AI Competence Frameworks and Policies in Higher Education: Synthesis Report

by Yeditepe University* and University of Tartu**

Krista Lepik-Verliin**
Berrin Yanıkkaya*

Ege Simge Demirel*
Helen Hint**
Djuddah Arthur Joost Leijen**

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Fostering Learners' AI Readiness

FLAIR

KEY ACTION

Partnerships for cooperation and exchanges of practices

ACTION TYPE

Cooperation partnerships in higher education

WEB INFORMATION

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For further information please contact:
Dr. Johanna Warm
Coordinator
Vienna University of Economics and Business
Teaching & Learning Development | Program Management & Teaching & Learning
Welthandelsplatz 1
1020 Vienna
Johanna.warm@wu.ac.at

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Abbreviations

AI - Artificial Intelligence

AIPA- Artificial Intelligence Policies Association

AQ Austria - Agency for Quality Assurance and Accreditation Austria

BMBWF - Federal Ministry of Education, Science and Research

CoHE - Council of Higher Education, Türkiye

CRUE - Conference of Rectors CRUE

ECTS - European Credit Transfer and Accumulation System

e-Estonia - A term for Estonia's digital society

ENIA - Estrategia Nacional de Inteligencia Artificial (ENIA)

EU - European Union

ERR - Education and Examination Regulations

EXAI - Estonian Centre of Excellence in Artificial Intelligence

fnma – Forum neue Medien in der Lehre Austria

GAI - Ethical Guidance for the Use of Generative Artificial Intelligence

GDPR - General Data Protection Regulation

HEA - Higher Education Authority

HEIs - Higher Education Institutions

ICT - Information and Communications Technology

IT - Information Technology

MBO - Middelbaar Beroepsonderwijs (secondary vocational education)

MEB - Ministry of National Education, Türkiye

NAIN - National Academic Integrity Network

NLAIC - Netherlands AI Coalition

NOLAI - National Education Lab AI

OECD - Organization for Economic Co-operation and Development

QQI - Quality and Qualifications Ireland

SFI - Science Foundation Ireland

STEM - Science, Technology, Engineering, and Mathematics

SURF - The collaborative organization for IT in Dutch education and research

UNESCO - United Nations Educational, Scientific and Cultural Organization

TÜBİTAK - The Scientific and Technological Research Council of Türkiye

WO - Wetenschappelijk Onderwijs (university education)

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Executive Summary

This report, as a key deliverable for the **"Fostering Learners' AI Readiness (FLAIR)"** project, focuses on AI Competence Frameworks and Policies in Higher Education and synthesizes the findings from six comprehensive national reports covering **Austria (Vienna University of Economics and Business), Estonia (University of Tartu), Ireland (University College Cork), the Netherlands (Tilburg University), Spain (Ramon Llull University), and Türkiye (Yeditepe University)**. Each of these national reports provides a multi-layered analysis of AI in (higher) education, incorporating reviews of national AI strategies, institutional case studies and examples of good practices from within each country, and a critical examination of international frameworks and scholarly literature. This synthesis compares and contrasts national findings to identify convergent trends, unique approaches, and significant gaps in applying AI in (higher) education context.

This comparative analysis aims to define AI literacy more clearly, deepen the understanding of existing policies, identify good practices, and ultimately support the development of a comprehensive AI literacy framework. The conclusions are drawn from a rich evidence base: the national reports from partner institutions—each integrating reviews of governmental policies, institutional actions, and scholarly work—supplemented by an analysis of 26 international AI-relevant documents from major organizations like UNESCO and the OECD, scholarly works and competency frameworks.

From this extensive review, a clear European consensus and framework emerge (see Figure 1 below): Core AI competencies should be developed ethically and, in a human-centered way, guided by appropriate pedagogical principles and within a framework of strategic implementation. National strategies consistently prioritize fostering broad "AI literacy" for all citizens and specialized skills for the future workforce, driven by goals of economic competitiveness and social well-being.

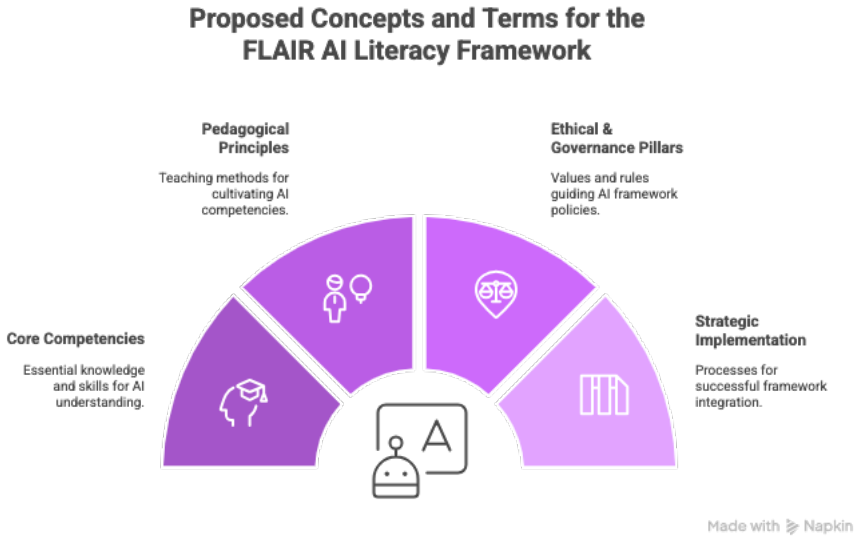

Figure 1 - Proposed Concepts and Terms for The FLAIR AI Literacy Framework

Common themes emerge, with an emphasis on lifelong learning and transversal skills such as critical thinking, creativity, and collaboration. Key competencies frequently cited include foundational AI knowledge, critical engagement with AI systems, ethical and responsible use, and an understanding of AI's societal impacts.

However, despite this strategic alignment, the reports identify a critical implementation gap. There is a widespread lack of concrete pedagogical models and sufficient professional development for educators, particularly in higher education. While national strategies set ambitious goals, the institutional capacity to translate these into new curricula, teaching methods, and assessment practices is lagging.

Therefore, this synthesis recommends that any new competencies framework for Higher Education must be fundamentally pedagogical. It should provide actionable guidance for educators and prioritize the reform of teaching and assessment to prepare society for the challenges of an AI-driven world. Furthermore, the changes that the higher education sector in general, and learning and teaching in particular, have been experiencing suggest that this transition should be conceptualized as change management.

Introduction

The role of generative artificial intelligence (GenAI) in education, and in higher education more specifically in the context of this report, has gained a lot of attention in recent years. Various institutions, organizations, and national governments have developed strategies and materials to support the application and integration of AI in education. In addition, there are many approaches and frameworks available that aim to clarify the concept of AI literacy and offer various strategies to enhance AI literacy among students. However, due to the abundance of materials, it may be very difficult for educators and students to decide which framework or strategy best covers their needs, or more importantly, which aspects addressed in these frameworks are relevant for their national or institutional contexts. In addition, as various frameworks seem to emphasize different components of AI literacy, it might be the case that for a full coverage of all dimensions of AI literacy, several frameworks should be adopted. Therefore, in FLAIR project, we aim to offer a thorough synthesis of current AI literacy frameworks (those presented and printed until the first half of 2025).

The objective of this cooperative partnership is to develop a novel AI literacy framework for Higher Education, which will then be used to create practical self-learning modules for students and materials ready to be used in the classroom. To define what constitutes AI literacy, this desk research analyses the key skills and competencies outlined in existing AI frameworks.

In the following pages, first, the national context of the participating institutions in the consortium will be summarized. In this section, drawing on regulations or guidance provided by national bodies and available policy documents will be referenced to grasp a general understanding of the current state of play.

Then, each higher education institution's (HEI's) previous and current activities and initiatives are presented. The focus is on the existence of official guidelines and policies, AI-related initiatives, and AI use in learning and teaching.

This is followed by the section which consolidates the findings from six reports analyzing AI-related international documents. This part involves a collective review of 26 global documents; most country teams analyzed four documents each, with one team analyzing six.

These documents encompass a range of types, including competency frameworks, scholarly articles, policy documents, and reports offering insights and recommendations. They originate from a diverse set of sources, from international organizations like UNESCO, the Open University, and the OECD, to national organizations such as the University of Hong Kong and Germany's Baden-Württemberg Cooperative State University.

We focus on competences that support "students' use of generative AI responsibly, ethically and effectively". This means that albeit some AI literacy frameworks or documents discussed in national reports justly approach AI literacy holistically, considering the entire ecology of AI education, the focus of our synthesis report is on one particular section, students from various

disciplines. Because of the sudden public availability of GenAI since the end of 2022, the focus of this synthesis report (as well as the entire FLAIR project) is also on the effective use of GenAI when creating new content.

The goal of the project is to develop practical self-learning modules for students and teaching materials for the classroom. At the end of the synthesis report, a comprehensive AI framework is developed based on the analysis of existing frameworks as well as recommendations formulated in the national reports by the partners. Based on this, a didactic framework will be developed, integrating also learnings from qualitative interviews done by the consortium partners.

To ensure a consistent analytical framework, the FLAIR project team developed a structured set of questions addressing various aspects of the selected documents. These questions aimed to guide the evaluation of all reports under a shared lens, addressing key themes such as definitions of AI literacy, policy scope, bias mitigation, implementation strategies, stakeholders, and educational implications.

In the conclusion part of the synthesis report, the answers to the following questions are explored:

- Where are the overlaps in the frameworks?
- What competences/approaches are missing?
- What is particularly important for AI skills framework on learning and teaching?
- What is specifically relevant for (adapting) teaching/learning in higher education?
- What are the proposed concepts and terms for the framework?

National Contexts

The six countries who contributed to this report (Austria, Estonia, Ireland, Netherlands, Spain, and Türkiye) all operate in a global context that affects the implementation of AI technologies (including generative AI). Global AI literacy frameworks are most often produced by EU institutions (European Commission, The Council of the European Union) or large international organizations (e.g., UNESCO, World Economic Forum). National policies and guidelines are the responsibility of the relevant line ministries (economy, education, digital affairs) or dedicated agencies (e.g., HEA, QQI in Ireland; BMBWF in Austria).

From the legal perspective, the most relevant regulation for this synthesis report is the EU AI Act (Regulation 2024/1689), which harmonizes AI use across the EU internal market. While it does not provide non-binding recommendations specifically for education, it directly affects higher education by classifying AI systems, setting requirements, and outlining potential prohibitions. The Act emphasizes transparency, the identification of high-risk systems, and related mitigation measures—highlighting education as a key area for such oversight.

