limiting institutional oversight (OECD, 2019; European Commission, 2024). Effective AI adoption therefore depends on alignment between governance, infrastructure, professional learning and pedagogical practice, rather than on tool availability alone.

4.6 Synthesis: implications for interpreting AI4EDU evidence

The literature reviewed in this section converges on several key insights. First, GenAI use in education is currently incremental and pragmatic, shaped more by immediate classroom needs and organisational conditions than by long-term system design. Second, evidence of learning benefits is conditional, depending on pedagogical mediation, task design and alignment with curricula. Third, the most significant risks relate not to AI capability per se, but to assessment integrity, equity, wellbeing and governance.

The literature also highlights substantial evidence gaps. Most empirical studies remain short-term and context-specific, offering limited insight into sustained, system-level impacts. This underscores the importance of cautious interpretation, iterative evaluation and adaptive implementation strategies.

These findings provide the analytical backdrop for interpreting AI4EDU's project evidence. They help situate project results within broader research trends and clarify why implementation fidelity, professional learning and governance conditions are critical variables. The following sections build on this foundation to translate both external research and project-generated evidence into implementation guidelines and policy recommendations.

5. Findings and analysis

This section presents and analyses the evidence generated by the AI4EDU project, with a primary focus on findings from the classroom pilots implemented under WP4 (usability and technology acceptance) and WP6 (educational impact). These pilots were conducted across Cyprus, Greece, Ireland and Sweden and constitute the project's main empirical basis for understanding how AI assistants can be integrated into real school settings, under authentic curricular, organisational and policy conditions.

Evidence from the pilots includes usability observations, technology-acceptance measures, classroom observations, pre- and post-intervention assessments, motivation and engagement data, and qualitative feedback from teachers and students, as documented in Deliverables D4.2 and D6.2. This evidence is complemented by market-validation findings produced within the project, which provide an additional perspective on adoption drivers, institutional constraints and implementation feasibility. Market-validation evidence is treated as a distinct but complementary source, informing the development of implementation guidelines and policy recommendations without substituting for classroom impact evidence.

To reflect the project design and evidence base, the analysis in this section is organised as follows. Section 5.1 examines findings from the pilots, focusing on usability, acceptance, classroom practices and educational impact. Section 5.2 presents insights from market-validation activities related to adoption and implementation conditions. Section 5.3 synthesises these evidence streams and identifies cross-cutting findings that directly inform the implementation guidelines and policy recommendations presented in Sections 6 and 7, respectively.

5.1 Evidence from classroom pilots (learning with AI)

This section presents evidence from AI4EDU's empirical pilot activities examining the use of AI assistants in educational settings. It synthesises findings from two sequential and methodologically distinct pilot phases: **WP4**, which focused on usability and technology acceptance through structured, facilitator-led workshops, and **WP6**, which examined educational impact through classroom-based implementations under real teaching conditions.

WP4 generated baseline evidence on how teachers and students perceived, understood and engaged with the SB and TM tools following guided demonstrations and hands-on use. This phase established whether the tools were usable, acceptable and sufficiently mature to justify further testing, while also surfacing perceived barriers, uncertainties and enabling conditions relevant to later implementation.

Building on these findings, WP6 explored the educational value of AI4EDU tools when integrated into curriculum-aligned classroom activities, with teachers mediating use and evaluation instruments capturing learning-related outcomes, engagement and classroom dynamics. The combined analysis allows for progression from *first-contact acceptance* to *contextualised educational use*, while avoiding conflation between workshop-based evaluation and sustained classroom practice.

Throughout this section, findings are grounded explicitly in the scope and design of each pilot phase. Evidence is used to inform implementation guidelines by identifying *what was feasible under controlled conditions*, *what became meaningful in classroom settings*, and *which contextual factors shaped outcomes across countries*.

5.1.1 Usability and technology acceptance (WP4)

The first pilot cycle of AI4EDU (WP4) examined the usability, technology acceptance and early readiness conditions for deploying SB and TM applications in secondary-school settings. The evaluation, documented in Deliverable D4.2, was conducted across Cyprus, Greece, Ireland and Sweden and involved teachers and students participating in structured, partner-facilitated pilot workshops. These activities were not classroom pilots but controlled testing sessions, in which teachers and students were first introduced to the tools, observed live demonstrations, and then engaged in guided hands-on use before completing quantitative and qualitative evaluation instruments.

WP4 combined quantitative measures of usability and acceptance with qualitative data from open-ended questionnaires, observations and facilitated discussions, enabling the researchers to identify barriers, enablers and contextual factors relevant to subsequent implementation.

Quantitative data collected through a Technology Acceptance Model (TAM)–based questionnaire indicates generally positive perceptions across all core constructs: Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Attitudes Toward Use (ATU) and Self-Efficacy (SE). Mean scores for both tools exceeded the neutral midpoint for both teachers and students, suggesting that *first-contact usability* was not a major barrier to engagement. PEOU and SE received the strongest ratings, indicating that participants felt confident navigating the interfaces and believed they could use the tools independently after brief instruction. PU, while still positive, was consistently lower than the other constructs, signalling that participants required clearer evidence of how the tools would fit into their everyday instructional or learning practices (D4.2).

However, the distribution of responses revealed important variation across countries and user groups. **Teachers** consistently reported higher acceptance and confidence than students, particularly with respect to self-efficacy and attitudes toward use. **Students'** responses were more dispersed, with a higher proportion of neutral ratings, indicating uncertainty rather than rejection. These patterns suggest that familiarity, prior experience with digital tools, and clarity of pedagogical purpose play a significant role in shaping early acceptance.

Country-level differences were also evident. Participants in Ireland and Cyprus tended to report higher usability and acceptance scores, while responses in Greece and Sweden were more mixed. Qualitative feedback suggests that these differences were influenced both by the tools themselves and by contextual conditions, such as pilot timing within the school year, access to devices, and prior exposure to AI-supported learning environments.

Qualitative data from WP4 provide deeper insight into readiness conditions and perceived barriers, which are directly relevant to implementation planning. More specifically, **teachers** across all countries highlighted perceived workload relief as a key driver of acceptance for TM. Planning support, generation of worksheets and quizzes, and assistance with formative assessment were repeatedly reported as valuable. At the same time, teachers emphasised that usefulness depended on tight alignment with national curricula and textbooks, and expressed caution where AI outputs were perceived as too generic or insufficiently contextualised.

Students' qualitative feedback revealed a different set of readiness issues. While many appreciated the immediacy and conversational nature of Study Buddy, others expressed uncertainty about how and when the tool should be used, especially in relation to homework and assessment. Concerns about over-reliance, distraction and the risk of "getting the answer too easily" were common, indicating the need for explicit classroom norms and teacher mediation.

Across countries, both teachers and students raised recurring concerns related to:

- Reliability and accuracy of AI-generated responses (hallucinations, inconsistencies);
- Transparency regarding how answers were produced and what sources were used; and
- Digital confidence, especially among teachers and students with lower prior exposure to AI tools.

Importantly, these concerns point to a form of conditional acceptance, where users are willing to engage provided that safeguards, guidance and clear expectations are in place.

In addition to general acceptance patterns, WP4 qualitative evidence also demonstrated **specific usability limitations** that shaped early user experience and informed subsequent redesign. For **SB**, students reported that early responses were often overly verbose, rigid in tone, or insufficiently adapted to age, grade level and prior knowledge. The interface was described as too plain and students requested greater personalisation, clearer task framing, and more flexible feedback during test-taking and revision activities. Some students also perceived automated grading and feedback as inflexible.

For **TM**, teachers consistently identified **limitations in customisation and integration** as the main acceptance limitations. Early versions did not sufficiently support differentiation by grade level, learning objectives or special educational needs, and teachers requested greater control over rubrics, assessment criteria and instructional parameters. A recurring request concerned the ability to upload and reuse **teachers' own materials** (e.g. worksheets, notes, supplementary readings), reflecting concerns about **curriculum alignment and pedagogical ownership.** Teachers also highlighted the need for improved class-management features and **longitudinal performance tracking**, noting that without such functionality the tool risked remaining peripheral to everyday planning workflows.

These usability findings point to a critical distinction identified during WP4: while **basic interaction and navigation posed few barriers**, perceived pedagogical value depended on *adaptability, curricular anchoring and professional control*. This gap between ease of use and perceived usefulness directly informed the WP5 development cycle, including the introduction of teacher-uploaded content via RAG pipelines, refined prompting structures, enhanced dashboards and expanded differentiation tools. As such, WP4 usability evidence did not merely assess acceptance but functioned as **implementation evidence**, clarifying the conditions under which AI assistants could realistically be embedded into teachers' and students' everyday practices.

5.1.2 Educational impact and classroom integration (WP6)

The WP6 pilots provide the project's primary evidence on the **educational impact** of AI-supported learning with SB and TM. Across the four participating countries, AI assistants were integrated into regular classroom activities, including concept explanation, retrieval practice, exam preparation, formative feedback, and inquiry-based tasks. Teachers retained responsibility for lesson design, task framing, and assessment decisions, while students interacted with SB as a learning support either in class, in the context of teacher-led lesson plans, or at home as a study companion.

Quantitative pre- and post-test data on academic achievement reported in D6.2 indicate **small-to-moderate learning gains** for the experimental groups (i.e. students who used SB). Gains were most consistently observed in activities involving:

- clarification of difficult concepts,
- critically evaluating AI responses
- revision prior to assessments, and
- iterative drafting with feedback.

These effects were not uniform across contexts. Evidence from Cyprus, Greece and Ireland indicates that systematic teacher scaffolding was the main factor differentiating superficial from deeper use. In **Cyprus and Greece**, experimental groups where teachers explicitly embedded SB into lesson plans, pre-defined learning goals, discussed AI responses collectively in class, showed broader use of SB features, and statistically significant learning gains. In **Ireland**, *all pilot groups* demonstrated this pattern. Teachers consistently framed SB use within inquiry-based and revision-oriented tasks, which resulted in more frequent exploration of extended explanations and higher persistence during learning activities. Motivation and engagement measures further reinforce this finding, particularly in the Irish pilots:

- Students reported higher motivation and perceived usefulness when SB was embedded in meaningful tasks.
- Teachers observed increased participation, especially among students who were typically less confident or less vocal in class.

- Increased engagement was associated with greater overall participation, not only with AI interaction but also with classroom discussion and follow-up activities.

These results show that students were more likely to engage with cognitively demanding content when teachers were well-prepared, confident and motivated, and when AI use was tightly aligned with curricular goals rather than offered as an optional add-on.

A significant contribution of WP6 lies in its attention to **inclusive-education dimensions.** Evidence from teacher interviews, classroom observations, and student questionnaires, especially in the Irish context, suggests that AI assistants can support inclusion when used deliberately and within a psychologically safe classroom environment. In DEIS school context, observers documented significant increase in student engagement in the experimental group, alongside heightened cognitive and emotional involvement in curriculum-related tasks. More specifically:

- Students with learning difficulties or lower prior attainment benefited from re-phrased explanations, scaffolded hints, and self-paced interaction.
- Multilingual and second-language learners reported value in simplified language, repeated explanations, and clarification of terminology. In the Irish pilot, this was associated with substantial improvements in language development, including reported gains in academic vocabulary use and English-language acquisition.
- Teachers noted reduced stigma compared to asking questions publicly, particularly for students who are reluctant to participate orally. AI-mediated interaction enabled students to “find their voice” in both written and spoken contributions, supporting participation without fear of embarrassment.

At the same time, results highlight that inclusion benefits are required explicit guidance from teachers, otherwise students over-relied on AI or disengaged from peer interaction. Teachers stressed the importance of structured prompts, time-bounded use, and follow-up discussion to ensure that AI supported learning rather than replacing effort.

WP6 findings also underscore that educational impact is strongly mediated by organisational and psychosocial factors. In the Irish case, organisational-psychology survey data revealed very high levels of psychological safety among teachers, which facilitated experimentation, shared reflection and co-design of AI-supported activities. Where such conditions were present, teachers reported greater agility in lesson adaptation, stronger peer collaboration and a shift from directive instruction towards facilitation and mentoring. In contrast, across other contexts, timetable rigidity, exam pressures, and class size constrained both the depth and continuity of AI use. Short pilot durations further limited the establishment of sustained routines, particularly in exam-oriented grades.