Austria: Current State of AI in Higher Education

Austria is yet to develop specific national regulations for AI in higher education, but the **AIM AT 2030** (Artificial Intelligence Mission Austria) strategy (Federal Government Republic of Austria. (2021a-b) provides a comprehensive national vision. This strategy, supported by a 2024 Implementation Plan (Federal Chancellery Republic of Austria, 2024), promotes a 'human-centered AI' approach. For the education sector, it endorses the use of AI for personalized learning and highlights four key areas for funding: smart content creation, intelligent tutoring systems, virtual learning guides, and learning analytics. The government steers universities through funding mechanisms, such as prioritizing AI skills in the 2025-2027 performance agreements, and through initiatives like the **"Discussion of Artificial Intelligence in the Education System" (2023)** guideline.

Until the beginning of 2025, Austrian universities have relied on individual approaches, generally focusing on guidelines and resources rather than rigid policies. For example, University of Vienna has an AI task force and extensive guidelines, University of Graz provides text blocks on AI use for teachers to include in their syllabi, Johannes Kepler University Linz has integrated AI into its centre for higher education didactics, and Paris Lodron University Salzburg has published specific tips for using tools like ChatGPT.

A national study conducted by **Brandhofer et al. (2024)** at the end of 2023 provides insights into the current state of AI use. Key findings include:

- **Competence**: Both teachers and students feel more competent with general digital technologies than with specific AI applications.

- **Usage**: AI is primarily used for language processing and research. Teachers plan to use it more for creating materials and checking for plagiarism, while students aim to use it for efficiency and data analysis.
- **Challenges**: Data protection and copyright are the main institutional challenges. Individually, teachers worry about the loss of expertise, while students are concerned about the accuracy of AI outputs and the skills needed to use the tools effectively.
- **Leadership Perspective**: University rectors and vice-rectors view AI competence as the ability to use AI meaningfully, critically evaluate its output, and understand its ethical implications. They see critical thinking and communication skills as essential transversal skills.

Estonia: Current State of AI in Higher Education

The context for AI policy in Estonia is identified by three key ministries involved: the Ministry of Economic Affairs and Communications, the Ministry of Justice and Digital Affairs, and the Ministry of Education and Research. The current AI policies are informed by foundational national documents, including the **"AI action plan for 2024-2026"** (Majandus- ja Kommunikatsiooniministeerium, Justiitsministeerium, Haridus- ja Teadusministeerium, n.d.) and the **"White book of data and AI 2024-2030"** (Haridus- ja Teadusministeerium, Justiitsministeerium, Majandus- ja Kommunikatsiooniministeerium, n.d.). These strategies are aligned with EU-level legislation, notably the **EU AI Act (Regulation 2024/1689)**. The report notes that Estonian guidelines for AI in education have been suggestive rather than prescriptive, allowing for academic freedom.

The goal in Estonia is framed as to systematically integrate data management and AI topics into all education levels by 2030 to ensure the workforce remains competitive. A major initiative is the **AI Leap 2025** program, which aims to provide students and teachers with free access to leading AI applications and training, building on the legacy of the earlier "Tiger Leap" program that digitized schools (Presidential Digital Council & Ministry of Education and Research, 2025; e-Estonia, 2025). While this, and the creation of AI guidelines by the Ministry of Education and Research (Haridus- ja Teadusministeerium, 2024) represent a coordinated national effort, several Estonian HEIs have developed their own AI guidelines independently, taking into account their academic cultures.

By the beginning of 2025, out of 18 educational institutions offering higher education, six had their AI guidelines available online. Topics covered in AI guidelines usually include: a) values such as honesty, ethical approach, and critical thinking, and the responsibility for the quality of one's own work; b) examples of learning activities where AI chatbots are allowed or even encouraged, some guidelines also provide a list of problems in AI technologies; c) instructions about citing and referring to the usage AI tools.

Ireland: Current State of AI in Higher Education

In Ireland, AI and GenAI policy and guidance is primarily provided by three key bodies: the Higher Education Authority (HEA) within the Department of Further and Higher Education, Research, Innovation and Science; the Department of Education; and the Department of Enterprise, Trade and Employment. These bodies develop national AI/GenAI education policy and strategy, working

alongside the National Academic Integrity Network (NAIN) to ensure consistent academic integrity standards. Key guidance documents include the HEA's ten considerations for GenAI adoption in higher education (2025), Ireland's refreshed National AI Strategy (2024), an AI skills assessment by the Expert Group of Future Skills Needs (2022), and NAIN's GenAI guidelines for educators (2023). The Irish government's *AI – Here for Good: A National Artificial Intelligence Strategy for Ireland* (updated in 2024) focuses on building public trust and developing skills, partly through education. The strategy is informed by the *AI Skills* report from the Expert Group of Future Skills Needs (EGFSN, 2022), which concluded that everyone will need some knowledge of AI and that educators require training to embed AI skills in teaching. The AI Advisory Council has also provided guidance, emphasizing privacy, equity, and the need for AI literacy to be a key part of professional development (AI Advisory Council, 2025).

While there is no single national policy regulating AI in Irish HEIs and Irish universities have significant scope to devise their own policies, guidance from NAIN and the HEA offers key considerations. The NAIN guidelines address awareness of AI's capabilities and limitations, adapting assessments, and providing training. The HEA's ten considerations cover topics such as AI literacy, academic integrity, equitable access, and sustainability. In practice, institutions like Trinity College Dublin (2025) and the University of Limerick (2025) have updated their own academic integrity policies and published principles for AI use.

Netherlands: Current State of AI in Higher Education

The Dutch national approach to AI is characterized by a blend of governmental guidance and significant institutional autonomy for universities. The national framework is built upon a philosophy of promoting human-centric, ethical, and transparent AI, allowing educational institutions to develop their own specific policies within these guidelines.

The overarching strategy is directed by key national initiatives, including the Strategic Action Plan for AI (2019) and the government's Vision on Generative AI (2024). These are supported by collaborative projects aimed at fostering digital sovereignty and practical application. The National Education Lab AI (NOLAI) promotes safe AI integration in primary and secondary education, whilst the GPT-NL project develops a national open-source generative AI model led by non-profit organizations (TNO, NFI, and SURF).

The Npuls program, a National Growth Fund initiative for all Dutch educational institutions, encompasses multiple projects: an Algorithm Register for transparency, Privacy and Ethics Reference Framework for AI 2.0, AI and Data Literacy Initiative, Vision on AI document, and the EduGenAI Platform for safe LLM use.

Dutch AI governance operates under general laws like AVG (localized GDPR), with institutions preparing for EU AI Act (Regulation 2024/1689) compliance, which is expected to be fully implemented by 2026. The approach aligns with European strategies whilst emphasizing collaborative structures and substantial pilot project investments.

Reflecting their institutional autonomy, Dutch universities are developing their own distinct approaches, generally maturing from initial guidelines towards comprehensive policies. For example, the **University of Amsterdam** (n.d.) has a regularly reviewed AI policy focused on supporting lecturers, assessing AI's impact on qualifications, and addressing concerns like plagiarism and privacy. Meanwhile, **Maastricht University** (n.d.) has a framework for integrating generative AI responsibly into its problem-based learning curriculum, offering practical support through training and an AI Prompt Library.

Spain: Current State of AI in Higher Education

Spain's approach to integrating Artificial Intelligence (AI) into higher education is guided by its comprehensive national strategy, the *Estrategia Nacional de Inteligencia Artificial* (ENIA), launched in **2020**. Aligned with the EU's Digital Agenda and backed by €600 million in EU recovery funds, this strategy explicitly commits to advancing AI research, developing talent, and ensuring ethical governance. A core pillar of ENIA (Spanish Government, 2020) focuses on reinforcing Spain's educational capabilities, recognizing universities as pivotal institutions for preparing the future workforce and fostering responsible innovation.

This national directive has prompted Spanish universities to embed AI across their structures (see for example ACCIÓ, 2024). Many have introduced specialized undergraduate and master's degrees in AI, Machine Learning, Robotics, and Big Data. AI is also being increasingly integrated into existing programs across diverse fields like engineering, economics, and the humanities, highlighting its interdisciplinary significance (BOE, 2020). Furthermore, there is a growing emphasis on lifelong learning initiatives and micro-credentialing to upskill professionals in AI competencies, often through partnerships with industry.

Spain's policy landscape is multi-layered, incorporating European and regional frameworks. The **National Digital Skills Plan (2021)** and the adoption of the DigCompEdu framework (Punie & Redecker, 2017) demonstrate integration with European priorities, such as the EU Digital Education Action Plan (2021-2027), to embed AI literacy and address the digital divide. Regional strategies, like the Catalonia.AI initiative, complement these national goals by positioning local universities as hubs for ethical research and industry collaboration. At the cross-institutional level, a **2024 report** from the Conference of Rectors (CRUE) guides universities in navigating AI's disruptive potential, balancing opportunities like personalized learning with challenges such as academic integrity and bias, and urging for the development of proactive institutional policies.

The Catalonia.AI Strategy by Generalitat de Catalunya (2021) positions Catalonia as an AI talent and innovation hub with universities at its centre. It proposes promoting AI research and training in critical areas like explainable AI and AI ethics, supporting AI integration into university curricula and processes, strengthening academia-industry collaboration through Living Labs, fostering AI literacy amongst students and staff, and increasing public investment in strategic AI education fields. The strategy aligns with European frameworks including Horizon Europe, Digital Europe, and the European Commission's Coordinated Plan on AI, ensuring local policies integrate with continental goals.

The Fundació Jaume Bofill's report "Els algorismes a examen: Per què la IA a l'educació?" / "Algorithms Under Scrutiny: Why AI in Education?" (2022) critically examines AI's educational impact. It emphasizes informed and participatory AI integration, positions teachers as key actors in helping students understand AI and digital rights, highlights both opportunities and inequality risks, calls for clear regulatory frameworks in higher education, and advocates for AI use aligned with human rights principles, referencing the UNESCO Beijing Consensus on AI and Education.

Türkiye: Current State of AI in Higher Education

Türkiye is developing a comprehensive, multi-layered approach to the integration of AI in education, driven by national strategy and supported by guidelines from educational bodies and individual universities. The policies prioritize ethical considerations, workforce development, and responsible innovation.

The cornerstone of the nation's approach is the **Türkiye Ulusal Yapay Zeka Stratejisi 2021–2025** (Turkish National Artificial Intelligence Strategy, published 2021). This national strategy aims to establish Türkiye as a regional AI leader by enhancing research and development, training a skilled workforce, and promoting ethical AI practices. It was developed collaboratively with public, private, and academic stakeholders, benchmarking against international standards from the OECD and EU.

Supporting this, the **Council of Higher Education (CoHE/YÖK)** released its **Ethical Guidance for the Use of Generative Artificial Intelligence (GAI)** in 2023. This document specifically targets academic research, outlining principles of transparency, accountability, and academic integrity. It advises that GAI is suitable for technical support tasks like data analysis but cautions against its use for high-level cognitive work such as hypothesis development.