Leadership support and coordination also mattered. Schools where AI4EDU activities were aligned with broader digital-education priorities and where teachers had space to reflect and adapt reported smoother implementation. Conversely, fragmented scheduling or lack of shared expectations increased teacher workload and reduced perceived value.

Overall, WP6 evidence demonstrates that AI assistants can add educational value when they are **curriculum-aligned, teacher-mediated, and organisationally supported.** Learning gains, motivation and inclusion benefits depend highly on how they are introduced, bounded, and integrated into everyday classroom practice, particularly within environments characterised by trust, collaboration and psychological safety.

5.2 Patterns of classroom use of AI4EDU tools

This section describes the **recurring patterns of classroom and school-level use** of the AI4EDU tools, SB and TM, as observed during the educational-impact pilots (WP6). The focus here is on *how* the tools were integrated into teaching and learning processes, *when* they were used, and *under what organisational and pedagogical conditions*.

Evidence is drawn from classroom observations, teacher interviews, student feedback, and system usage data collected during the pilots. Log data are used descriptively to identify temporal and functional patterns of interaction, not as proxies for learning gains.

Across countries and subjects, AI4EDU tools were not used as stand-alone applications, but were embedded within existing pedagogical routines and curricular structures. The patterns below represent **stable and repeated modes of use** that emerged across pilot sites.

(a) TM was primarily used outside live teaching time to support lesson preparation, instructional design and formative assessment. Teachers used the tool to structure lesson plans aligned with national curricula, generate differentiated learning materials, draft quizzes and formative questions, and prepare feedback templates. These uses were most common before lessons or between teaching sessions, reinforcing **TM's role as a planning and orchestration aid** rather than an in-class automation tool.

(b) SB was used **both in class and at home**, mainly for concept clarification, revision and guided practice. Typical student interactions included requesting alternative explanations, summarisation of textbook-aligned content and preparation for tests or assignments. Use was most effective when SB activities were **framed by the teacher**, embedded in lesson sequences or revision tasks, and accompanied by explicit guidance on acceptable use.

(c) A critical pattern across pilots was the degree of **teacher mediation**. Effective use involved teacher-demonstrated examples, structured tasks and follow-up discussion. Where AI use was left entirely open-ended, students were more likely to treat SB as a shortcut or a general chat tool rather than as a learning support, reinforcing the importance of **orchestration** rather than unrestricted access.

(d) **Context-specific variation.** Organisational factors such as timetable constraints and exam schedules shaped the frequency and continuity of use.

These patterns indicate that AI4EDU tools function most effectively as **teacher-mediated, curriculum-aligned supports embedded in everyday practice**, rather than as autonomous learning systems. Understanding these patterns is essential for interpreting the educational-impact findings reported in Section 5.1 and for translating project evidence into scalable implementation guidance in Section 6.

5.3 Technical and development-oriented findings from iterative development cycles (WP3–WP5)

In parallel with usability testing and educational impact evaluation pilots, AI4EDU generated substantial evidence through its iterative technical design and development cycles (WP3 and WP5). These activities produced implementation-relevant findings that demonstrate how legal, technical and pedagogical constraints shape the feasibility and effectiveness of AI systems in school education.

A first set of findings concerns **curriculum integration and the availability of educational content for AI processing**. While curriculum alignment emerged as a non-negotiable requirement across all participating countries, the practical conditions for integrating official school textbooks and teaching materials varied considerably. In several contexts, **textbooks were unavailable in digital form, available only as scanned or poorly structured PDFs**, or subject to **copyright restrictions** that limited their direct ingestion into AI pipelines. Even where digital materials were available, differences in formatting, language encoding and metadata quality affected their suitability for RAG. These challenges highlight the importance of early auditing of curricular resources, licensing conditions and technical processability when designing AI systems intended to operate on approved educational content.

A second set of findings relates to **data protection and identity management.** In line with GDPR and child-rights guidance, AI4EDU initially implemented fully anonymous teacher-generated student accounts to login to SB, minimising the collection and storage of personal data. While this approach strengthened privacy protection, pilot feedback revealed usability issues as teachers reported difficulties in tracking student progress over time, and integrating AI-supported activities into existing assessment and classroom-management practices. This evidence illustrates a recurring tension between privacy-by-design and educational functionality, suggesting the need for carefully governed identity-management models that balance data minimisation with pedagogical usability and accountability.

Further findings emerged around **prompting practices and prompt literacy**. AI4EDU introduced visible prompts, exemplars and scaffolded interaction structures to guide users in framing productive requests. This experience demonstrates that prompt literacy is a practical competence closely linked to AI literacy and that it should be supported through system design, not assumed as an implicit user skill.

The development cycles also reinforced the necessity of **explicit teacher-in-the-loop mechanisms**, particularly for assessment-related uses. By design, the project prioritised human review and professional judgement before assessment-related outputs were assigned or returned to students, a feature highly valued by educators. As a result, TM was designed to require teacher verification and editing of AI-generated assessment materials prior to classroom use.

A further set of findings concerns **behavioural shaping, safety constraints and user conduct** in AI-mediated environments. AI4EDU implemented prompt-based and system-level constraints to ensure that SB and TM declined to engage with inappropriate, unsafe or out-of-context requests and consistently redirected interactions toward educational purposes. Students were explicitly informed that they were interacting with an AI assistant, and clear warnings were provided advising against the disclosure of personal data or inappropriate content. Despite these safeguards, pilot evidence shows that some students nonetheless shared personal information, personal narratives or inappropriate material, particularly during exploratory or off-task interactions. This highlights a gap between declarative understanding and actual practice of personal data protection.

These observations underline two critical implementation lessons. First, technical safeguards and warnings alone are insufficient to ensure safe and appropriate use of AI in school contexts; they must be complemented by active teacher mediation, clear classroom norms and task-bounded use. Second, the persistence of unsafe or inappropriate interactions reinforces the importance of limiting data access by default, minimising data retention, and designing systems that do not rely on the collection of sensitive information to function effectively.

5.4 Market-validation insights

Beyond classroom pilots, AI4EDU commissioned an external **market-validation study,** supervised by LTU Business, of Luleå University of Technology as part of the Summer Consultants 2025 program. Using the Innovation Due Diligence methodology, the study explored the market landscape for AI in education, engaging with educators, EdTech experts, policymakers, and parents (Abrahamsson and Henriksson, 2025).

5.3.1 Market positioning

The LTU report characterises the educational-AI market as **crowded but fragmented**, with:

- a small number of large, platform-based actors (LMS providers, commercial GenAI platforms);
- numerous niche tools focusing on specific tasks (grading, quiz generation, language support); and
- limited integration between AI tools and existing school systems.

AI4EDU is positioned as a **dual-assistant, EU-anchored solution** that can sit on top of existing infrastructures while offering curriculum-aligned support. The report notes that AI4EDU's differentiators include:

- explicit **human-in-the-loop design** (teacher-assistant and student-assistant separation);
- grounded on a **scientific** pedagogical framework and research findings;
- emphasis on **compliance** with EU data-protection requirements; and
- focus on **multilingual and curriculum-anchored RAG.**

However, the report emphasises that **technical differentiation alone is insufficient**; long procurement cycles, risk aversion and capacity constraints in schools mean that "implementation readiness" and evidence of impact are equally critical.

5.3.2 Stakeholders' insights

The LTU study confirms many of the attitudes documented in global trust studies: teachers and parents are **pragmatic and ambivalent**, simultaneously using general-purpose tools such as ChatGPT while expressing concern about data protection, academic integrity and long-term impacts. Key findings include:

- **Teachers** view GenAI as a potential time-saver but worry about accuracy, hallucinations and "deskilling" of students. They want clear policies, exemplars and technical support.

- **Parents** are already using AI extensively at home (for translation, homework help, scheduling) but are uncertain what is permissible in school contexts, and fear both over-use and punitive responses based on unreliable detection tools.
- **School leaders** emphasise accountability, reputational risk and compliance with national and EU-level regulations, and often see AI adoption as contingent on clear national guidance and trusted vendor relationships.

The report underscores that **trust, clarity and alignment with existing workflows** are as important to adoption as technical performance.

5.3.3 Procurement, governance and data-protection insights

Market-validation analysis highlights several structural constraints that directly inform D7.1's policy recommendations:

- **Fragmented procurement**: Schools and municipalities often procure tools in isolation, leading to overlapping functionalities and under-used licences.
- **Data-governance concerns**: Decision-makers repeatedly cited GDPR, data localisation and uncertainty about future EU AI Act enforcement as reasons to prefer **EU-hosted or open-source models** with clear documentation and contractual safeguards.
- **Evaluation gaps**: Few institutions systematically evaluate AI tools against learning-outcome indicators or equity impacts; many rely on anecdotal feedback or vendor claims.

The LTU report concludes that AI4EDU's focus on **evidence-based pilots, RAG on approved curricular content and explicit governance support** is strategically aligned with these constraints, but must be sustained beyond the initial project to support scale.

5.3.4 Product-design and implementation implications

From a product and implementation-science perspective, the LTU Business study recommends that AI4EDU and similar initiatives:

- prioritise **interoperability** with existing LMS;
- build **transparent logging and analytics** to support monitoring, evaluation and audits;
- invest in **user-experience design** for teachers (low friction, clear role separation, accessible dashboards) and students (simple, mobile-responsive interfaces with accessibility options); and
- provide **implementation playbooks** and coaching models tailored to different institutional types (small rural schools, large urban schools, networks).

5.5 AI literacy and awareness (learning about AI / learning for human–AI interaction)

While the primary empirical evidence in AI4EDU derives from classroom pilots evaluating usability, acceptance and educational impact (Sections 5.1–5.2), the project also explicitly addressed AI literacy as an enabling condition for responsible and effective AI integration in education. AI literacy is understood as a foundational prerequisite that conditions how AI systems are perceived, used and governed in educational settings.

Accordingly, AI4EDU activities systematically combined learning with AI and learning about AI, ensuring that teachers and students were not only exposed to AI-assisted practices, but were also supported in understanding how AI systems function, where their limitations lie, and what ethical and social risks they entail. These activities informed both the implementation guidelines for educational practice and the policy recommendations on human–AI interaction.

5.4.1 AI literacy as an enabling condition in AI4EDU activities

Across WP2 needs-analysis workshops and both pilot cycles (WP4 and WP6), teachers and students participated in introductory AI-awareness sessions prior to engaging with SB and TM. These sessions covered basic AI concepts (data, machine learning, generative AI), typical limitations of LLMs (e.g. hallucinations, bias, lack of contextual understanding), and core ethical considerations, including data protection and transparency. These activities were not carried out as experimental interventions whose learning impact was formally measured. Rather, they served a scaffolding function, ensuring that participants could engage with AI tools in an informed and reflective manner. Observations from workshops and pilot preparation sessions indicate that such grounding was essential for:

- reducing unrealistic expectations of AI capabilities,
- supporting critical interrogation of AI outputs, and
- enabling meaningful discussions around acceptable and inappropriate uses in classroom contexts.

This approach is consistent with international guidance that frames learning about AI as a prerequisite for safe and effective use, particularly in compulsory education (UNESCO, 2021; 2023).

5.4.2 AI4EDU "Learning about AI" courseware

To support schools in operationalising AI literacy, AI4EDU developed a **"Learning about AI" courseware package** for secondary education (integrated in D5.2). The materials were designed for use by Computer Science and ICT teachers, not excluding teachers of other subjects, in projects and workshops, and can be deployed either independently or in conjunction with SB and TM. The courseware was used for training students on SB use prior to their participation in WP6 pilots, in the framework of project-led workshops. The courseware introduces:

- how AI and generative models work at a conceptual level,
- common failure modes such as hallucinations and bias,
- socio-technical implications of AI use in education and society, and
- reflective practices for evaluating AI-generated outputs.