Initiatives also extend to pre-university education. The **Ministry of National Education (MEB)** published the **Artificial Intelligence Tools – Handbook for Teachers** in May 2024 to provide practical guidance for K-12 educators. Furthermore, **TÜBİTAK**'s (Scientific and Technological Research Institution of Türkiye) **Artificial Intelligence Technology Workshops for Middle Schools** framework (2023) aims to build AI literacy among younger students through hands-on programming and ethics education.

The **Artificial Intelligence Policies Association (AIPA)** contributed with its **Artificial Intelligence in Education – Policies** document in 2023, which defines key competencies such as digital, algorithmic, and data literacy, and promotes ethical AI integration in education.

At the institutional level, a review of Türkiye's 209 universities found that 12 have developed formal AI policies. These documents vary in detail but share common themes of academic integrity, ethical use, data privacy, and transparency.

Notable examples include:

- **Boğaziçi University's "Academic Integrity and Artificial Intelligence Policy"** (n.d) provides general guidance and links to international examples.
- **Burdur Mehmet Akif Ersoy University's "Ethical Guide for the Use of Generative Artificial Intelligence (GAI)"** (n.d) is a detailed document that references specific national laws, such as those concerning data protection and intellectual property.
- **Koç University** has implemented role-specific guidelines for faculty, students, and researchers and established an **Artificial Intelligence Governance Committee** to oversee policy development and ethical review (Koç University, n.d).
- **MEF University's** policy (2024) is particularly comprehensive, aligning with the national strategy and referencing international frameworks from the OECD and EU. It establishes a dedicated AI Committee with diverse representation to manage its implementation across teaching, research, and administration.

The countries of the partnering institutions recognize AI's impact on higher education teaching and learning, though the depth of impact and coverage varies significantly. Estonia offers the most concrete, time-bound targets for implementation. Ireland provides sector-specific guidelines tailored to different educational contexts. Austria relies on voluntary action and funding incentives rather than regulatory mandates. The Netherlands combines government guidance with institutional autonomy, creating a balanced approach. Spain is positioning universities as central hubs for ethical AI research and industry collaboration. Türkiye emphasizes education's importance in training skilled personnel whilst prioritizing research and development as essential for field advancement. Whilst all reports address this topic, Austria explicitly advocates for the absence of binding regulatory rules, viewing voluntary measures as more appropriate.

Most of the national reports do not document government, government-commissioned, or institutional studies specifically investigating AI use in higher education. Austria emphasizes the fnma ('Forum neue Medien in der Lehre Austria') project, which addresses how AI will transform teaching and learning in higher education through a one-off survey. In Estonia, a few representative studies cover AI use by faculty members (Laak et al., 2024) and students (Tamm, 2024; Tragel et al., 2025) at the University of Tartu. Ireland explicitly acknowledges the absence of national-level higher education surveys on this topic. The Netherlands highlights the Npuls program, which encompasses several projects and working groups serving all public vocational and education training schools, universities of applied sciences, and research universities. In Türkiye, which has a national AI policy document, a report is available containing analyses of the current situation and application examples at the K-12 level (T.C. Millî Eğitim Bakanlığı, 2024).

Institutional Case Studies

For the institutional report analysis conducted within the scope of the project, each partner institution examined its own university's AI policies and activities. This section provides summaries of the case studies from Vienna University of Economics and Business (WU), University of Tartu (UT), University College Cork (UCC), Tilburg University (TiU), University of Ramon Llull (URL) and Yeditepe University (YU).

WU Case Study

Since spring 2023, Vienna University of Economics and Business (WU) has proactively managed the integration of AI. Key initiatives include:

- Creating **informational websites** and organizing **regular faculty meetings** to facilitate open discussions on integrating AI into teaching and learning. In a similar vein, WU has been actively involved in broader discussions and collaborations concerning AI in education. Among other activities, WU has hosted a Seamless Learning Conference in 2024, focusing on the role of AI as a co-teacher.
- **Conducting surveys** to understand discipline-specific AI use in teaching, learning and research, and students' use of AI tools.
- **Designing workshops for staff and students** on topics like AI citation, legal issues such as copyright and data protection, and AI-resilient teaching.
- Publishing a **Policy on Lists of Aids Used in Student Seminar Papers and Theses** in December 2024. Starting from January 2025, students will have to submit a list of aids together with their master's and bachelor's thesis, to provide an overview of which aids they have used where, how and to what extent in a paper.
- Planning for the 2025-2027 period includes developing **online modules and a dynamic community hub** to further build AI literacy among students and staff.

UT Case Study

As a response to the widespread use of OpenAI's ChatGPT, University of Tartu formed an ad hoc working group of university staff members to develop the **guidelines for using AI applications on teaching and learning** in April 2023. A more systematic approach to developing and updating the guidelines has been adopted since 2024, when a stable 'AI in teaching' working group was formed.

Since 2023, UT has focused on four key initiatives:

- **Guidelines and policies:** UT developed guidelines (University of Tartu, n.d.) that encourage the purposeful, ethical, transparent, and critical use of AI in teaching and learning. The university also issued a position statement advising against the use of AI detection software.
  The first version of guidelines (in 2023) included general guiding principles, and recommendations about using AI chatbots in teaching and learning. The increased

demand for more specific recommendations necessitated updating the guidelines and adding a chapter (in 2024) about the use of AI in thesis writing, by providing a list of activities where the use of AI is allowed, and where it is prohibited.

- **Training courses and seminars:** in 2024, the 'AI in teaching' working group created an online learning resource for staff and students and regularly organizes practical workshops and experience-sharing seminars (Hiiesalu et al., 2024). The teaching staff has been strongly encouraged to use the online learning resource, and to discuss the benefits and drawbacks of using AI with their students, too.
- **Monitoring current practices:** UT actively monitors AI adoption through staff surveys and practical experiments. In addition to finding out about staff's preferences of AI tools and adjustments of teaching practices, the staff surveys are particularly useful to detect what forms of support and training are needed to navigate the rapidly evolving AI landscape. One experiment revealed that students with no prior knowledge could use AI to complete assignments and achieve a passing grade, highlighting the urgent need to rethink assignment design.
- **Research and collaboration:** UT was instrumental in founding the **Estonian Centre of Excellence in Artificial Intelligence (EXAI)**, a national initiative fostering interdisciplinary research on reliable and ethical AI.

UCC Case Study

University College Cork (UCC) has updated its **Academic Integrity for Examinations and Assessments Policy** in 2024 to state that submitting work from generative AI without acknowledgement and authorization is a breach of academic integrity. The policy also clarifies that the use of AI detection software is not sanctioned by the university.

Key initiatives by UCC include:

- **Supporting staff with resources** such as the **Toolkit for the Ethical Use of GenAI in Learning and Teaching** (Goff & Dennehy, 2024) and **Short Guide 9: Assessment in the Age of AI** (Thelen, 2024). The Toolkit contains case studies along with contextual information on what GenAI is, critical AI literacy (bias/misinformation, copyright/intellectual property/privacy, environmental impact, and exploitation of workers), and an academic integrity framework for considering GenAI use. The Short Guide provides guidance for academic staff to support academic integrity and offers suggestions for assessment design.
- **Supporting students** with a ***GenAI Learning Hub*** to aid their responsible and effective use of GenAI. This resource provides useful knowledge about generative AI – the topics vary from GenAI's working principles and ethical considerations to effective prompting, critical appraisal, and the role of the user in the academic context (keeping in mind academic integrity, acknowledgement, and uses during stages of assessment).
- **Organising regular workshops** – offered by the Skills Centre, Centre for the Integration of Teaching, Learning and Research (CIRTL), the university library, and the Digital Advisory Centre on topics like accessibility, responsible AI use and assessment design.
- **Research** focus on AI through its *UCC Futures: Artificial Intelligence & Data Analytics* initiative, which involves the **Insight SFI Research Centre for Data Analytics**.

TiU Case Study

Tilburg University's approach to the responsible and ethical use of Generative Artificial Intelligence (GenAI) is outlined below, including the development of its policies, guiding principles, support for staff and students, and examples of good practice.

Instead of imposing immediate top-down rules, Tilburg University adopted a collaborative approach to develop its GenAI guidelines between 2023 and 2025. This several key initiatives are listed below:

- **Working Group Recommendations (2023):** Two advisory reports provided initial guidance. The first offered urgent advice to teaching staff on handling AI in assessments, while the second provided broader, long-term recommendations for integrating AI into curriculum design and staff training.
- **Education and Examination Regulations (EER) Addendum (2023–2024):** The university's formal regulations were updated to classify the unauthorized use of GenAI in examinations as a form of fraud. This codified the principle that examiners must grant explicit permission for AI use in assessments.
- **Privacy & Security Guidelines (2025):** The Chief Information Security Officer (CISO) published detailed advice for all university members. Key principles include not inputting confidential or personal data into external AI tools, adhering to GDPR, and critically verifying all AI-generated output for errors and biases.
- **Library and Academic Integrity Guidance:** The library provides practical resources on how to use AI ethically and cite it correctly in academic work, promoting transparency and good scholarly practice.

- Tilburg University provides extensive support to help staff and students navigate GenAI through **the Tilburg.ai platform**, **E-Module and workshops**, a virtual teaching assistant, transparent AI-assisted assignments, **and the TUNED IN Community, which is a** community of practice for lecturers and support staff to share experiences and solutions related to AI in education.

URL Case Study

As an institutional case study, Universitat Ramon Llull (URL) initiated its formal approach to Artificial Intelligence by establishing a working group that developed a foundational set of ten recommendations in **December 2023**. These were designed to establish ethical criteria and good practices, ensuring the use of AI tools aligns with the university community's values. The core recommendations advocate for respectful and responsible action, privacy protection, environmental awareness, promoting AI knowledge, cultivating critical thinking, ensuring fairness, encouraging human interaction, using AI as a tool, verifying information, and maintaining transparency.

Building on this foundation, the working group published a series of more specific recommendations in **2024** to explore key societal and ethical dimensions of AI. The key initiatives of URL include:

- **Artificial Intelligence and Legality (May 2024):** This addresses the legal and ethical issues arising from AI, placing them within the context of recent regulations like the European Parliament's AI Act, which was approved in March 2024.
- **Artificial Intelligence and Creativity (May 2024):** This document frames the relationship between AI and art as a "collaborative" one, emphasizing that while AI can generate content, the human element of intention and emotion remains essential to art.
- **Artificial Intelligence and the Digital Divide (May 2024):** This paper examines how rapid digitalization, including AI, can create inequality and argues for comprehensive, critical, and ethical digital education to ensure equitable access and skills.
- **Environmental Impact of Artificial Intelligence (May 2024):** This highlights the often-unseen environmental costs of AI, from the energy and water consumption of data centers to the generation of electronic waste, aiming to raise awareness of technology's physical footprint.
- **Artificial Intelligence and Mental Health (June 2024):** This explores the dual repercussions of AI on mental well-being, considering both the positive and negative effects it can have on individuals and on the relationships between healthcare professionals and users.