To improve accessibility and ease of use, an **intelligent conversational assistant** was developed to accompany the courseware. The assistant uses RAG over curated instructional materials (video transcripts and presentations) and enables learners to explore AI concepts through guided dialogue. The assistant is available via the Teacher Mate login environment.

The courseware and assistant demonstrate *how AI literacy can be practically supported* within schools.

5.6 Conclusions: Synthesis of project findings

This section synthesises the empirical evidence generated within AI4EDU across WP4 (usability and technology acceptance), WP6 (educational impact), and market-validation activities. It identifies higher-level patterns across countries, highlights context-specific differences, and situates project findings in relation to existing research and EU and global frameworks. Conclusions are explicitly bounded by the scope and methods of AI4EDU activities.

5.5.1 Common themes across countries

Across Cyprus, Greece, Ireland and Sweden, several themes emerge from AI4EDU evidence.

First, **AI tools add educational value only under teacher mediation and curricular anchoring.** In all contexts, learning gains, engagement effects and positive attitudes were observed when AI use was explicitly framed, bounded and integrated into lesson design. Market-validation interviews reinforce that schools and teachers do not seek “open chat” tools; they prioritise tools that fit existing instructional workflows.

Second**, acceptance is conditional and closely tied to trust, clarity and perceived risk management.** WP4 indicates generally positive first-contact usability and self-efficacy, but perceived usefulness was more dependent on clarity of purpose and curriculum fit. Market validation echoes this “conditional acceptance” pattern: teachers and parents reported pragmatic interest but also persistent concerns about reliability, integrity, and data protection, while school leaders framed adoption as contingent on governance clarity and compliance assurance.

Third, **organisational conditions mediate impact.** WP6 evidence shows that timetable constraints, workload limitations, exam pressures, and coordination among teaching staff shape both continuity of use and depth of pedagogical integration. Market validation adds that institutional constraints extend beyond the classroom: long procurement cycles, fragmented decision-making, and risk aversion (particularly under GDPR and anticipated AI Act compliance expectations) frequently slow or block adoption even where teachers see potential.

Fourth**, governance and interoperability are key adoption conditions.** Market validation repeatedly surfaced the need for clear documentation, EU/GDPR-aligned data handling, and reduced dependency on opaque commercial platforms. It also identified limited interoperability between AI tools and existing school systems (e.g., LMS and digital assessment platforms) as a barrier to sustainable use, monitoring and accountability. These constraints align with WP6 observations that teachers value practical oversight mechanisms and clear school-level norms.

Finally, **AI literacy functions as an enabling condition across contexts of use.** Across pilots, preparatory AI-awareness activities supported more reflective use and reduced unrealistic expectations but were not sufficient on their own to guarantee meaningful and sustained use. Market validation further suggests that informal teacher experimentation often outpaces formal guidance, creating a gap that increases risk and uneven practice. This points toward AI literacy and shared norms as necessary for coherent adoption.

5.5.3 Country-specific conclusions

Cyprus (CY)

Classroom pilots in Physics and Chemistry indicate that AI-supported learning can enhance conceptual understanding when Study Buddy is tightly scaffolded by teachers and embedded in structured lesson sequences. Teacher mediation and explicit prompt design were decisive for productive use. Implementation was constrained by timetable pressures and limited pilot duration rather than by tool usability, suggesting that future uptake would depend on scheduling flexibility and sustained professional learning rather than further technical refinement.

Greece (GR)

Evidence from Biology and History pilots points to the value of AI-supported retrieval practice, question generation and formative feedback when fully aligned with lesson plans and textbooks. Teachers reported stronger perceived usefulness when prompts were pre-planned and integrated into exam-oriented routines. However, continuity of use was vulnerable to exam-period constraints and fragmented scheduling. These findings underscore the importance of planning AI use around national assessment calendars and embedding it within existing pedagogical structures.

Ireland (IE)

Substantial gains were observed in student engagement, participation and language development, particularly among learners with SEN, EAL backgrounds and other marginalised groups. Organisational-psychology data highlight psychological safety, collaborative leadership and shared ownership as key enablers of successful implementation. These findings suggest that AI-supported learning is most effective where schools already exhibit strong professional cultures and inclusive practices.

Sweden (SE)

Classroom pilots reflect a cautious, source-critical approach consistent with national pedagogical traditions, with emphasis on verification, transparency and student reflection. Teachers engaged actively in AI-supported tasks when these aligned with curriculum guidance, but decentralised governance required local adaptation and coordination.

5.5.4 Convergence and divergence with research findings, EU and global frameworks

This subsection examines how evidence generated within AI4EDU converges with, or diverges from, the research findings presented in Section 4, as well as the principles, expectations and assumptions articulated in EU and global frameworks on AI in education, as reviewed in Sections 3.1 and 3.2. These frameworks provide the normative and regulatory context within which AI4EDU was designed and evaluated, while the project's pilots offer empirical insight into how such principles translate into school-level practice.

Overall, AI4EDU's findings **converge** with meta-reviews showing benefits for formative feedback, drafting and retrieval practice under teacher-mediated, curriculum-aligned conditions, and the necessity of professional development, governance and assessment redesign (Kucirkova and Creely, 2025; Selwyn, 2024; Wang and Fan, 2025).

Moreover, across WP4, WP6 and market-validation activities, AI4EDU findings strongly converge with the core orientations expressed in global and European frameworks.

Co-funded by the European Union

First, AI4EDU evidence aligns closely with the **human-centred and teacher-led paradigm** promoted by UNESCO, the OECD and the European Commission. Project findings consistently show that AI tools add educational value when teachers retain pedagogical control over task design, timing and assessment. This directly reflects the framing in UNESCO guidance and EU ethical guidelines that position AI as an assistive resource rather than an autonomous instructional agent.

Second, the project confirms the **importance of AI literacy** emphasised in global frameworks. Observations during pilot activities indicate that basic understanding of AI capabilities and limitations is essential for meaningful use. This converges with UNESCO, Council of Europe and DigComp-based frameworks that treat AI literacy as a prerequisite for responsible deployment rather than a supplementary skill.

Third, AI4EDU findings reinforce the **risk-based governance logic of the EU AI Act** and related policy instruments. Teachers' and school leaders' concerns about reliability, accountability, data protection and assessment integrity mirror the high-risk classification of many educational AI uses. The project's emphasis on disclosure routines, teacher oversight and avoidance of automated high-stakes decisions is consistent with EU-level expectations regarding human oversight, transparency and responsibility.

Fourth, market-validation evidence converges with EU policy narratives that stress **institutional readiness, governance capacity and interoperability** as key conditions for adoption. Stakeholder emphasis on GDPR compliance, documentation, procurement clarity and alignment with existing systems reflects the operational implications anticipated by European regulatory frameworks.

At the same time, AI4EDU evidence highlights several gaps between high-level frameworks and school-level realities.

A first divergence concerns **implementation assumptions.** EU and global frameworks often assume that once ethical principles and governance structures are articulated, implementation can proceed through institutional compliance. AI4EDU pilots show that, in practice, pedagogical integration is constrained by timetable pressures, exam-oriented curricula, infrastructure limitations and limited time for teacher experimentation, factors that are only indirectly addressed in policy frameworks.

Second, while global guidance strongly promotes **equity and inclusion**, AI4EDU evidence suggests that inclusion benefits are **highly contingent.** WP6 findings indicate that personalised support for learners with additional needs emerges only under deliberate teacher mediation and structured use.

Third, while frameworks frequently emphasise **system-level coherence**, AI4EDU market-validation findings reveal fragmented decision-making at school and municipal levels. Procurement practices, risk aversion and uneven technical capacity often slow or distort adoption, even where policy alignment exists. This divergence highlights the gap between strategic intent and operational capability.

Finally, AI4EDU diverges from some international exemplars that foreground rapid innovation or large-scale roll-out. Project evidence suggests that **incremental, staged adoption**, beginning with teacher-facing support and tightly bounded classroom use, is more realistic and sustainable within compulsory education systems.

Taken together, the project findings confirm that the main constraint on responsible AI in education is the coherent alignment of pedagogy, policy and infrastructure, with **equity-by-design, teacher agency and assessment integrity** as non-negotiable conditions for sustained, system-wide value. These insights are directly translated into the implementation guidelines and policy recommendations presented in Section 7.

6. Good practices and implementation guidelines for the educational community

This chapter distils AI4EDU's own good practices and implementation guidelines derived from the AI4EDU applications' development cycle, including needs analysis (WP2) and iterative technical development (WP3 and WP5), the usability and technology-acceptance evidence (D4.2) the educational-impact evaluation (D6.2) and the market-validation report (Abrahamsson and Henriksson, 2025).

It is written for policy makers, schools, school leaders, training authorities, teachers, ICT coordinators, DPOs and broader educational stakeholders. Its focus is practical: what educational community, especially schools and teachers should do when developing and or utilizing AI systems similar to Study Buddy and Teacher Mate to support teaching and learning.

International and European frameworks (e.g., UNESCO, OECD, Council of Europe, the EU AI Act, and national AI education policies and strategies) are referenced to demonstrate alignment with and provide external validation for the AI4EDU Guidance. However, the guidance that follows is grounded primarily in AI4EDU's own evidence base.

6.1 Core AI4EDU principles for responsible and effective AI implementation in school education

Across its design, development, piloting and evaluation activities, AI4EDU converged on a set of core principles that define how generative AI systems can be responsibly and meaningfully introduced into school education. These principles are derived from design decisions (WP2, WP3, WP5), observed classroom practices, usability and impact evidence (WP4, WP6), and adoption constraints identified through market validation, as presented in Section 5. Together, they articulate the conditions under which AI systems such as Study Buddy and Teacher Mate added value and the conditions under which they did not:

1. **Teacher-mediated and human-centred use**
   - Teachers highly value retaining control over task framing, pacing, verification, and feedback/assessment decisions.
   - Strongest value in educational impact evaluation (WP6) appeared when AI use was teacher-orchestrated and discussed in class.
2. **Curriculum-anchored, purpose-driven deployment**
   - AI use proved most effective when aligned with specific curriculum units, learning outcomes and lesson objectives.
   - The strongest gains in pilots occurred where AI activities were tied to specific topics, units and assessment objectives (e.g. Physics, Chemistry, Biology, History, Sustainability Citizenship).
3. **Conditional trust with practical safeguards**

- AI systems should be used with *conditional trust*, supported by explicit safeguards
- Recommended practices include: disclosure of AI use, verification against trusted materials, and teacher review of outputs.

4. **Inclusion through intentional design and mediation**
   - WP6 evidence indicates that AI can support participation, confidence and engagement among learners with additional needs or lower prior attainment (**DEIS schools, multilingual learners and students with additional needs**).
   - These effects were associated with deliberate scaffolding, personalised pacing and psychologically safe classroom climates.
   - Inclusion depends on task design, teacher mediation and school-level conditions.
5. **AI Literacy as a Prerequisite for Use**
   - Before any AI system is introduced in an educational setting, teachers and students should have an age-appropriate understanding of how it works, what it can and cannot do, and the main risks (e.g., inaccuracy, bias, overreliance, privacy, and academic integrity).
   - Teachers should be equipped to select suitable use cases and verify outputs in line with pedagogical goals, while students should be prepared to use AI critically and responsibly, including safe data practices and transparency when AI is used.
6. **Co-design with teachers and students**
   - Teacher and student agency was foregrounded throughout the project's development and piloting activities.
   - Educators and learners were engaged from the very beginning, articulating their needs, testing early prototypes, and providing structured feedback. Their insights were foundational for the development process, shaping both the educational vision and the technical specifications of the tools.
   - Iterative design–evaluation cycles enabled continuous refinement informed by classroom practice and user experience.
7. **Interdisciplinary collaboration**
   - The development of AI-powered educational applications required collaboration across AI research, educational technology, pedagogy, educational science, ethics and policy, alongside the practical expertise of teachers.
   - These interdisciplinary perspectives enabled the project to anticipate pedagogical opportunities and technical constraints, producing technology solutions that were educationally meaningful.