The working group's current focus has shifted towards practical academic applications, specifically on sharing good practices among its schools and faculties concerning plagiarism, academic integrity, and the resulting impact on assessment methodologies.

YU Case Study

Yeditepe University has been proactively integrating Artificial Intelligence (AI) into its academic framework through various research centers, working groups, and educational programs, although a comprehensive, university-wide policy is still in development. The key initiatives of YU includes:

- **AI Working group** establishment in the 2018-2019 academic year which brought together experts from diverse fields to promote scientific study and organize events. An interdisciplinary AI course was also introduced for all undergraduate students.
- The university has focused on the **ethical and legal dimensions of AI**. In December 2024, it addressed the potential for AI to cause discrimination, emphasizing the need for fair development and new legal regulations.
- **Social Sciences Institute** introduced an **Academic Integrity Policy** in 2025 that incorporates ethical considerations for AI, signaling a move towards a broader institutional framework.
- In 2024, YU-LEARNT **(Learning and Teaching Implementation and Research Centre)** organized several events, including a workshop on AI integration in education, a seminar with Dr. Barbara Oakley on the links between AI and neuroscience, and webinars on the ethical applications of AI in teaching. The centre has also developed three distinct AI modules to support staff and students: an introduction to AI, a module on AI in higher education for academic staff, and a module on AI tools for students.

While these activities demonstrate a significant commitment to AI, the university has not yet published a formal policy document on the use of AI in learning and research. A working group, established by the Rector's Office, is currently developing these official guidelines.

Summary of Institutional Case Studies

Across these diverse partnering European HEIs, AI literacy is treated as a civic-level competence that every student must develop. However, institutional backgrounds—including disciplinary focus, culture, and funding mechanisms—determine the pace and methods through which this goal is pursued.

All institutions interpret AI literacy as a baseline competence for every student, transcending disciplinary and program boundaries. Each partnering institution acknowledges the importance of responsible use, transparency, and academic integrity. Ethical judgement, critical evaluation, and social impact are highlighted and prioritized. All partnering HEIs have developed approaches to AI governance in alignment with their specific academic cultures, either by outlining key principles (WU, TiU, UT) or recommendations (URL), or by developing a toolkit (UCC) or a comprehensive framework (YU).

AI Literacy Global Context: Sample Documents from Across the World

This section presents a qualitative analysis of 26 selected documents: frameworks (see Appendix 1), scholarly papers (Appendix 2), and regulations and other types of documents (Appendix 3) on digital literacies, or more specifically, AI literacy to identify core AI competences. The analysis applied in this report builds on three methodological steps: 1) data selection, 2) categorization of the relevant content in the data, and 3) analysis and interpretation of the relevant content.

1) **Data selection**. The partner institutions of the project consortium identified the documents based on their relevance to AI literacy and their focus on either educational policy or competency development. The corpus of documents under scrutiny contained an agreed selection of well-known official publications from organizations such as UNESCO, the EU Commission and other governmental and non-governmental organizations. Documents were included based on their relevance in addressing AI competences and applicability to the HE context. The usability assessment conducted by the project group evaluated each document's relevance to AI literacy versus other forms of literacy (such as digital literacy), practical applicability to GenAI in higher education, and clarity of definitions.

2) **Content categorization.** Each of the six consortium-partners was then assigned four or five documents for conducting a thorough document analysis, which followed a structured approach, using predefined categories, including key concepts to define AI literacy, AI competencies, challenges, recommendations, examples, ethical considerations, and future trends. Recurring themes, similarities, and differences between the documents were identified to present a concluding interpretation of the findings.
   As the initial document selection procedure resulted in variation in document quality and relevance, the national reports also differentiate between the applicability of AI competencies within the specific context.

3) **Analysis and interpretation of the content**. Recurring themes, similarities, and differences between the documents were identified to present a concluding interpretation of the findings in light of AI skills frameworks and the discourse on AI literacy.

This procedure resulted in 6 document analysis reports, one report by each consortium partner, which all synthesized AI frameworks based on a different subset of selected documents. These national reports have then been collated into the following synthesis report, which consists of five major questions to inform the next stages of the project.[1]

[1] For detailed analysis and each nation report please use the links provided in the document.

Despite the thorough planning of the methodology and the breadth of material assembled, the present synthesis report also bears some limitations. These limitations are the result of the synthesis process of the source documents analysed, which includes the competence descriptions and examples included as well as the contextualization of these descriptions and examples into our own national contexts.

First, the source documents (frameworks, scholarly works, policies, etc.) take very different approaches. Because each text was written for a different audience and policy cycle, direct comparison is possible only at a very general level.

Second, the competence descriptions themselves are vague. Most national reports endorse "understanding AI mechanisms", "critical thinking" and "ethical awareness", yet none specifies the observable behaviors that would demonstrate mastery. In practice this means that essential hands-on abilities, such as prompt-engineering, bias testing, or explaining what an AI-assisted workflow looks like are not expanded on.

Third, the Recommendations and Examples sections in the national reports offer illustrations rather than evidence-based guidance. The examples are frequently single-institution case-studies; the recommendations tend to repeat the need for "clear guidelines" or "structured yet adaptable frameworks" without demonstrating how these can be constructed or could be tested in another context. As a result, there is a risk of over-generalization from a lack of evidence.

Fourth, the national reports make uneven reference to teaching methodology. The documents systematically link specific competences to concrete pedagogical strategies or quality-assurance checkpoints but leave a gap between what students are expected to learn and how lecturers might teach or assess it.

Finally, empirical feedback loops are missing- Currently, partnering HEIs can draw on internal surveys, but there are no longitudinal data and no standard instrument across the three settings. This makes it difficult to judge effectiveness or to identify contextual factors that might require local adaptation.

Overall Summary of the Document Analysis

Overall Findings

Core AI Competencies – For Students and for Teachers

The analyzed documents present a comprehensive view of AI competencies, highlighting a shared foundation for both students and teachers, while also defining distinct roles and responsibilities. These competencies are consistently categorized across several key domains: technical understanding, critical evaluation, practical application, ethical awareness, and communication and collaboration.

For students, the competencies are tailored towards developing them as informed, creative, and responsible digital citizens. The focus is on creative problem-solving, and the ability to use AI

ethically in their learning. For teachers, the competencies are more expansive, encompassing a significant pedagogical and professional dimension. They are expected not only to possess personal AI literacy but also to design AI-enhanced learning experiences, assess AI tools for educational use, guide students on ethical issues, and engage in continuous professional development to keep pace with technological advancements.

Main Domains of AI Competencies

The analyzed documents categorize AI literacy competencies into several distinct, yet interconnected, domains (see Figure 2):

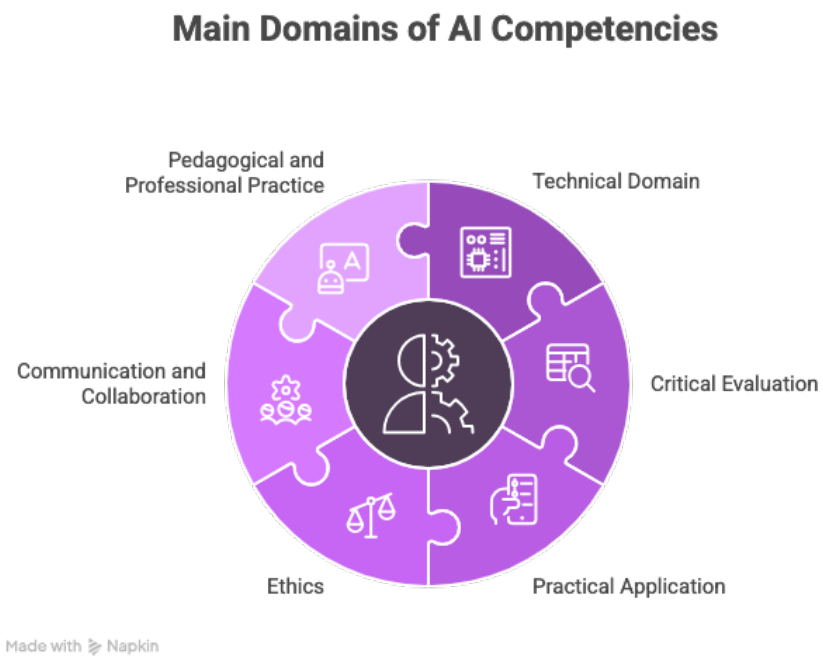

Figure 2 - Main Domains of AI Competencies

Technical Domain: This domain covers the foundational knowledge of what AI is and how it works, including concepts like algorithms, machine learning, data, and the capabilities and limitations of different AI systems.

Critical Evaluation: This involves the ability to evaluate, analyze, and question AI systems and their outputs. It includes skills in assessing information for bias, accuracy, and reliability, as well as data and media literacy.

Practical Application: This domain focuses on the functional skills required to use and interact with AI tools effectively. It includes everything from prompt engineering to applying AI for problem-solving and creative expression.

Ethics: This crucial domain addresses the moral dimensions of AI, including an awareness of bias, fairness, privacy, accountability, transparency, and the broader societal and environmental impacts of AI technologies.

Communication and Collaboration: This domain includes the skills needed to discuss AI concepts, collaborate with others on AI-related projects, and effectively work alongside AI systems as partners.

Pedagogical and Professional Practice: Primarily for teachers, this domain covers the skills needed to integrate AI into educational settings, including curriculum design, assessment strategies, facilitating student learning, and engaging in reflective practice and continuous professional development.

1) Core Competencies for Students and Teachers

Both students and teachers are expected to develop a core set of AI competencies to function (see Figure 3).

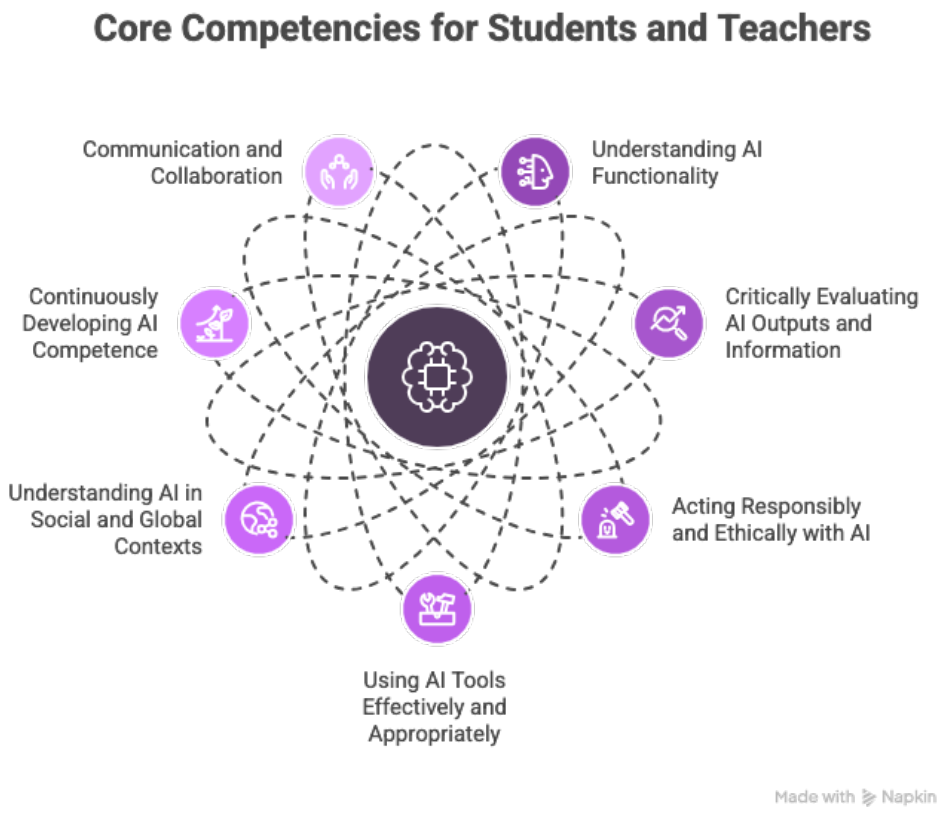

Figure 3 - Core Competencies for Students and Teachers

- **Understanding AI Functionality:** A shared foundational competence is understanding AI fundamentals, including how algorithms and machine learning work, what AI systems can and cannot do, and how to recognize AI in everyday life (Long & Magerko, 2020; Vuorikari et al., 2022). This also includes the ability to distinguish between AI-based and rule-based systems (Curi et al., 2024).

- **Critically Evaluating AI Outputs and Information:** Both groups must be able to critically evaluate AI outputs for accuracy, relevance, and bias (Chan, 2023; Hervieux & Wheatley, 2024). This involves questioning the credibility and trustworthiness of AI systems (Becker et al., 2024), critically interpreting data, and understanding concepts like data bias and quality (U.S. Department of Education, Office of Educational Technology, 2023). For students, this competence is crucial for maintaining academic integrity and developing the discernment to balance AI assistance with their own independent thinking (Chiu et al., 2024).
- **Acting Responsibly and Ethically with AI:** A strong ethical foundation is crucial for all users. This includes an awareness of bias, data protection, fairness, accountability, and transparency (Allen & Kendeou, 2024; U.S. Department of Education, Office of Educational Technology, 2023). It also involves reflecting on the societal impact of AI, understanding privacy concerns, and recognizing the potential harms AI could cause to different groups (Hervieux & Wheatley, 2024; Miao & Shiohira, 2024a).
- **Using AI Tools Effectively and Appropriately (Prompt Engineering):** The ability to interact effectively with AI, often referred to as prompt engineering, is a key skill for creating precise queries and leveraging AI's capabilities (World Economic Forum, 2025; Hervieux & Wheatley, 2024). This includes the creative and appropriate use of AI tools for problem-solving and learning, as well as knowing when it is, and is not, suitable to use them (Miao & Shiohira, 2024a).
- **Understanding AI in Social and Global Contexts:** Both students and teachers should engage in the broader societal discussion about AI, framed as developing skills for "digital citizenship in an AI world" (Miao & Shiohira, 2024a). This involves understanding AI's role in media, its impact on labor markets, its governance and policy implications, and its overall social impact on communities (Velander et al., 2024; World Economic Forum, 2025).
- **Continuously Developing AI Competence:** Given the rapid pace of change, a commitment to lifelong learning and adapting to new AI tools and capabilities is essential for both students and teachers (Chan, 2023; Faruqe et al., 2021)**.**
- **Communication and Collaboration:** The ability to discuss AI with peers, collaborate on AI-related projects, and share learning and experiences is a key skill for navigating the AI landscape (Miao & Shiohira, 2024a).

2) Role-Specific Competencies for Teachers

For teachers, competencies extend beyond personal use into pedagogical practice and professional responsibility (see Figure 4).

- **Integrating AI into Teaching and Learning:** This is a core domain for teachers, which includes designing AI-enhanced learning experiences, adapting teaching practices, and using AI for assessment and feedback (Miao & Shiohira, 2024b; Ng et al., 2023). They are expected to integrate AI tools to support lesson planning, create learning materials, and use intelligent teaching platforms and personalized learning systems (Australian Department of Education, 2023; Bai & Talin, 2024).

- **Evaluating AI Tools for Education:** Teachers require the competence to critically assess and select AI tools for educational purposes, evaluating them for pedagogical value, reliability, and potential bias (Miao & Shiohira, 2024b).
- **Providing Ethical Guidance and Leadership:** Teachers must be able to address complex ethical issues like fairness, data protection, and transparency in the classroom and foster students' awareness of AI ethics and social responsibility (Miao & Shiohira, 2024b; Bai & Talin, 2024).
- **Engaging in Continuous Professional and Reflective AI Practice:** Teachers must engage in continuous professional development and reflective practice to keep up with AI advancements and adapt their teaching strategies accordingly (Miao & Shiohira, 2024b; Punie & Redecker, 2017).
- **Facilitating Student Learning about AI:** Teachers need the skills to teach about AI as a subject, facilitate student projects, and guide learners in their responsible use of digital technologies (Punie & Redecker, 2017; Miao & Shiohira, 2024b).
- **Integrating Interdisciplinary Perspectives on AI:** Teachers should build interdisciplinary knowledge systems, integrating concepts from computer science, pedagogy, and ethics to create comprehensive AI-focused learning opportunities (Bai & Talin, 2024).

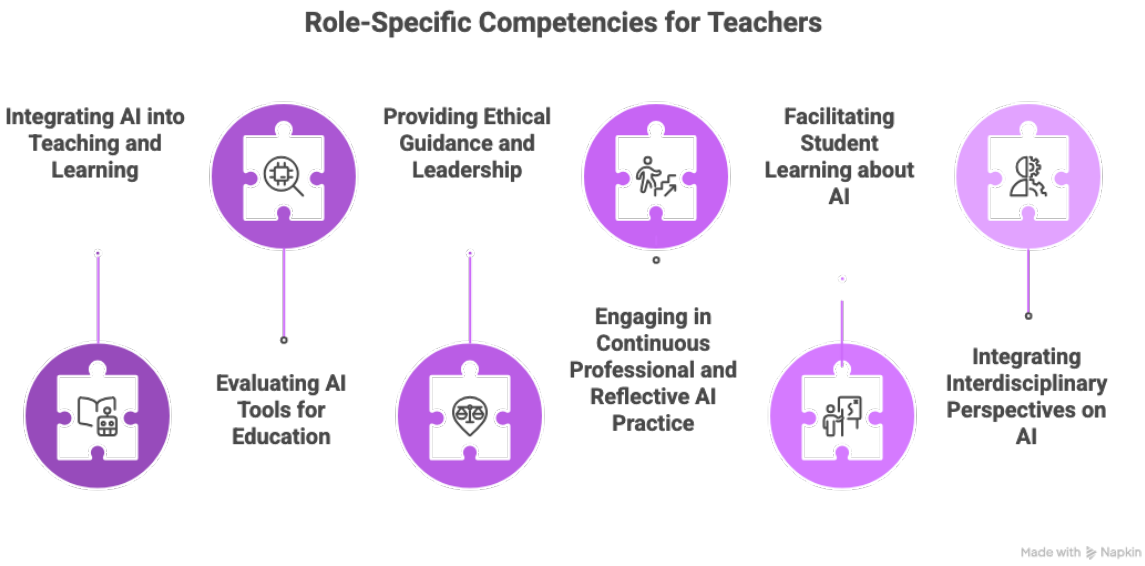

Figure 4 - Role-Specific Competencies for Teachers

Challenges of AI Use for Teaching and Learning Addressed in the Documents

The analyzed documents collectively identify a wide array of significant challenges posed by the integration of Artificial Intelligence into teaching and learning. These challenges span multiple

domains and can be categorized into four main areas (see Figure 5): C**ritical ethical concerns** such as algorithmic bias, data privacy, and a severe threat to academic integrity represent the first domain of challenges. There are also profound **pedagogical challenges**, including the risk of students' over-reliance on AI, which could diminish critical thinking and other key learning opportunities. Furthermore, the rapid pace of AI development creates **substantial institutional and professional hurdles**, most notably a widespread lack of adequate teacher training and the absence of clear, effective policies to guide AI's implementation. Systemically, educational institutions face challenges of inequitable access to technology, the absence of clear governance and policies for AI integration, and a growing skills gap as the rapid pace of technological change outpaces the ability of curricula to adapt. This creates a risk of teaching outdated skills and failing to prepare students for a future workforce shaped by AI. Finally, **technical and accessibility issues**, such as the "black box" nature of many AI systems and the persistent digital divide, threaten to create or exacerbate inequities in education. Addressing these interconnected challenges is presented as a prerequisite for the responsible and beneficial use of AI in education.

Figure 5 - Challenges of AI Use in Teaching and Learning

Recommendations for Using AI in the Context of Teaching and Learning

The analyzed documents provide a comprehensive set of recommendations for integrating Artificial Intelligence into education, all of which converge on the need for a balanced, human-centric, and ethically grounded approach. A central theme is the development of **robust AI literacy** for both students and teachers, which should be embedded across the curriculum rather than taught in isolation. This involves not only understanding the technical aspects of AI but also fostering critical thinking and ethical awareness. This is underpinned by a strong call for **continuous and comprehensive teacher training** and professional development to equip educators with the necessary pedagogical and technical skills.

Key recommendations include the urgent need for comprehensive teacher training and ongoing professional development to equip educators with the necessary pedagogical and technical skills. A recurring theme is that **pedagogy must lead technology**. AI should be used as a supportive tool to enhance, not replace, human-centered teaching, critical thinking, and creativity. To achieve this, recommendations emphasize the importance of **explainability and transparency** in AI tools to demystify their workings. The documents universally advocate for the creation of clear, context-specific policies and ethical guidelines to ensure transparency, fairness, and accountability in AI use. For students, the focus is on active, hands-on, and collaborative learning experiences that use AI as a tool for problem-solving and creativity while upholding academic integrity. Ultimately, the recommendations aim to leverage AI to enhance and personalize education, while ensuring that human oversight, critical judgment, and ethical considerations remain at the core of the learning process. Finally, there is a strong recommendation for collaboration between all stakeholders—policymakers, educators, and technologists—to ensure AI integration is responsible, effective, and aligned with future skills needs.

Figure 6 provides an overview of the recommendations for using AI in the context of teaching and learning.