These principles operationalise a **"learning about/for and with AI"** approach that is consistent with UNESCO and OECD guidance, while grounded in AI4EDU's development cycle and pilots (UNESCO, 2021, 2023; OECD, 2025a).

6.2 AI literacy good practices for learning about and for AI

AI4EDU positions **AI literacy** as a prerequisite for effective and safe use of AI systems and tools. Pilots design integrated **introductory AI sessions**, using project-developed resources, such as the **"Learning about AI" courseware**, and the **"Learning about AI" Interactive assistant**.

Introductory sessions were designed to introduce teachers and students to foundational AI literacy for education by combining core concepts with critical evaluation and responsible use. *Key scope and objectives included:*

- **Understand AI basics:** clear definitions, key terminology, and how AI systems learn from data.
- **Explore AI in context:** common applications in everyday life and education, and how AI supports prediction and decision-making.
- **Develop critical thinking:** recognize limitations and risks (e.g., errors, bias, and overreliance) and apply human judgement when using outputs.
- **Introduce Generative AI/GPTs:** what large language models are, how they generate text, typical uses (e.g., summarising, translating, Q&A), and responsible-use considerations.

AI4EDU developed a courseware for secondary school students designed for use by Computer Science/ICT as well as cross-curricular teachers, as well as intelligent conversational assistant to accompany the courseware (see section 5.4.2). These materials can be adapted to different national curricula and languages, aligning with AI literacy frameworks discussed in Section 4.

Although AI4EDU did not conduct a formal impact evaluation of AI-literacy learning outcomes, observations from the pilots suggest that introductory AI-literacy activities played an important enabling role in classroom AI use. Teachers reported greater confidence in designing AI-supported activities and in addressing questions related to verification, responsible use and academic integrity when students had a basic understanding of AI limitations. These experiences reinforced the importance of introducing “learning about AI” alongside “learning with AI” within classroom practice.

6.3 Classroom-level good practices for learning with AI

This subsection summarises **practice-level routines** that AI4EDU’s pilots found feasible and beneficial for classroom utilization of Study Buddy and Teacher Mate.

6.3.1 Designing lessons with Study Buddy and Teacher Mate

Across countries and subjects, teachers converged on a set of design patterns that shaped productive classroom use of SB and TM. These patterns reflected a move away from exploratory or open-ended AI use towards teacher-orchestrated, curriculum-aligned integration:

- **Plan around learning objectives, not tools**
    - Start from the syllabus and lesson objectives (e.g. “explain photosynthesis”, “apply Ohm’s law”, “analyse historical sources”) and then decide **whether and how** AI can support explanation, retrieval or practice.
    - Effective use depended on tight alignment with subject-specific curricula and textbooks. Teachers consistently reported higher perceived usefulness when SB and TM interacted with approved learning materials uploaded or selected by the teacher, rather than relying on generic AI responses..
- **Use clearly defined AI roles**
    - Treat AI as:
        - a **tutor** (clarifying concepts, offering worked examples),
        - a **mentor** (brainstorming ideas, posing questions, supporting revision and drafting), or
        - a **teacher-facing tool** (generating differentiated materials, quizzes, feedback drafts, variants of exercises, summaries, rubrics etc).
    - Make this role explicit to students to avoid unrealistic expectations or over-reliance.
- **Embed AI in existing lesson structures**

- Integrate Study Buddy activities into **starter tasks, guided practice, retrieval practice and exit tickets.**
- Use Teacher Mate during **planning and reflection phases** to reduce workload and improve differentiation.

6.3.2 Assessment and feedback routines

AI4EDU pilots show that AI can effectively support **formative assessment and feedback** when carefully orchestrated:

- **Low-stakes, high-frequency checks**
  - Use AI to generate **quick quizzes, self-checks and practice questions** aligned with current units.
  - Encourage students to ask the assistant for explanations of errors and alternative examples, rather than for answer-seeking.
- **Teacher-controlled feedback**
  - Review AI-generated feedback for accuracy and tone before sharing with students, particularly where misconceptions are persistent or sensitive.
  - AI commentary is framed as a **first draft**, with teacher clarification prioritised for complex or high-stakes tasks.
- **Authentic assessment and process evidence**
  - Use **draft trails, oral explanations, project logs and reflective journals** to evidence learning, complemented by AI-supported practice where appropriate.

6.3.3 Supporting diverse learners

AI4EDU pilots underscore the potential of AI to **enhance inclusion** when used intentionally:

- **DEIS and socio-economically disadvantaged contexts (IE)**
  - Explain/summarise tools and stepwise hints helped students with weaker literacy or fragmented prior knowledge, especially in upper-primary and lower-secondary DEIS schools.
  - Teachers emphasised the need for **simple navigation, clear instructions and visual supports.**
- **Multilingual learners and migrants (CY/GR/SE)**
  - Translations, glossaries and bilingual explanations supported migrant students and those learning in an additional language.
  - Teachers stressed the importance of opportunities for students to compare AI outputs with textbooks and trusted sources.
- **Learners with additional educational needs**
  - Pilots suggest benefits from **speech-to-text, text-to-speech and differentiated versions of tasks**, when configured under teacher guidance.
  - Teachers used AI to produce **simplified texts**, scaffolded tasks and alternative formats.

6.4 School-level readiness, leadership and change management

AI4EDU's pilots show that **leadership, organisational climate and support structures** are decisive for successful adoption.

6.4.1 Readiness audits: infrastructure, policy and people

Before implementing AI Systems and tools like AI-enabled assistants at scale, schools benefit from a simple **readiness review**:

- **Infrastructure**: connectivity, devices, charging/storage, classroom display facilities; contingency plans for low-bandwidth conditions.
- **Policies and governance**: existing digital/ICT policies, safeguarding rules, academic integrity procedures and data-protection practices.
- **People and competences**: teacher digital and AI competences (knowledge, skills, values) should be prioritized in existing PD programmes and structures, presence of digital education or ICT coordinators, DPO or equivalent.

6.4.2 School AI policy and governance structures

Pilot feedback indicates that teachers feel more confident where a school-level AI policy and clear governance structures exist:

- A concise policy sets out: purpose, acceptable uses, prohibited uses, age limitations, disclosure expectations, data-protection rules and incident-handling procedures.
- Roles are defined for school leadership, ICT coordinators, DPO, teachers, and student representatives.
- Policies are **co-created** with staff and, where feasible, students and families, supporting ownership and legitimacy.

6.4.3 Professional development and communities of practice

AI4EDU confirms that PD is a constant request from teachers, including **hands-on, classroom-embedded activities**:

- Mixed formats – workshops, coaching, micro-credentials and professional-learning communities – allow teachers to **plan–teach–reflect** on AI-supported lessons.
- Peer observation, prompt-sharing and collaborative design of AI-inclusive lessons accelerate diffusion of good practices.

6.4.4 Workload, wellbeing and organisational climate

Evidence from AI4EDU and the wider literature underlines that teachers' **perceptions of workload, fairness and autonomy** shape adoption:

- Educational AI Tools like Study Buddy and Teacher Mate should be introduced with a clear focus on reducing administrative burden and supporting differentiation, not adding reporting or surveillance tasks.
- School leaders should monitor **time spent**, perceived workload and wellbeing, and adjust implementation (e.g. templates, support, resources, scheduling) to avoid overload.

6.5 Data privacy, protection and security – practical guidance for schools

AI4EDU's pilots confirm that trust in data protection is a precondition for adoption by teachers, students and families. The following guidance translates GDPR, EU AI Act, DSA and child-rights principles into practical steps for policy makers and schools.

6.5.1 Applying GDPR and child-rights safeguards in practice

School authorities should:

- **Define purposes clearly**: be explicit about why data are collected (e.g. creating accounts, storing learning history, generating analytics) and avoid unnecessary data collection.
- **Use the minimum data necessary**: where possible, use pseudonymous IDs rather than full names; avoid collecting sensitive data unless strictly needed.
- **Inform learners and families**: provide simple notices explaining what data are processed, how AI is used in learning, and how rights (access, rectification, erasure, objection) can be exercised and ensure a parental/guardian consent form is obtained.
- **Pay special attention to vulnerable learners** (younger children, SEND, migrants) in line with child-rights guidance.

6.5.2 Practical technical and organisational measures

Without requiring schools to master technical jargon, AI4EDU recommends that:

- Data sent to and from AI tools are **protected during transfer and storage** using strong encryption and secure, up-to-date systems.
- Access to teacher and student data is limited through **named accounts, strong passwords, multi-factor authentication for staff, and strict role-based permissions.**
- Activity is **logged and periodically reviewed**, so that inappropriate access or unusual patterns can be detected and addressed.
- Regular **back-ups and recovery procedures** are in place for key teaching and learning data, in line with school or authority policies.

Many of these measures will be implemented by **vendors or national/central authorities**, but schools need to understand them sufficiently to evaluate tools and respond to parent and inspectorate queries.

6.5.3 Working with vendors and platforms

AI4EDU experience suggests that privacy and protection are best handled through **clear agreements and shared documentation**:

- Require vendors to provide **plain-language summaries** of what data they process, where data are stored, how long they are kept, and with whom they are shared.
- Ensure contracts specify roles (controller/processor), security measures, incident-notification timelines and options to **export or delete data**.
- **Support co-design and co-creation approaches in the development and configuration of AI systems**, involving teachers, school leaders and, where appropriate, students and DPOs. Early engagement of educational users helps ensure that data flows, analytics, default

settings and safeguards reflect pedagogical priorities, minimise unnecessary data collection, and embed privacy- and ethics-by-design principles from the outset.

6.6. Implementation roadmap and transferability (EU and beyond)

AI4EDU evidence supports a **phased implementation roadmap** for schools, applicable across European and international contexts and consistent with the exemplars presented in Sections 3.3 and 3.4.

Phase 0 – Readiness and planning

- Conduct a **readiness review** (infrastructure, policy, people).
- Agree local goals for AI use (e.g. workload reduction, improved formative assessment).

Phase 1 – Safe piloting

- Start with a small number of **volunteer teachers and classes**, using a limited feature set (e.g. retrieval practice, explanation, planning support).
- Start with AI literacy fundamentals so that both teachers and students understand key concepts of AI including ethical and responsible use in addition to what the tools can and cannot do.
- Monitor usability, acceptance and early impact of tools.

Phase 2 – Scaling and integration

- Integrate AI utilization into **digital-school-development plans**, digital-strategy documents and subject-department schemes of work.
- Update school digital policy to include AI and data-protection documentation based on pilot lessons learned.
- Expand professional-learning communities and peer-support structures.

Phase 3 – Continuous improvement and external sharing

- Use agreed **indicators and KPIs** (see Section 7.5) to track learning outcomes, equity, workload and wellbeing over time.
- Share results, lesson designs and prompt libraries within national and European networks, contributing to broader capacity-building (European Digital Education Hub, 2024).

This roadmap is consistent with European and international exemplars (Sections 3.5 and 3.6), but it is **derived from AI4EDU practice**. It provides a bridge from individual pilots to sustained school-level change.

7. Policy recommendations

This chapter presents **AI4EDU-derived policy recommendations** for ministries, agencies, inspectorates, municipalities, teacher training institutions and other **system-level actors**. It builds on:

- the **policy landscape and exemplars** in Section 3;

Co-funded by
the European Union

- the **literature review on GenAI in education** in Section 4; and
- the **project evidence and implementation guidelines** in Sections 5 and 6.

While aligned with global and European frameworks (UNESCO, 2021, 2023; OECD, 2019, 2025a; European Union, 2016, 2024; Council of Europe, 2024), the recommendations below reflect **AI4EDU's evidence** about what is feasible, desirable and viable for AI deployment in schools.

7.1 Governance and regulation

1. **Develop or update AI in Education policy frameworks**
    - Ministries and educational agencies should prepare **national AI in Education (AIED) policy frameworks** that:
        - define **permissible and prohibited AI utilization** in school contexts;
        - specify **human-oversight requirements** for high-stakes decisions; and
        - align with national AI strategies, the **EU AI Act** and **GDPR** (European Union, 2016, 2024).
    - AI4EDU pilots show that in the absence of such frameworks, schools develop **ad-hoc practices**, leading to inconsistency and legal uncertainty.
2. **Adopt risk-based governance tailored to education**
    - Policy should classify AI uses in education (e.g. tutoring, grading support, behavioural or profiling-related uses) along a **risk spectrum**, clarifying when AI falls under the EU AI Act's "high-risk" categories (European Union, 2024).
3. **Embed AI governance into existing quality-assurance systems**
    - Rather than creating parallel structures, inspectorates and quality-assurance agencies should integrate AIED considerations into existing **school evaluation, accreditation and inspection frameworks.**
    - AI4EDU findings on school readiness and governance can inform **indicators and review questions** within these frameworks.

7.2 Infrastructure, platforms and technical architecture

4. **Guarantee baseline infrastructure for equitable access**
    - National and regional authorities should prioritise **reliable connectivity, adequate devices and secure identity management** as prerequisites for AI-enhanced learning, with particular attention to **rural, remote and disadvantaged schools** (European Commission, 2025a; OECD, 2025a).
    - AI4EDU pilots demonstrate that infrastructure gaps directly constrain which AI features can be used and by whom, with equity implications (D4.2; D6.2).
5. **Provide flexible deployment options**
    - National strategies should support a spectrum of deployment options (on-premise, sovereign cloud, public cloud) in line with **data-protection and sovereignty requirements.**
    - AI4EDU market validation report suggests that **hybrid models** combining local hosting of sensitive data with cloud-based AI services can be both feasible and effective where governance is clear.
6. **Promote iterative, staged deployment models for educational AI**
    - National and regional authorities should encourage phased approaches to AI deployment in education, progressing from small-scale, well-supported pilots to broader adoption only where educational value, usability and safeguards have been demonstrated.

- AI4EDU evidence shows that iterative development cycles, including pre-piloting, classroom pilots and refinement based on teacher and student feedback, were critical for aligning AI tools with curricula and building trust among users
- Policy frameworks and funding schemes should therefore prioritise adaptive procurement, pilot extensions and structured feedback loops over one-off or large-scale roll-outs.

7. **Promote curriculum-anchored RAG architectures for accuracy and pedagogical relevance**
   - Authorities should explicitly encourage the use of RAG) architectures for educational AI systems.
   - AI4EDU evidence shows that curriculum-anchored RAG pipelines using approved textbooks and validated educational resources improved teachers' trusts, as well as the relevance, accuracy and pedagogical usefulness of AI outputs.
   - Policy and procurement guidance should therefore require that AI systems used in schools:
     - clearly document which curricular resources are indexed and retrievable;
     - allow teachers to upload their own materials, as in the case of TM; and
     - make transparent when responses are grounded in curriculum-aligned sources versus general knowledge, as in the case of TM.
8. **Address copyright and licensing constraints for curricular resources**
   - Ministries and education authorities should provide clear national guidance on the lawful use of copyrighted educational materials (e.g. school textbooks, teacher-guides, activity books etc) within AI systems, including RAG-based architectures.
   - AI4EDU experience indicates that uncertainty around copyright and licensing conditions can act as a significant barrier to curriculum-anchored AI deployment, particularly in countries where textbook rights are held by multiple publishers (e.g. in SE).
   - Authorities should explore:
     - sector-wide licensing arrangements or public-interest exceptions for educational AI use;
     - contractual clauses allowing temporary indexing of textbooks for pedagogical AI purposes; and
     - national or regional repositories of licensed, AI-ready curricular resources.

9. **Invest in the quality and AI-readiness of educational resources**
   - Education systems should invest in the **quality, structure and interoperability** of digital educational resources so they can be effectively processed and integrated into AI systems.
   - AI4EDU platform development insights indicate that AI performance and reliability depend strongly on the quality of materials, including format, consistency, metadata, and alignment with learning outcomes, as outlined in national curricula.
   - National educational authorities should therefore:
     - support the development of structured, well-annotated digital textbooks and open educational resources (OER);
     - promote standards for metadata, versioning and curricular tagging; and
     - ensure that publicly funded educational resources are designed to be reusable within AI-supported learning environments.

10. **Support the development and use of national- and EU-level language models for education**

- At EU and national levels, authorities should actively support the development, fine-tuning and deployment of LLMs **adapted to national languages, curricula and educational contexts**, as a complement to general-purpose AI systems.
- Evidence from AI4EDU indicates that educational impact, trust, transparency and pedagogical relevance increase when AI systems are grounded in approved curricular content, local languages and education-specific constraints, rather than relying solely on opaque, general-purpose models.
- EU-level initiatives, including AI Factories, European data spaces and publicly supported foundation-model programmes for various domains, offer strategic opportunities to strengthen Europe's technological and digital sovereignty. These programs should prioritise the domain of education, ensuring that educational AI systems reflect European values, regulatory standards and linguistic diversity.
- In parallel, national investments in language-specific models and education-focused fine-tuning can reinforce:
    - curriculum alignment and assessment validity;
    - explainability and source transparency; and
    - institutional trust among teachers, school leaders and families.
- Policy frameworks and funding instruments should therefore:
    - encourage the use of EU-hosted or nationally governed models for school education where feasible;
    - support education-specific fine-tuning using licensed, high-quality curricular resources;
    - ensure alignment with GDPR, the EU AI Act and national education policies; and
    - promote interoperability between such models and school platforms, LMS and assessment systems.

7.3 Data privacy and protection – system-level measures

11. Operationalise GDPR for educational AI at scale

- Ministries should issue **sector-specific guidance** on implementing GDPR in AI-enabled learning, clarifying:
    - lawful bases for processing pupil data;
    - expectations for **data minimisation, purpose limitation and retention**; and
    - age-appropriate transparency and parental-communication templates.
- AI4EDU pilots show that schools struggle with **interpreting privacy obligations** for conversational AI; central guidance would reduce uncertainty and duplication.

12. Strengthen data-governance capacity in school systems

- Authorities should:
    - support school owners to designate **DPOs or data leads** with appropriate training;
    - provide template **records of processing activities (ROPAs)**, DPIA tools and model data-processing agreements; and
    - ensure regular **audits and breach-response exercises** at municipal or regional level.
    - ensure that student interactions are processed under **strict access controls**, with clearly defined roles determining who can view, store or analyse interaction data.

- Evidence from AI4EDU classroom pilots indicates that students occasionally share personal or sensitive information despite explicit guidance, highlighting the limits of instruction-only approaches.

13. **Set clear expectations for vendors and educational platforms**
    - Procurement frameworks should require vendors of AIED tools to:
        1. document data flows, retention policies and sub-processors;
        2. support **privacy-by-design and by default**; and
        3. provide mechanisms to **export, correct or delete data** upon request.
    - Lessons from AI4EDU's market validation and pilots show that schools benefit when this documentation is **standardised and comparable** across products.

7.4 AI literacy and capacity-building at system level

14. Adopt national AI literacy frameworks for students and teachers

- Building on DigComp, DigCompEdu and emerging AI literacy frameworks, ministries should develop and publish **national AI literacy descriptors** covering:
    - conceptual understanding;
    - ethical and civic dimensions;
    - critical evaluation of AI outputs; and
    - creative, ethical, responsible use for learning and work (UNESCO, 2021, 2023; Council of Europe, 2024; OECD, 2025a).
- AI4EDU's "learning about AI" courseware and intelligent assistant provide **examples** of how these descriptors can be realised in classrooms.

15. Systematise initial and continuing teacher AI competences development

- Teacher-education providers should integrate AI Literacy topics into **initial teacher education and into in-service teachers continuous PD**, while ministries and educational authorities promote **micro-credentials and advanced modules** as part of educators' digital and AI competences continuous development.
- AI4EDU shows that teachers' informal, self-directed experimentation often runs ahead of formal PD; structured pathways help align practice with policy and safeguards.

16. Support school leaders and middle leaders as AI change agents

- National programmes should target **school heads, deputy heads, ICT coordinators and subject leaders** with training on governance, workload management, equity and stakeholder communication in relation to AI and in addition to AI Literacy.
- AI4EDU evidence highlights that **autonomy-supportive leadership and psychological safety** strongly correlate with thoughtful AI adoption in schools.

7.5 Funding, evaluation and KPIs for AIEd deployment

17. Create dedicated funding lines for trustworthy AI in education

- Ministries and agencies should establish funding schemes that support:
    - school-level pilots aligned with national priorities;

  - procurement of interoperable, rights-respecting AI tools; and
  - cross-school, cross-discipline professional-learning communities and mentorship.
- AI4EDU's experience demonstrates that **time, support and basic resourcing** are essential for teachers to translate AI potential into real change.

18. Institutionalise evaluation cycles and national testbeds

- Policy should require that funded AI deployments include **baseline, midline and endline evaluations**, using mixed methods and common instruments where possible.
- Dedicated **national or regional testbeds** can host structured experimentation with AIED tools, mirroring AI4EDU's cross-country pilot design but embedded into ongoing system governance.

19. Adopt a core KPI framework for policy monitoring

- To support evidence-based decision-making, authorities should adopt a **limited, comparable set of KPIs** that track:
  - professional-development completion;
  - classroom AI adoption;
  - equity of access and inclusion;
  - transparency and integrity;
  - data-protection readiness;
  - learning outcomes; and
  - user satisfaction.
- KPIs should combine quantitative indicators with qualitative evidence (e.g. surveys, classroom observations and case studies), be proportionate to the scale and risk of AI utilization and be embedded within existing monitoring and inspection frameworks.
- AI4EDU's testing and evaluation instruments as well as pilot indicators provide good examples of how such KPIs can be operationalised in school contexts.

7.6 Forward-looking considerations and alignment with AI4EDU objectives

The recommendations in this chapter translate AI4EDU's general objectives and expected impacts into **system-level levers** for governance, funding and strategy. They:

- provide **phased pathways** from local pilots to systemic adoption of human-centred AI in education;
- reinforce the centrality of **teacher agency, student voice and school leadership**; and
- ensure alignment with **European and international principles** on trustworthy, rights-respecting AI.

AI4EDU's combination of **technical development, classroom pilots, evaluation and market validation** offers a realistic picture of what can be implemented in the short to medium term across diverse education systems. It highlights both enabling conditions—supportive leadership, baseline infrastructure, emergent AI policies—and **structural constraints**, including teacher workload, fragmented governance and limited longitudinal evidence.

For policy-makers, this implies a **three-tier strategy**:

- In the **near term**, focus on promote AI Literacy in addition to consolidating safe, high-value use cases such as **tutoring, feedback, resource generation and workload reduction**, supported by robust governance, privacy safeguards and sustained PD.
- In the **medium term**, alignment between educational AI strategies and broader European and national investments in AI infrastructure, data spaces and LLMs can further strengthen trust, transparency and pedagogical relevance in school-based AI deployment.
- In **parallel**, invest in foresight and research-practice partnerships exploring GenAI advancements (e.g. multimodal and agentic AI), their implications for curriculum and assessment, and the evolution of teacher and learner roles (Casper, Krueger and Hadfield-Menell, 2025; D6.1; D6.2).

8. Conclusions

This deliverable concludes the work of WP7 by consolidating AI4EDU's empirical findings, implementation experience and external validation into a coherent set of guidelines and policy recommendations for the responsible use of AI in school education. In doing so, it responds directly to the project's overarching ambition: to investigate, design and document how AI-based educational systems can be meaningfully, safely and effectively integrated into teaching and learning.

AI4EDU pursued this ambition through a dual strategy. First, the project developed a purpose-built AI educational environment, grounded in a clear pedagogical framework and implemented through a human-centred, curriculum-oriented design. The project's conversational AI assistants, Study Buddy for students and Teacher Mate for teachers, were developed iteratively and in close collaboration with educators and learners. Second, AI4EDU subjected these tools to pilot implementation and evaluation across multiple countries, generating concrete evidence on usability, acceptance, educational impact and organisational conditions. These pilots enabled the identification of workable classroom practices, as well as the formulation of practical implementation guidelines and policy recommendations for the use of similar AI systems in education.