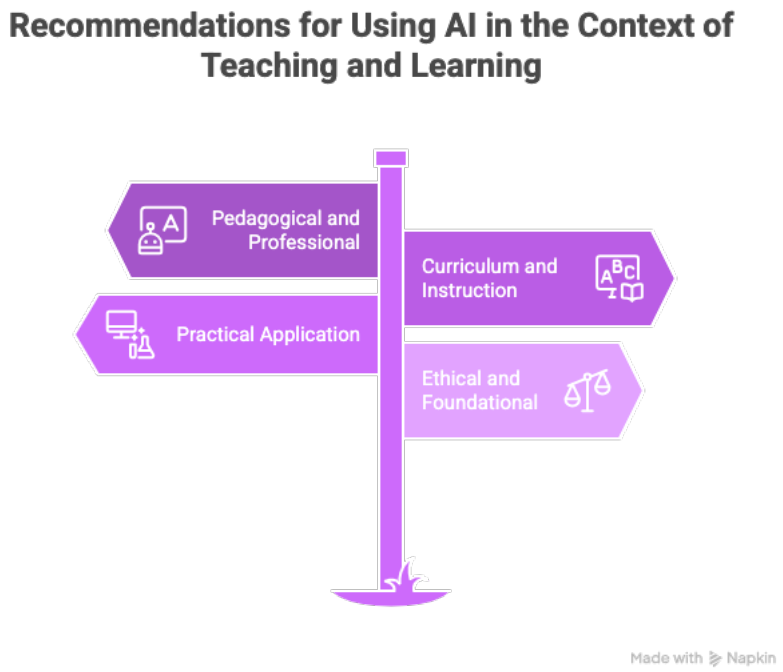

Figure 6 - Recommendations for Using AI in the Context of Teaching and Learning

1. Pedagogical and Professional Recommendations (for Educators and Institutions)

This category covers high-level, structural recommendations for how educational institutions and educators should approach AI integration.

- **Invest in Teacher Training and Professional Development:** A universal recommendation is the need for comprehensive and ongoing professional development to equip teachers with the skills to understand, evaluate, and effectively use AI tools. The UNESCO Teacher Framework by Miao & Shiohira (2024b) advocates for integrating AI literacy into teacher education programs, while Chan (2023) and Hervieux & Wheatley (2024) stress the necessity of training for faculty to integrate AI effectively. The World Economic Forum (2025) also recommends developing continuing education programs to improve AI skills.
- **Develop Clear Policies and Guidelines:** The documents consistently call for the development of clear, transparent, and context-specific policies and guidelines for AI use. Miao & Shiohira (2024b) advocate for context-specific policies, while Hervieux & Wheatley (2024) and Chan (2023) stress that guidelines must address ethical, legal, and academic challenges.
- **Prioritize Pedagogy and Maintain Human Oversight:** A core principle is that educational goals should drive technology use, not the other way around. The EU AI Act (Regulation 2024/1689) implies that pedagogy should be prioritized over technology. The insights and recommendations by U.S. Department of Education, Office of Educational Technology (2023) and other documents strongly recommend that AI should assist, not replace, educators, and that teachers must retain control over critical educational decisions.
- **Foster Communities of Practice:** To support professional growth, the UNESCO Teacher Framework (Miao & Shiohira, 2024b) and the EU framework (Punie & Redecker, 2017)

recommend creating communities of practice where educators can collaborate and share best practices for AI integration.

2. Curriculum and Instruction Recommendations (for Student Learning)

This category focuses on the pedagogical strategies and curriculum design needed to build student competencies.

- **Integrate AI Literacy Across the Curriculum:** Rather than teaching AI as a standalone subject, the recommendations favor integrating AI literacy across all disciplines. The UNESCO Student Framework (Miao & Shiohira, 2024a) focuses on this, and Allen and Kendeou (2024) explicitly advocate for integrating AI training into different subject areas for both students and teachers.
- **Promote Active and Experiential Learning:** The documents recommend moving beyond passive learning to hands-on, active engagement. The UNESCO Student Framework (Miao & Shiohira, 2024a) and Faruqe et al. (2021) advocate for hands-on and experiential learning. Long & Magerko (2020) suggest "embodied interactions," such as simulating algorithms, and DigCompEdu (Punie & Redecker, 2017) also recommends involving learners in hands-on activities and complex problem-solving.
- **Use Collaborative and Project-Based Approaches:** The UNESCO Student Framework (Miao & Shiohira, 2024a) and Velander et al. (2024) both promote collaborative AI projects and project-based learning to build practical competencies and connect education to real-world applications.
- **Personalize and Contextualize Learning:** To increase engagement, Long & Magerko (2020) recommend leveraging learners' personal interests, identities, and cultural values. The 4D Competency Framework (Center for Curriculum Redesign, 2024) also warns against "one-size-fits-all" methods and promotes personalization as key to deeper learning.

3. Practical Application Recommendations (Using AI as a Tool)

This category includes specific examples of how AI can be used as a tool to support and enhance teaching and learning activities.

- **Teacher and Administrative Support:** AI is recommended as a tool to reduce teacher workload. Ng et al. (2023) and U.S. Department of Education, Office of Educational Technology (2023) provide examples such as AI-assisted lesson planning, course design, and automated student progress tracking.
- **Assessment and Evaluation:** AI can be used to provide automated grading for various types of assignments, offering efficient assessment. Ng et al. (2023) give examples like Turnitin AI and Gradescope.
- **Personalized Learning and Tutoring:** AI can support adaptive learning by adjusting to individual student needs. U.S. Department of Education, Office of Educational Technology (2023) highlights personalized instruction and formative assessment, while Ng et al. (2023) point to AI chatbots and virtual assistants that can answer student queries.
- **Content and Engagement:** AI can be used to make learning more engaging. Ng et al. (2023) mention AI-generated lecture summaries from tools like Otter.ai and classroom engagement platforms like Socratic AI.

4. Ethical and Foundational Recommendations

This category covers the core principles that should underpin all AI use in education.

- **Ensure Transparency and Explainability:** A crucial recommendation is to avoid "black box" AI systems. Long & Magerko (2020) advocate for promoting transparency in all aspects of AI design and using graphical visualizations and interactive demonstrations to aid understanding. The EU AI Act (Regulation 2024/1689) also implies that educators should seek explainable AI solutions.
- **Foster Critical Thinking and Ethical Discussion:** The recommendations stress the need to move beyond technical skills to critical and ethical awareness. The UNESCO Student Framework (Miao & Shiohira, 2024a) encourages ethical discussions, and Long & Magerko (2020) suggest having learners critically question the intelligence and trustworthiness of AI technologies.
- **Protect Data and Ensure Privacy:** Educational institutions must prioritize the secure and ethical handling of student data. The EU AI Act (Regulation 2024/1689) implies strong data protection standards, including anonymization and ensuring compliance with privacy regulations.
- **Guarantee Equitable Access:** The documents stress the need to ensure equitable access to AI tools and infrastructure to prevent widening the digital divide. This is a key recommendation across all frameworks, including the EU's advocacy for national strategies and the World Bank's focus on localized solutions (Cobo et al., 2024).

Examples of the Use of AI In Learning and Teaching

The analyzed documents describe a dual role for Artificial Intelligence in education: first, as a practical tool to support and enhance the processes of teaching and learning, and second, as a subject of instruction in its own right. As a practical tool, AI is shown to be valuable for **teacher support**, automating administrative tasks, assisting with lesson planning, and providing automated assessment and feedback. For students, its use centers on **personalizing the learning experience** with adaptive content, providing research assistance, and acting as a tool for creative and analytical tasks such as brainstorming ideas, summarizing texts, creating content, writing and coding. Furthermore, AI applications are enhancing **accessibility** through speech-to-text and translation services and providing student support via chatbots.

As a subject of instruction, the focus shifts to building AI literacy. This involves moving beyond simply using AI tools to engage in hands-on, critical, and ethical learning activities. Examples include students training their own machine learning models, debating ethical dilemmas using case studies, and critically analyzing AI-generated content and the data it is trained on. A recurring observation across the documents is that while many potential uses are identified, the examples provided are often generic and lack the detailed, practical guidance needed for widespread implementation.

The uses of AI described in the documents can be organized into four main categories (see Figure 7):

- Teacher and administrative support,

- Student learning and engagement,
- AI as a subject of instruction to build AI literacy, and
- AI for institutional and systemic support.

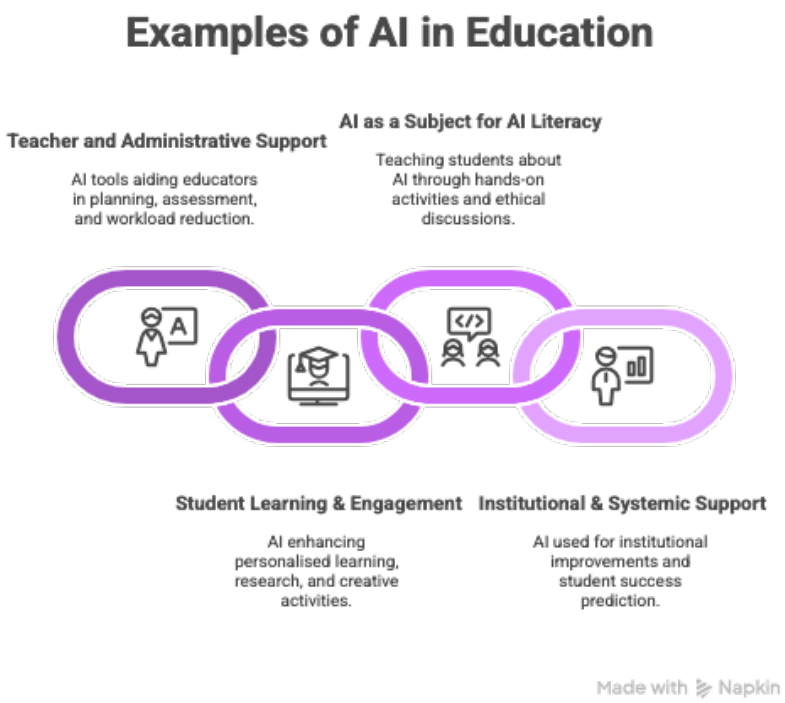

Figure 7 – Examples of AI in Education

1. Use for Teacher and Administrative Support

This category covers applications where AI is used to increase the efficiency and effectiveness of educators and administrative processes.

- **Lesson Planning and Course Design:** Several documents highlight AI's role in assisting teachers with their instructional preparation. The Australian framework (Australian Department of Education, 2023) and Allen and Kendeou (2024) both mention using AI for lesson planning. The framework by The Open University (2025) expands on this, describing AI's use in course redesign, development, and curriculum planning by analyzing student data to improve materials.
- **Assessment and Feedback:** AI is widely cited as a tool for automating the assessment process. Chan (2023) and The Open University's framework (2025) point to its application in assessments, with the latter specifying automated grading and real-time feedback. The UNESCO Teacher Framework (Miao & Shiohira, 2024b) also includes assessment tools and personalized feedback as key professional applications.
- **Workload Reduction:** A primary benefit identified is the reduction of teachers' administrative workload. The Australian Department of Education (2023) and Chan (2023) both state that AI can relieve teachers' workload by automating administrative tasks.