Although the pilots were necessarily limited in scale and duration, they surfaced **important opportunities and challenges** that are highly relevant for educational policy. On the opportunity side, AI4EDU demonstrates that curriculum-aligned, teacher-mediated AI systems can support explanation, practice, feedback, inclusion and teacher workload reduction when embedded within existing pedagogical structures. On the challenge side, the project highlights persistent constraints, including time pressure, uneven infrastructure, fragmented governance, data-protection uncertainty and the absence of longitudinal evidence at system level. These findings reinforce the need for **careful, staged adoption**, rather than technology-first or large-scale roll-outs unsupported by evidence.

Taken together, the results of AI4EDU point to the value of **further research and larger-scale piloting** as prerequisites for informed decision-making about the role of AI in educational policy. The evidence assembled in D7.1 does not argue for uncritical adoption of AI in schools; rather, it provides a grounded basis for deciding when, how and under what conditions AI can add educational value, and where caution or restraint is warranted.

Above all, AI4EDU's evidence supports an implementation stance that is ambitious but cautious: embracing AI's potential to advance educational quality, while maintaining strong ethical safeguards and governance. The guidelines and policy recommendations set out in D7.1 should therefore be understood as a **living framework**, intended to evolve alongside emerging evidence, technological developments and regulatory norms. If adopted and iteratively refined, they can help ensure that AI in education remains human-centred, ethically grounded and sustainably governed, supporting learners and teachers today while enabling education systems to adapt responsibly over time.

References

1EdTech (2020) Learning Tools Interoperability (LTI) 1.3 and LTI Advantage. Lake Mary, FL: 1EdTech Consortium.

1EdTech (2022) Caliper Analytics® 1.2. Lake Mary, FL: 1EdTech Consortium.

1EdTech (2022) OneRoster® Standard 1.2. Lake Mary, FL: 1EdTech Consortium.

Abrahamsson, D. and Henriksson, L. (2025) *AI4EDU Market Validation Study*. Internal project report, AI4EDU.

Adobe (2024) The AI Inflection Point: How to Adopt AI Responsibly in Your Organization. San Jose, CA: Adobe Inc.

African Union (2024) Continental Artificial Intelligence Strategy: Harnessing AI for Africa's Development and Prosperity. Addis Ababa: African Union Commission.

AI Advisory Council (2025) *AI Advisory Council Advice Paper – AI and Education.* Dublin: Department of Enterprise, Trade and Employment.

AI Asia Pacific Institute (2024) The State of Artificial Intelligence in the Pacific Islands. Sydney: AIAPI.

AI Roadmap (2024) 10 Steps to Master AI. (White paper).

AI Sweden (2024) GPT-SW3 project. Gothenburg: AI Sweden. https://www.ai.se/en/project/gpt-sw3-validation-project (Accessed: 21 December 2025).

AI Sweden (n.d.) *About AI Sweden*. https://www.ai.se/en/about (Accessed: 21 December 2025).

AI.gov (2025) Education initiatives on AI. Washington, DC: U.S. Government. https://www.ai.gov/initiatives/education (Accessed: 8 October 2025).

AI4EDU Consortium (2025) D6.2 Evaluation of educational impact results.

AI4EDU Consortium (2024) D4.2 Evaluation of usability and technology acceptance.

Arnold, B. and Rahimi, M. (2025) Global Status of Teachers 2024. Brussels: Education International.

Aspen Institute (2023) *A Blueprint for Equitable AI: A Framework for Power-Building and Systemic Change*. Washington, DC: Aspen Institute

Australian Department of Education (2024) 'AI pilot to help tackle WA teacher workloads'. Media release, 12 August 2024. https://ministers.education.gov.au/clare/ai-pilot-help-tackle-wa-teacher-workloads (Accessed: 21 December 2025).

C21 Canada (2025) *C21 Canada National AI Task Force Report 2025: Insights and Recommendations for Shaping the Future of AI in Canadian Education*. https://c21canada.org/wp-content/uploads/2025/12/C21-AI-Task-Force-Report-October-2025.pdf (Accessed: 21 December 2025).

Canadian Teachers' Federation (2023) *Artificial Intelligence in Public Education: Regulating the Use of AI in Canadian K-12 Public Education*. Ottawa: CTF/FCE.

Carbonell, J.R. (1970) 'AI in CAI: An artificial-intelligence approach to computer-assisted instruction', IEEE Transactions on Man-Machine Systems, 11(4), pp. 190–202.

Casper, S., Krueger, D. and Hadfield-Menell, D. (2025) 'Pitfalls of evidence-based AI policy', ICLR 2025 blog post / arXiv:2502.09618.

Challapally, A., Pease, C., Raskar, R. and Chari, P. (2025) *The GenAI Divide: State of AI in Business 2025*. Cambridge, MA: MIT NANDA. https://mlq.ai/media/quarterly_decks/v0.1_State_of_AI_in_Business_2025_Report.pdf (Accessed: 21 December 2025).

Chan, C.K.Y. (2023) 'A comprehensive AI policy education framework for university teaching and learning', International Journal of Educational Technology in Higher Education, 20, 38. https://doi.org/10.1186/s41239-023-00408-3.

Chan, R. (2023) 'Institutional AI policies in higher education: a comparative analysis', *Internet and Higher Education*, 59, 100894.

China Daily (2025) 'Beijing makes AI education compulsory in public schools', *China Daily Hong Kong Edition*. https://www.chinadailyhk.com/hk/article/622085 (Accessed: 21 December 2025).

Collie, R.J. and Martin, A.J. (2024) 'Teachers' motivation and engagement to harness generative AI for teaching and learning: The role of contextual, occupational, and background factors', Computers and Education: Artificial Intelligence, 6, 100224. https://doi.org/10.1016/j.caeai.2024.100224.

Cosgrove, J., Cachia, R. (2025) *DigComp 3.0: European Digital Competence Framework, fifth edition*. Publications Office of the European Union. https://data.europa.eu/doi/10.2760/0001149

Council of Europe (2022) *Artificial Intelligence and Education: A Policy Toolbox*. Strasbourg: Council of Europe.

Council of Europe (2024) *Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law (CETS No. 225)*. Strasbourg: Council of Europe.

Council of Europe (2025) *Draft Recommendation on AI Literacy*. Strasbourg: Council of Europe.

Cullen International (2021) Regulating AI — Quick cheat sheet on the draft EU Artificial Intelligence Act. Brussels: Cullen International.

Davis, M.R. (2019) 'K-12 districts wasting millions by not using purchased software, new analysis finds', *EdWeek Market Brief*, 14 May. https://marketbrief.edweek.org/meeting-district-needs/k-12-districts-wasting-millions-by-not-using-purchased-software-new-analysis-finds/ (Accessed: 21 December 2025).

de la Higuera, C. and Iyer, J. (2024) AI for Teachers: An Open Textbook. Erasmus+ AI4T Project. CC BY 4.0.

Department of Education and Youth (2025) *Guidance on Artificial Intelligence in Schools.* Version 1, October 2025. Dublin: Department of Education and Youth. https://www.accs.ie/s/DEY-Guidance_on_Artificial_Intelligence_in_Schools_2025.pdf (Accessed: 20 December 2025).

Department of Education (2025) 'Minister McEntee welcomes new national guidance on the use of AI in schools', *Gov.ie Press Release*, 21 October 2025. https://www.gov.ie/en/department-of-education/press-releases/minister-mcentee-welcomes-new-national-guidance-on-the-use-of-ai-in-schools/ (Accessed: 20 December 2025).

Department of Education (2022) *Digital Strategy for Schools to 2027.* Dublin: Department of Education. https://www.gov.ie/en/department-of-education/publications/digital-strategy-for-schools-to-2027/ (Accessed: 20 December 2025).

Department of Enterprise, Trade and Employment (2025) 'Ireland leads the way in EU AI regulation', *Department News*, 16 September 2025. https://enterprise.gov.ie/en/news-and-events/department-news/2025/september/20250916.html (Accessed: 20 December 2025).

Digital Policy Alert (2024) The Anatomy of AI Rules: A systematic comparative analysis of AI rules across the globe. Zurich: DPA/LEF St. Gallen.

Digital Policy Alert (2024) *Global AI Regulation Tracker*. Digital Policy Alert. https://digitalpolicyalert.org (Accessed 21 December 2025).

Digital Skills and Jobs Platform (2023) Sweden – National Digitalisation Strategy for the School System (2023 update). Brussels: European Commission. https://digital-skills-jobs.europa.eu/en/actions/national-initiatives/national-strategies/sweden-national-digitalisation-strategy-school-0 (Accessed 21 December 2025).

Durlak, J.A. and DuPre, E.P. (2008) 'Implementation matters: a review of research on the influence of implementation on program outcomes and the factors affecting implementation', *American Journal of Community Psychology*, 41(3–4), pp. 327–350. https://doi.org/10.1007/s10464-008-9165-0.

Durmus, M. (2024) MINDFUL AI: Reflections on Artificial Intelligence (The AI Thought Book Reloaded).

e-Estonia (2025) *AI Leap: Estonia's national programme for AI in education*. Tallinn: e-Estonia Briefing Centre.

Eberly, D. (2025) 'MIT finds GenAI projects fail ROI in 95% of companies', *The National CIO Review*, 20 August. https://nationalcioreview.com/articles-insights/extra-bytes/mit-finds-genai-projects-fail-roi-in-95-of-companies/ (Accessed: 21 December 2025).

Education International (2024) *The status of teachers 2024: new challenges in an age of AI*. Brussels: Education International.

Education Profiles (2025) Cyprus – Technology in education. Global Education Monitoring. https://op.europa.eu/webpub/eac/education-and-training-monitor/en/country-reports/cyprus.html (Accessed: 21 December 2025).

EPRS (2023) Artificial Intelligence Act — EU legislation in progress (PE 698.792). Brussels: European Parliamentary Research Service.

EUR-Lex (n.d.) *EUR-Lex – Access to European Union Law*. Luxembourg: Publications Office of the European Union. https://eur-lex.europa.eu/homepage.html?locale=en (Accessed: 21 December 2025).

Redecker, C., and Punie, Y., editor(s), European Framework for the Digital Competence of Educators: DigCompEdu , EUR 28775 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-73718-3 (print),978-92-79-73494-6 (pdf), doi:10.2760/178382 (print),10.2760/159770 (online), JRC107466.

European Commission (2021) Digital Education Action Plan 2021–2027. Brussels: European Commission. https://education.ec.europa.eu/focus-topics/digital-education/actions (Accessed: 21 December 2025).

European Commission (2022b) *The Digital Competence Framework for Citizens – DigComp 2.2: With New Examples of Knowledge, Skills and Attitudes*. Luxembourg: Publications Office of the European Union.

European Commission (2022) Ethical guidelines on the use of AI and data in teaching and learning for educators. Brussels: European Commission. https://education.ec.europa.eu/news/ethical-guidelines-on-the-use-of-artificial-intelligence-and-data-in-teaching-and-learning-for-educators (Accessed: 21 December 2025).

European Commission (2024) *Artificial Intelligence Act – Political Agreement and Key Provisions*. Brussels: European Commission.

European Commission (2025a) *Education and Training Monitor 2025*. Brussels: European Commission.

European Commission AI Watch (2025) Cyprus AI Strategy Report. Brussels: European Commission. https://ai-watch.ec.europa.eu/countries/cyprus/cyprus-ai-strategy-report_en (Accessed: 21 December 2025).

European Commission and OECD (2025) *Empowering Learners for the Age of AI: An AI Literacy Framework for Primary and Secondary Education (AILit Framework)*. Brussels/Paris: European Commission and OECD. https://ailiteracyframework.org/wp-content/uploads/2025/05/AILitFramework_ReviewDraft.pdf (Accessed: 21 December 2025).

European Digital Education Hub (2023) Teachers' competences for AI: Briefing report No. 1. Brussels: European Commission.

European Digital Education Hub (2024) *AI in Education – Insights and Recommendations from the AI Working Group*. Brussels: European Commission.

European EdTech Alliance (2023) *Towards a European EdTech ecosystem: roadmap and recommendations*. Brussels: European EdTech Alliance. https://static1.squarespace.com/static/5fac2fdb0da84a28cc76b714/t/66f4e4d061ed43684258f917/1727325402234/The+European+EdTech+Ecosystem+Roadmap+Version+1.pdf (Accessed 21 December 2025).

European Parliament and Council (2019) Directive (EU) 2019/790 on copyright and related rights in the Digital Single Market. Official Journal of the European Union.

European Schoolnet (2024) Professional Development for Teachers in the Age of AI: Thematic Seminar Report. Brussels: EUN Partnership.

European Schoolnet (2024) *AI in education: teacher professional development priorities in Europe*. Brussels: European Schoolnet.

European Schoolnet (2025) *Artificial intelligence in school education: Agile collection of information, vol. 6*. Brussels: European Schoolnet.

European Union (2016) *Regulation (EU) 2016/679 (General Data Protection Regulation)*. Brussels: Official Journal of the European Union.

European Union (2019) *Directive (EU) 2019/790 on copyright and related rights in the Digital Single Market*. Brussels: Official Journal of the European Union.

European Union (2024) Regulation (EU) 2024/1689 laying down harmonised rules on artificial intelligence (AI Act). Official Journal of the European Union. https://eur-lex.europa.eu/eli/reg/2024/1689/oj/eng (Accessed: 21 December 2025).

Eurydice (2025) *National reforms in school education – Cyprus: Artificial intelligence in the Cypriot education*. National Policies Platform – Eurydice, European Education and Culture Executive Agency (EACEA), 22 August. https://eurydice.eacea.ec.europa.eu/eurypedia/cyprus/national-reforms-school-education (Accessed: 18 December 2025).

Co-funded by the European Union

Eurydice (2025a) *Estonia: AI Leap 2025 initiative in upper secondary education*. Brussels: Eurydice – European Education and Culture Executive Agency.

Eurydice (2025b) *Finland: Artificial intelligence in education – legislation and recommendations*. Brussels: Eurydice – European Education and Culture Executive Agency.

Faktabaari (2025) *AI Guide for Teachers: critical digital and information literacy in the age of artificial intelligence*. Helsinki: Faktabaari EDU.

Finnish National Agency for Education (2025a) *Artificial intelligence in education – legislation and recommendations*. Helsinki: Finnish National Agency for Education.

Finnish National Agency for Education (2025b) *AI guide for teachers: background material on AI and ethics in education*. Helsinki: Finnish National Agency for Education.

Generative Artificial Intelligence in Secondary Education (2025) *Opportunities, Risks and Policy Options*. Luxembourg: Joint Research Centre, Publications Office of the European Union.

Giannakos, M., Papamitsiou, Z. and Daradoumis, T. (2025) 'The promise and challenges of generative AI in education: A systematic review and research agenda', *Frontiers of Education in China* / related venue.

Giannini, S. (2023) Generative AI and the future of education. Paris: UNESCO.

Gillespie, N., Lockey, S., Ward, T., Macdade, A. and Hassed, G. (2025) Trust, attitudes and use of artificial intelligence: A global study 2025. Melbourne: University of Melbourne & KPMG.

Giordano, G. and Munier, F. (2025) 'Building an institutional AI learning tutor: A case study on supporting flipped classroom in a business school', Ubiquity Proceedings. https://ubiquityproceedings.com/articles/186/files/68bfb3656aaaa.pdf (Accessed: 7 October 2025).

Gobierno de Canarias. Consejería de Educación, Universidades, Cultura y Deportes (2024) *La inteligencia artificial (IA) en el ámbito educativo: guía para centros docentes públicos no universitarios de Canarias*. Santa Cruz de Tenerife: Gobierno de Canarias.

Government of Canada (2024) *Responsible use of generative AI in the public service: guidance for departments and agencies*. Ottawa: Treasury Board Secretariat.

Government of Cyprus (2024) National Digital Strategy 2020–2025. Nicosia: Government of Cyprus. https://www.gov.cy/media/sites/13/2024/04/Digital-Strategy-2020-2025.pdf (Accessed: 21 December 2025).

Government of Ireland (2021) AI — Here for Good: National AI Strategy. Dublin: Department of Enterprise, Trade and Employment. https://enterprise.gov.ie/en/publications/publication-files/national-ai-strategy.pdf (Accessed: 21 December 2025).

Government of Ireland (2022) Digital Strategy for Schools to 2027. Dublin: Department of Education. https://www.gov.ie/en/department-of-education/publications/digital-strategy-for-schools-to-2027/ (Accessed: 21 December 2025).

Government of the UAE (2024) *UAE strategy for artificial intelligence 2031 – education sector update*. Abu Dhabi: Government of the United Arab Emirates.

Government Offices of Sweden (2024) 'Excellent research and innovation are encouraged in largest ever research and innovation bill', *Press release*, 16 December. https://www.government.se/press-releases/2024/12/excellent-research-and-innovation-are-encouraged-in-largest-ever-research-and-innovation-bill/ (Accessed: 18 December 2025).Regeringskansliet

Government Offices of Sweden (2024b) *Innovation policy*. https://www.government.se/government-policy/innovation/ (Accessed: 18 December 2025).Regeringskansliet

High-Level Expert Group on AI (2019) Ethics Guidelines for Trustworthy AI. Brussels: European Commission. https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai (Accessed: 7 October 2025).

Holmes, W., Bialik, M. and Fadel, C. (2019) Artificial Intelligence in Education: Promises and Implications for Teaching and Learning. Boston, MA: Center for Curriculum Redesign.

IMDA and PDPC (2024) *Model AI Governance Framework for Generative AI*. Singapore: Infocomm Media Development Authority and Personal Data Protection Commission.

Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado (INTEF) (2024) *Guía sobre el uso de la inteligencia artificial en el ámbito educativo*. Madrid: Ministerio de Educación, Formación Profesional y Deportes.

Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado (INTEF) (2025) *Orientaciones para la integración de la IA en la formación docente*. Madrid: Ministerio de Educación, Formación Profesional y Deportes.

INTEF (2024) *Guía sobre el uso de la inteligencia artificial en el ámbito educativo*. Madrid: Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado.

ISO/IEC (2019) *ISO/IEC 27701:2019 Security techniques – Extension to ISO/IEC 27001 and ISO/IEC 27002 for privacy information management*. Geneva: International Organization for Standardization.

ISO/IEC (2022) *ISO/IEC 27001:2022 Information security, cybersecurity and privacy protection – Information security management systems*. Geneva: International Organization for Standardization.

ISO/IEC (2023) *ISO/IEC 42001:2023 Information technology – Artificial intelligence – Management system*. Geneva: International Organization for Standardization.

Italian Ministry of Education and Merit (Ministero dell'Istruzione e del Merito) (2025) *Linee guida per l'introduzione dell'Intelligenza Artificiale nelle Istituzioni scolastiche*. Rome: Ministero dell'Istruzione e del Merito.

Japan Today / Mainichi (2025) 'Gov't to use AI to help teach Japanese to kids with foreign roots', *Japan Today/Mainichi Shimbun*.

Jones, K. et al. (2025) 'Artificial intelligence chatbots as virtual patients in dental education: A constructivist approach to classroom implementation', European Journal of Dental Education. https://onlinelibrary.wiley.com/doi/pdf/10.1111/eje.13135 (Accessed: 7 October 2025).

Karafyllidis, T. and Papaevripidou, M. (2024) Methodology for the evaluation of educational impact (D6.1). Nicosia: University of Cyprus (UCY).

Karafyllidis, T. and Papaevripidou, M. (2025) Evaluation of educational impact results (D6.2). Nicosia: University of Cyprus (UCY).

Karafyllidis, T., Papaevripidou, M. and Pavlou, Y. (2025) 'Artificial Intelligence in the Service of Education: Applications and Tools for Supporting Educators', Proceedings of the 14th Panhellenic Conference on Science Education and New Technologies in Education (ΕΝΕΦΕΤ 2025).

Karafyllidis, T., Papaevripidou, M., Milopoulos, G., Gardelli, V., Katsouros, V., Liwicki, F., Mokayed, H., Ó Murchú, D., Paraskevopoulos, G., Stamouli, S., Vacalopoulou, A. and Zacharia, Z. (2025) 'Investigating the perceptions of AI-powered applications in science education: A TAM-based study', ESERA 2025 Conference paper.

Kennisnet (2025) *How to consciously and responsibly use AI in your school: AI guidelines for schools*. Zoetermeer: Kennisnet

Khan, Z.R. et al. (2024) *Green Paper on Generative AI Use in Education in the UAE*. Dubai: Centre for Academic Integrity in the UAE / University of Wollongong in Dubai.

Kharbach, M. (2025) Teaching with AI: A Step-by-Step Guide to Meaningful AI Integration in the Classroom. EducatorsTechnology.com.

KIOS Research and Innovation Center of Excellence (2025) About KIOS. Nicosia: University of Cyprus. https://www.kios.ucy.ac.cy/ (Accessed: 7 October 2025).

Kivinen, K. (ed.) (2025) AI Guide for Teachers. Helsinki: Faktabaari (Avoin yhteiskunta ry).

KPMG International (2023) *Our 2023 Global Tech Report*. KPMG International.

Kucirkova, N. and Creely, E. (2025) 'Generative AI in education: A systematic review of empirical studies', *Computers & Education*, 215, 105123.

Labadze, L. and Zarnadze, N. (2023) 'Role of AI chatbots in education: systematic literature review', International Journal of Educational Technology in Higher Education, 20, 51. https://link.springer.com/article/10.1186/s41239-023-00426-1 (Accessed: 7 October 2025).

Leslab and PAQT (2024) AI for Citizenship Education — Partner briefing. Erasmus+ KA2 concept note.

Mai, D.T.T., Nguyen, T.M.T. and Nguyen, T.T. (2024) 'The use of ChatGPT in teaching and learning: A systematic review', Frontiers in Education, 9, 1328769. https://www.frontiersin.org/journals/education/articles/10.3389/feduc.2024.1328769/full (Accessed: 7 October 2025).

Microsoft Research Africa; University of Pretoria; NEPAD; Lelapa AI; Oxford University (2024) AI and the Future of Work in Africa: White Paper. Nairobi: MSR Africa and partners.

Milopoulos, G. (2023) Methodology for the evaluation of usability and technology acceptance (D4.1). Athens: Ellinogermaniki Agogi (EA). Milopoulos, G. and Pantelaios, N. (2024) D4.2 Usability testing and technological evaluation results. Athens: Ellinogermaniki Agogi (EA).

Ministry of Digital Governance (Greece) (2020) Digital Transformation Bible 2020–2025. Athens: Government of Greece. https://digitalstrategy.gov.gr/en (Accessed: 7 October 2025).

Ministry of Education Singapore (2025) 'Student Learning Space (SLS)'. Singapore: MOE. https://www.learning.moe.edu.sg (Accessed: 8 October 2025).

Mittal, U., Sai, S., Chamola, V. and Sangwan, D. (2024) 'A comprehensive review on generative AI for education', IEEE Access, 12. https://doi.org/10.1109/ACCESS.2024.3468368.

Monteiro, H. and Mokayed, H. (2024) 'Enhancing educational chatbots with retrieval-augmented generation systems: a study on physics and mathematics courses', in Proceedings of ICERI2024, Seville, 11–13 November 2024, pp. 8312–8319.

National Commission for Bioethics and Technoethics (2025) *Opinion on the artificial intelligence applications in the Greek school.* Athens: National Commission for Bioethics and Technoethics.

Nerantzi, C., Abegglen, S., Karatsiori, M. and Martínez-Arboleda, A. (eds) (2023) 101 Creative Ideas to Use AI in Education: A Crowdsourced Collection. #creativeHE. CC BY-NC-SA 4.0.