2. Use for Student Learning and Engagement

This category includes direct applications of AI by students to support and enhance their learning activities.

- **Personalized and Adaptive Learning:** This is one of the most frequently mentioned uses. Chan (2023) describes how AI can adapt learning paths to individual needs. Ng et al. (2023) and U.S. Department of Education, Office of Educational Technology (2023) provides detailed examples, including adaptive learning systems that adjust difficulty, intelligent tutoring systems that provide real-time guidance, and NLP-powered chatbots that answer student queries.
- **Research and Content Processing:** Students use AI as a powerful research assistant. The World Bank's report (Cobo et al., 2024) gives the example of using ChatGPT to simplify complex articles and debug code. The World Economic Forum (2025) notes generative AI's ability to summarize complex information, draft text, and translate content. Becker et al. (2024) also mention its use in outlining, research, and revision.
- **Content Creation and Creativity:** AI is used as a tool for creative production. The Australian Department of Education (2023) notes its value for content creation. More specific examples come from the World Bank report (Cobo et al., 2024), where students use tools like Midjourney to create video game assets, and from Curi et al. (2024), who describe an activity where students use generative AI to enhance storytelling.
- **Accessibility:** AI tools can make learning more accessible for students with disabilities. U.S. Department of Education, Office of Educational Technology (2023) gives the example of speech recognition technologies like text-to-speech and voice recognition for visually impaired or dyslexic learners. The EU Digital Education Action Plan also mentions assistive technologies.

3. Use as a Subject of Instruction (Building AI Literacy)

This category focuses on pedagogical activities where the goal is to teach students *about* AI, fostering critical and ethical understanding.

- **Hands-On Technical Engagement:** To demystify AI, several documents propose practical, hands-on activities. Curi et al. (2024) give an example of an activity where students train their own machine learning model using Teachable Machine. The UNESCO Student Framework (Miao & Shiohira, 2024a) suggests having students code simple AI models.
- **Critical Analysis and Data Literacy:** A key use is teaching students to critically evaluate AI. The UNESCO Student Framework (Miao & Shiohira, 2024a) includes critically analyzing AI-generated content as a core activity. Long & Magerko (2020) provide several examples, such as having learners engage with "messy" datasets to understand bias and write "data biographies" to understand the limitations and origins of data.
- **Ethical Debates and Simulations:** AI is used to facilitate discussions on complex ethical issues. Miao & Shiohira (2024a) suggest role-playing ethical dilemmas, an idea echoed by inferred examples like simulating self-driving car ethics. Long & Magerko (2020) describe initiatives that use "ethical matrices" to consider stakeholder values and discuss AI representations in popular media.
- **Formal Training and Workshops:** Educational institutions are beginning to offer formal training on AI skills. Hervieux & Wheatley (2024) show that universities are providing

workshops on generative AI, prompt engineering, and machine learning, and are incorporating AI ethics into information literacy training.

4. Use for Institutional and Systemic Support

This category includes applications where AI is used at a higher level to support the educational system itself.

- **Early Warning and Student Support:** AI can be used to analyze data to support student success at a systemic level. The World Bank's "100 Student Voices" report mentions deploying AI to predict student dropout risks (Cobo et al., 2024). Similarly, Ng et al. (2023) and The Open University (2025) describe using data-driven learning analytics to detect struggling learners and suggest targeted interventions.
- **Professional Self-Assessment:** AI can be used to help educators evaluate their own competencies. The EU Digital Education Action Plan mentions SELFIE for Teachers, an AI-powered self-assessment tool that helps educators evaluate their digital and AI readiness.

Values, Ethical Principles and Security Frameworks

The analyzed documents present a strong and consistent consensus on the necessity of a human-centric ethical foundation for the use of Artificial Intelligence in education. Core principles that emerge universally are **fairness and non-discrimination, transparency and explainability, human agency and oversight, privacy and data protection, and accountability**. These values are intended to guide the development, deployment, and use of AI to ensure it serves learners and society responsibly.

The EU AI Act (Regulation 2024/1689) stands out as a foundational regulatory framework, establishing legally binding requirements for safety, security, and fundamental rights, particularly for "high-risk" AI systems used in education. It mandates technical robustness, cybersecurity, bias mitigation, and traceability. While the documents are rich in defining ethical principles and identifying key dilemmas—such as algorithmic bias, misinformation, and data surveillance—they also reveal a significant gap. There is a noted lack of clear, practical security frameworks and implementation guidelines that educational institutions can readily adopt at the classroom and institutional levels, leaving a disconnect between high-level principles and on-the-ground practice.

The overarching consensus is that AI must be implemented as a human-centric tool that respects fundamental rights and enhances, rather than undermines, educational integrity. The documents outline a multi-layered approach to ethics and security, combining high-level regulation with professional principles and institutional governance.

Categorization of values, principles, and frameworks for AI in Education

The values, ethical principles, and security frameworks addressed in the documents can be categorized into four main areas (see Figure 8).

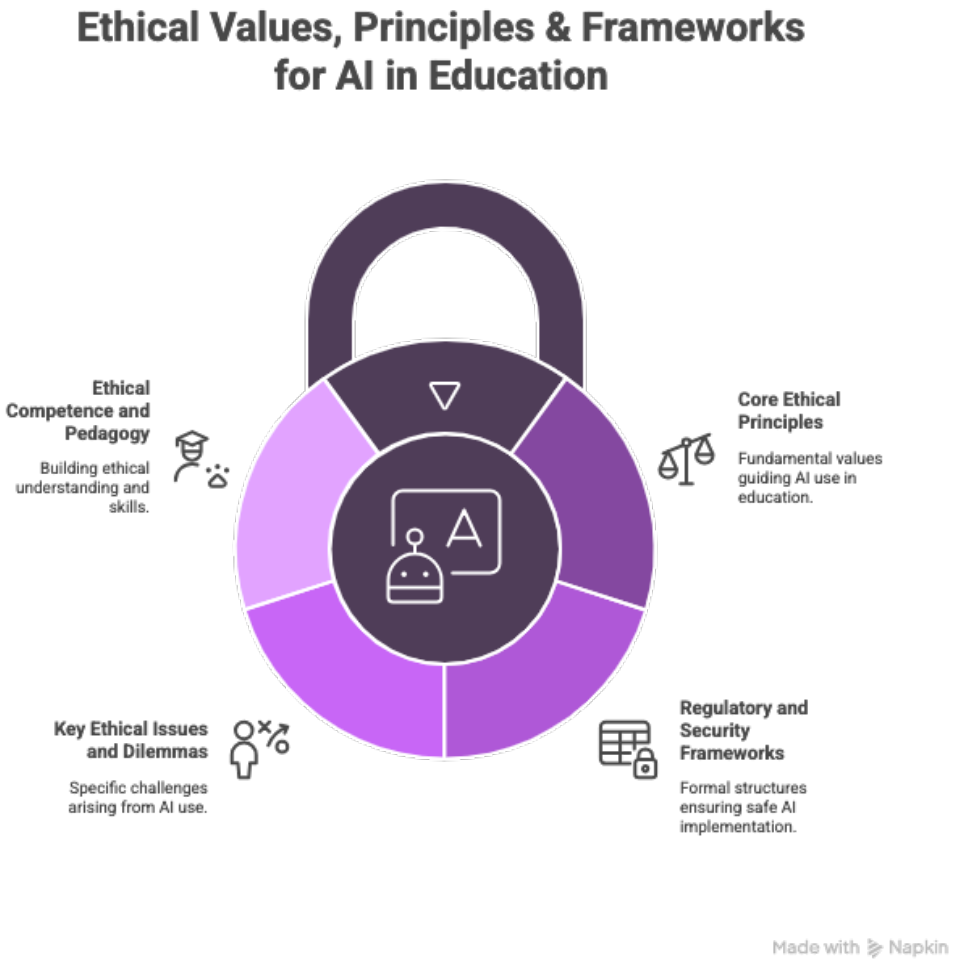

Figure 8 - Ethical Values, Principles & Frameworks for AI in Education

1. Ethical Competence and Pedagogy

This category covers the need to build ethical understanding and skills as a core part of AI literacy for both students and educators.

- **Ethics as a Core Competence:** Several frameworks position ethics as a central competence (Ehlers et al., 2024; Bai & Talin, 2024; Long & Magerko, 2020, etc.).
- **The Role of the Educator:** Educators are seen as playing a pivotal role in fostering ethical understanding. Allen and Kendeou (2024) argue that teachers are crucial for "instilling the significance of ethics" and helping students recognize how ethical considerations shape all aspects of AI.
- **Pedagogical Approaches to Ethics:** The documents suggest various methods for teaching AI ethics. Long & Magerko (2020) describe interdisciplinary strategies like creating "ethical matrices" to consider stakeholder values, discussing AI representations in media, and engaging in programming activities that reveal algorithmic bias.

2. Core Ethical Principles

This category covers the fundamental values that are consistently recommended across multiple frameworks to guide the use of AI in education.

- **Fairness, Equity, and Non-Discrimination:** This is a paramount principle. Australian Department of Education (2023) insists that AI must not reinforce existing inequalities, a position supported by Chan (2023) and U.S. Department of Education, Office of Educational Technology (2023). The documents call for rigorous bias audits and inclusive design to ensure AI is accessible and serves all learners equitably (Curi et al., 2024; Regulation 2024/1689).
- **Transparency and Explainability:** There is a strong emphasis on the need to understand how AI systems make decisions. The UNESCO Teacher Framework (Miao & Shiohira, 2024b), U.S. Department of Education, Office of Educational Technology (2023), and Faruqe et al. (2021) all highlight transparency as a key principle. Long and Magerko (2020) advocate for eliminating "black-box" functionality to build trust and understanding.
- **Human Agency and Oversight:** A non-negotiable principle is that AI should augment, not replace, human educators. The UNESCO Teacher Framework (Miao & Shiohira, 2024b), Curi et al. (2024), and U.S. Department of Education, Office of Educational Technology (2023) all stress that educators must remain in control of critical instructional decisions, positioning AI as a supportive tool rather than an autonomous agent.
- **Privacy and Data Protection:** The collection and use of student data is a central concern. Miao & Shiohira (2024b), Long & Magerko (2020), and the Australian framework (2023) all identify data privacy as a critical ethical issue. The Open University (2025) framework includes privacy and security as key criteria for evaluating any AI tool.
- **Accountability and Responsibility:** Institutions and developers must be accountable for the AI systems they deploy. U.S. Department of Education, Office of Educational Technology (2023) calls for institutions to audit AI systems for errors and unintended consequences, while Faruqe et al. (2021) focus on responsibility in deployment.

3. Key Ethical Issues and Dilemmas

This category details the specific ethical challenges and problems that arise from the use of AI in educational contexts.