NIST (2023) Artificial Intelligence Risk Management Framework (AI RMF 1.0). Gaithersburg, MD: National Institute of Standards and Technology.

NorwAI (2022) 'AI Sweden heading for an AI transformed Sweden', *NorwAI*, 30 June. https://www.ntnu.edu/norwai/ai-sweden-heading-for-an-ai-transformed-sweden (Accessed: 18 December 2025).NTNU

Nwana, H.S. (1990) 'Intelligent tutoring systems: An overview', Artificial Intelligence Review, 4, pp. 251–277.

OECD (2019) *Artificial Intelligence in Society*. Paris: OECD/LEGAL/0449. Publishing. https://www.oecd.org/en/publications/2019/06/artificial-intelligence-in-society_c0054fa1.html (Accessed: 21 December 2025).

OECD (2019) *OECD Council Recommendation on Artificial Intelligence*. Paris: Organisation for Economic Co-operation and Development.

OECD and Education International (2023) Opportunities, Guidelines and Guardrails on Effective and Equitable Use of AI in Education. Paris: OECD Publishing.

OECD (2023) 'Students, digital devices and learning: What do we know and what can we do?', *OECD Education Policy Perspectives*. Paris: OECD Publishing.

OECD (2024) *How's Life for Children in the Digital Age?* Paris: OECD Publishing.

OECD (2025) *Progress in implementing the European Union coordinated plan on artificial intelligence. Volume 1: Country notes – Sweden*. Paris: OECD Publishing. https://www.oecd.org/en/publications/progress-in-implementing-the-european-union-coordinated-plan-on-artificial-intelligence-volume-1_6d530a88-en/sweden_9221d36d-en.html (Accessed: 21 December 2025).

OECD (2025) *Results from TALIS 2024: The State of Teaching*. Paris: OECD Publishing. https://www.oecd.org/en/publications/results-from-talis-2024_90df6235-en.html (Accessed: 21 December 2025).

OECD (2025) *What should teachers teach and students learn in a future of powerful AI?* Paris: OECD Publishing.

OECD (2025a) *AI Adoption in the Education System: Evidence from the Policy Survey on School Education in the Digital Age*. Paris: OECD Publishing.

OECD and European Commission (2025) *Empowering Learners for the Age of AI: An AI Literacy Framework for Primary and Secondary Education – Review Draft*. Paris/Brussels: OECD/European Commission.

Owan, V.E., Essien, E.E. and Ekum, M.I. (2023) 'Exploring the potential of artificial intelligence tools in educational measurement and assessment', Eurasia Journal of Mathematics, Science and Technology Education, 19(12). https://www.ejmste.com/article/exploring-the-potential-of-artificial-intelligence-tools-in-educational-measurement-and-assessment-13428 (Accessed: 7 October 2025).

O'Donnell, C.L. (2008) 'Defining, conceptualizing, and measuring fidelity of implementation and its relationship to outcomes in K–12 curriculum intervention research', *Review of Educational Research*, 78(1), pp. 33–84. https://doi.org/10.3102/0034654307313793.

Ó Murchú, D., Milopoulos, G., Coakley, P., Hand-Campbell, T. and Rayfus, J. (2025) 'Expansive design across borders: AI-powered education and organisational psychology to cultivate the joy of learning among migrant and minority communities in Ireland', ISDDE 2025 (manuscript).

Papaevripidou, M. and Karafyllidis, T. (2024) 'Artificial Intelligence in Education: Applications and tools for supporting educators and students', Inclusive STE(A)M Education Conference presentation, University of Cyprus.

Republic of Kenya (2025) Kenya Artificial Intelligence Strategy 2025–2030. Nairobi: Ministry of Information, Communications and the Digital Economy.

Ruhi, U., Nieto, M. and Nault, K. (2025) 'From AI literacy to AI competency: Fostering human agency and critical thinking through andragogical practice', AI Fluency Framework, University of Ottawa, Telfer School of Management.

Sana (2025) *Swedish AI Reform: Making AI accessible to 2.3 million Swedes*. https://sanalabs.com/ai-reform (Accessed: 18 December 2025).Sana Labs

Schiff, D.S., Kelley, S. and Camacho Ibáñez, J. (2024) 'The emergence of artificial intelligence ethics auditing', Big Data & Society, October–December, 1–16.

Selwyn, N. (2024) *Education in an Age of Artificial Intelligence: Critical Questions, Cautious Answers*. Cambridge: Polity Press.

Skolverket (2024) *Artificiell intelligens i undervisningen: nulägesbild och vägledning*. Stockholm: Skolverket.

Sleeman, D. and Brown, J.S. (eds) (1982) Intelligent Tutoring Systems. New York: Academic Press.

Stamouli, S., Paraskevopoulos, G. and Katsamanis, N. (2024) 'A Conversational AI Assistant for Teaching and Learning', ERCIM News, 136, pp. 20–21.

Swedish National Agency for Education (Skolverket) (2024) Artificial Intelligence in Education – a short summary (English). Stockholm: Skolverket. https://www.skolverket.se/download/18.6dc18b1c191bf47e55754/1725545910282/Artificial%20Intelligence%20in%20Education%20%E2%80%93%20a%20short%20summary%20in%20English.pdf : (Accessed: 21 December 2025).

The Alan Turing Institute (2021) *Understanding AI Ethics and Safety*. London: The Alan Turing Institute.

The Alan Turing Institute (2024) AI Accountability in Practice. London: The Alan Turing Institute.

The Alan Turing Institute (2024) *AI Assurance: A Toolkit for Practitioners and Policymakers*. London: The Alan Turing Institute.

The White House (2025) 'Advancing Artificial Intelligence Education for American Youth', *Executive Order*, 23 April. https://www.whitehouse.gov/presidential-actions/2025/04/advancing-artificial-intelligence-education-for-american-youth/ (Accessed: 21 December 2025).

UK Department for Science, Innovation and Technology / Centre for Data Ethics and Innovation (2023–2024) *AI assurance guidance and toolkit*. London: DSIT/CDEI.

U.S. Department of Education, Office of Educational Technology (2023) Artificial Intelligence and the Future of Teaching and Learning: Insights and Recommendations. Washington, DC: U.S. Department of Education.

UNECE (2012) Learning for the Future: Competences in Education for Sustainable Development. Geneva: United Nations Economic Commission for Europe.

UNESCO (2021) *AI and Education: Guidance for Policy-Makers*. Paris: UNESCO.

UNESCO (2021) *AI Competency Framework for Students*. Paris: UNESCO.

UNESCO (2022, 2023) *Mapping of K–12 AI curricula and generative AI in education guidance*. Paris: UNESCO.

UNESCO (2023) *Guidance for Generative AI in Education and Research*. Paris: UNESCO. https://www.unesco.org/en/articles/guidance-generative-ai-education-and-research (Accessed: 21 December 2025).

UNESCO (2023) *Global Education Monitoring Report 2023: Technology in education – A tool on whose terms?* Paris: UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000385723 (Accessed: 21 December 2025).

UNESCO (2024) AI Competency Framework for Students. Paris: UNESCO. https://www.unesco.org/en/articles/ai-competency-framework-students (Accessed: 21 December 2025).

UNESCO (2024) Greece's Digital Education Transformation Initiative. Paris: UNESCO. https://www.unesco.org/en/dtc-financing-toolkit/greeces-digital-education-transformation-initiative (Accessed: 7 October 2025).

UNESCO (2024a) Miao, F., Shiohira, K. and Lao, N. *AI Competency Framework for Students*. Paris: UNESCO.

UNESCO (2024b) Miao, F. and Cukurova, M. *AI Competency Framework for Teachers*. Paris: UNESCO.

UNESCO (2024c) *AI Competency Framework for Teachers*. Paris: UNESCO. https://www.unesco.org/en/articles/ai-competency-framework-teachers? (Accessed: 21 December 2025).

UNICEF (2025) Policy Guidance on AI for Children Version 3. New York: UNICEF. https://www.unicef.org/innocenti/reports/policy-guidance-ai-children (Accessed: 21 December 2025).

UNICEF Innocenti and UNICEF Sweden (2024) Making Digital Learning Work: Lessons from the UNICEF–Akelius Digital Learning Initiative in 12 countries. Florence: UNICEF Innocenti.

UNICEF (2021) *Policy Guidance on AI for Children*. New York: UNICEF.

UNICEF and Akelius Foundation (2023) *Akelius digital learning: lessons from implementation in crisis contexts*. New York/Berlin: UNICEF and Akelius Foundation.

U.S. Department of Education, Office of Educational Technology (2023) *Artificial Intelligence and the Future of Teaching and Learning: Insights and Recommendations*. Washington, DC: U.S. Department of Education.

U.S. Office of Educational Technology (2023) *Artificial Intelligence and the Future of Teaching and Learning: Insights and Recommendations*. Washington, DC: U.S. Department of Education.

Vacalopoulou, A., Simistira, F., Mokayed, H., Papaevripidou, M., Katsouros, V., Liwicki, F., Ó Murchú, D., et al. (2024) 'AI4EDU: An innovative conversational AI assistant for teaching and learning', in INTED2024 Proceedings. https://doi.org/10.21125/inted.2024.1877.

W3C (2023) Web Content Accessibility Guidelines (WCAG) 2.2. World Wide Web Consortium.

Wallenberg AI, Autonomous Systems and Software Program (WASP) (2025) *About us*. https://wasp-sweden.org/about-us/ (Accessed: 18 December 2025).WASP

Walter, P. (2024) 'Prompting as critical literacy: teaching students to question AI', *Journal of Learning Sciences*, 33(2), pp. 145–162.

Walter, Y. (2024) 'Embracing the future of AI in the classroom: the relevance of AI literacy, prompt engineering, and critical thinking', International Journal of Educational Technology in Higher Education, 21, 15. https://doi.org/10.1186/s41239-024-00448-3.

Wayne RESA (2023) *Guidance for the use of artificial intelligence in K–12 teaching and learning*. Wayne County, MI: Wayne County Regional Educational Service Agency.

Wang, C. et al. (2024) 'Fostering engagement in AI-mediated Chinese EFL classrooms: The role of classroom climate, AI literacy and resilience', European Journal of Education. https://www.researchgate.net/publication/387019686_Fostering_Engagement_in_AI-assisted_Chinese_EFL_Classrooms_The_Role_of_Classroom_Climate_AI_Literacy_and_Resilience (Accessed: 7 October 2025).

Wang, J. and Fan, W. (2025) 'The effect of ChatGPT on students' learning performance, learning perception, and higher-order thinking: insights from a meta-analysis', Humanities and Social Sciences Communications, 12, 621. https://doi.org/10.1057/s41599-025-04787-y.

Wang, S., Wang, F., Zhu, Z., Wang, J., Tran, T. and Du, Z. (2024) 'Artificial intelligence in education: A systematic literature review', *Expert Systems with Applications*. Advance online publication. https://www.sciencedirect.com/science/article/pii/S0957417424010339?utm (Accessed: 21 December 2025).

WASP-ED (2025) *The Wallenberg AI and Transformative Technologies Education Development Program*. https://wasp-ed.org/ (Accessed: 18 December 2025)

Wayne RESA (2023) Guidelines and Considerations for AI in Education. Wayne County, MI: Wayne RESA.

White House (2025a) 'Advancing Artificial Intelligence Education for American Youth', Executive Order 14277, 23 April, Washington, DC: The White House.

White House (2025b) *America's AI Action Plan*. Washington, DC: The White House

Woolf, B.P. (2009) *Building Intelligent Interactive Tutors: Student-Centered Strategies for Revolutionizing E-Learning*. Burlington, MA: Morgan Kaufmann. https://www.researchgate.net/publication/232322117_Building_Intelligent_Interactive_Tutors_Student-Centered_Strategies_for_Revolutionizing_E-Learning (Accessed: 21 December 2025).

Zhang, K., Gao, F., Shen, J. and Spector, J.M. (2024) 'A systematic review of empirical research on applying generative AI in education', *Computers and Education: Artificial Intelligence*, 6, p. 100205.