- **Algorithmic Bias:** A major issue is that AI can perpetuate and amplify societal biases present in its training data. Long & Magerko (2020) directly link algorithmic bias to biased datasets, and the Australian framework (Australian Department of Education, 2023) and Chan (2023) warn that this could deepen educational inequalities.
- **Misinformation and Content Quality:** The ability of AI to generate plausible but false content is a significant problem. Long & Magerko (2020) note that the spread of misinformation has been exacerbated by AI algorithms. *DigCompEdu* (Punie & Redecker, 2017) and The Open University (2025) also raise the related issue of copyright violation by generative AI tools.
- **Academic Integrity:** While AI can be used to detect plagiarism, it also presents new challenges to academic integrity. Ng et al. (2023) and The Open University (2025) discuss both sides of this issue, addressing AI-generated content and the difficulty in maintaining academic honesty.
- **Societal Impact:** The broader societal consequences of AI are a recurring theme. Hervieux & Wheatley (2024) call for critical reflection on these impacts, while Long &

Magerko (2020) raise concerns about technology replacing the human workforce and the long-term risks of superintelligence.

4. Regulatory and Security Frameworks

This category focuses on the formal structures and rules designed to ensure the safe and secure implementation of AI.

- **The EU AI Act:** This is the most prominent regulatory framework mentioned, designed to ensure AI systems are safe, transparent, traceable, non-discriminatory, and respect fundamental rights. It classifies certain educational AI as "high-risk" and imposes strict obligations on providers, including requirements for robustness, cybersecurity, accuracy, quality management systems, activity logging for traceability, and proactive bias mitigation (Regulation 2024/1689).
- **Institutional Policies and Technical Safeguards:** The documents advocate for robust institutional policies, such as AI review boards to evaluate tools against ethical standards. They also highlight the need for technical safeguards like data anonymization and encryption and prohibitions against intrusive surveillance technologies.
- **Identified Gaps in Security Frameworks:** A key finding across the reports is the lack of clear, practical security frameworks for implementation. Hervieux & Wheatley (2024) and others note that while principles are well-defined, the documents do not outline how these can be applied effectively at the institutional and classroom levels.

Future Trends in AI and Education

The future of AI in education is characterized by rapid, continuous evolution that necessitates constant adaptation from educational systems, policymakers, and individuals. The key technological trends point towards increasingly sophisticated and ubiquitous AI, including the rise of powerful **generative AI** for co-creation, the deployment of **hyper-personalized learning environments** that adapt in real-time, the use of **predictive analytics** for institutional planning and student support, and the integration of **immersive technologies** like AI-powered virtual labs. They collectively forecast a future where Artificial Intelligence is integrated into all facets of education, becoming an inescapable and intrinsic element of thinking and learning. This pervasive integration necessitates a continuous and proactive adaptation of educational strategies, curricula, and regulatory frameworks.

This technological acceleration is creating a parallel trend in the world of work, driving a significant **transformation of the skills landscape**. There will be surging demand not only for technical AI-related skills but also for uniquely human "soft skills" like creative thinking, adaptability, and lifelong learning. Consequently, a major future trend is the deep **integration of AI literacy** into all levels of curricula, shifting from a niche topic to a fundamental competence. This is accompanied by a growing movement towards **strengthened ethical regulation and governance** to ensure that as AI becomes more powerful and embedded in society, its development remains human-centric, equitable, and safe.

The future will see a proliferation of personalized and adaptive learning technologies, alongside the maturation of ethical and legal frameworks to govern their use. Ultimately, the vision is for a

hybrid educational model where AI enhances and supports human educators, provided that institutions prioritize systemic adaptability and ethical integration.

Categorization of Future Trends

The future trends identified in the documents can be categorized into four main areas: the evolution of skills and competencies, the transformation of teaching and learning, the advancement of AI technologies, and the maturation of governance and policy.

1. The Evolution of Skills and Competencies

This category covers the predicted shifts in the skills and knowledge required for students and the workforce in an AI-driven future.

- **AI Literacy as a Core Competency:** There is a strong consensus that AI literacy will become a fundamental skill, as essential as traditional literacies. Hervieux & Wheatley (2024) predict that being AI-literate will be omnipresent in higher education. Becker et al. (2024) anticipate AI becoming an intrinsic part of communication, requiring the integration of AI literacy across all of education. Miao & Shiohira (2024a) also identify AI literacy as essential for future workforce participation.
- **Demand for a Dual Skillset:** The World Economic Forum (2025) report forecasts a dual impact on employment, creating a surge in demand for both technical and human-centric skills. The top three fastest-growing skill sets are predicted to be AI and big data, networks and cybersecurity, and technological literacy. Simultaneously, soft skills such as creative thinking, resilience, adaptability, curiosity, and a commitment to lifelong learning are projected to become increasingly valuable.
- **Emphasis on Lifelong Learning:** The need for continuous upskilling is a recurring theme. Ehlers et al. (2024) emphasize in AIComp lifelong learning to keep pace with rapid technological advancements. Werner (2024) also notes that AI can facilitate continuous learning and skills development, which is crucial for rapidly changing job markets.

2. The Transformation of Teaching and Learning

This category focuses on how pedagogical approaches, curriculum design, and the roles of educators and students are expected to change.

- **Shift in the Teacher's Role:** The role of the teacher is predicted to shift from a knowledge dispenser to a facilitator and guide. The UNESCO Teacher Framework (Miao & Shiohira, 2024b) anticipates this transformation, emphasizing that teachers will need ongoing professional development to manage AI integration effectively.
- **Curriculum Evolution:** Curricula are expected to evolve to teach not just technical skills but also ethical reasoning and the critical evaluation of AI outputs. Ehlers et al. (2024) identify competences like ethical awareness and creative problem-solving as essential for the future.
- **Pervasive Integration:** AI is expected to be integrated across all levels and subjects, blurring the lines between digital and non-digital education. Allen and Kendeou (2024) operate on the assumption that AI integration is "becoming increasingly inescapable," while Becker et al. (2024) advocate for its integration across all of education.

3. The Advancement of AI Technologies in Education

This category describes the specific technological applications and platforms that are expected to become more prevalent in education.

- **Personalized and Adaptive Learning:** A significant trend is the growth of AI-powered adaptive learning. Werner (2024) predicts that AI will be able to analyze students' learning patterns to provide customized content and recommendations, with platforms adjusting task difficulty in real-time. The Open University (2025) framework and U.S. Department of Education, Office of Educational Technology (2023) also highlight adaptive learning technologies as a key future trend.
- **AI-Powered Tutors and Support:** The use of AI for direct student support is expected to grow. Werner (2024) suggests that AI-powered tutors will provide one-on-one instruction, supplementing classroom teaching.
- **Predictive Analytics for Student Success:** AI will increasingly be used to support students proactively. Werner (2024) notes that AI can predict student performance and identify those at risk of falling behind, allowing for early interventions.
- **Streamlined Administration:** AI will continue to be used to reduce the administrative burden on educators. Werner (2024) mentions that AI can streamline tasks such as grading, scheduling, and resource allocation.

4. The Maturation of Governance and Policy

This category covers the expected development of ethical, regulatory, and policy frameworks to manage the integration of AI in education.

- **Continuous Adaptation of Frameworks:** The rapid pace of AI development necessitates that guidelines be constantly updated. The Australian framework (Australian Department of Education, 2023) recommends an annual review, and Chan (2023) also emphasizes the importance of continuously adapting educational strategies.
- **Maturing Ethical and Regulatory Frameworks:** The documents forecast that ethical and regulatory frameworks will become more robust. The EU AI Act (Regulation 2024/1689) is positioned as a leading example, establishing a legal framework for high-risk AI systems, including those used for educational admissions and evaluation, to ensure transparency and data sovereignty.
- **Focus on Localized and Equitable Solutions:** There is an anticipated shift towards more context-aware AI implementation. Cobo et al. (2024) suggest that developing nations will focus on localized AI solutions that address infrastructure gaps and cultural relevance. Velander et al. (2024) also highlight an increasing focus on equity and more participatory AI development.

Discussion

The discussions across the analyzed documents converge on several key points regarding the nature and implementation of AI literacy. The central conclusion is that **AI literacy is a multifaceted and holistic competence**, extending far beyond mere technical skill to encompass critical thinking, ethical awareness, and responsible action. While there is broad agreement on the foundational pillars—understanding how AI works, critically evaluating its

outputs, and ensuring its ethical use—there is **little consensus on a single, standardized framework**, leading to the strong recommendation that educators and institutions adopt a flexible, integrated approach, drawing from multiple sources to suit specific contexts.

The discussion highlights a significant disconnect between the high-level principles of AI literacy and the practical realities of its implementation in educational institutions. A central, emphasized critique is that the integration of AI is consistently failing to be treated as a formal **Change Management** process, leading to a lack of clear vision, stakeholder engagement, and structured support. While there is a general consensus that AI literacy must transcend basic technical skills to include critical thinking and ethical awareness, there is **very little agreement** on the specific competencies required or how to teach them.

A major emphasis is placed on the **primacy of critical evaluation and ethics**, which are seen as essential for navigating the complexities and opacities of AI, such as algorithmic bias and data privacy issues. To cultivate these deeper competencies, the discussion strongly advocates for **prioritizing hands-on, experiential learning** with real-world data. Finally, it is repeatedly stressed that AI literacy must be viewed not as a one-time training event, but as a **continuous, lifelong competence**, requiring constant adaptation from individuals and educational systems to keep pace with the rapid evolution of technology and its societal impacts.

The analysis singles out the work of Chiu et al. (2024) as particularly valuable for its comprehensive, co-designed framework. However, it also points out that many existing frameworks are too generic, not directly applicable to higher education, or lack a necessary ethical focus. The discussion concludes with a strong recommendation against following any single framework, advocating instead for **a blended, holistic, and context-aware approach** that addresses the critical need for standardized guidelines, a global perspective on access, and hands-on, experiential learning.

Categorization of Discussion Outcomes

The emphasized points and outcomes of the discussion can be categorized into five main areas.

1. A Redefined, Holistic View of AI Literacy

A primary outcome is the emphasis on a broad, multifaceted definition of AI literacy. The discussion highlights that AI literacy is not merely about technical proficiency but is a comprehensive competence.

- **Emphasis on Chiu et al. (2024):** This work is repeatedly singled out as providing the "most interesting discussion" and a valuable framework for defining AI literacy, even for higher education. The text explicitly states that the definitions and the five key components from this framework are "worth being considered."
- **Literacy vs. Competency:** The discussion emphasizes the distinction made by Chiu et al. (2024), where AI literacy focuses on *knowing* (knowledge and skills), while AI competency focuses on *how well individuals use AI* in beneficial ways, incorporating confidence and self-reflection.

- **Beyond Technical Skills:** A recurring theme is that AI literacy must encompass critical thinking, ethical awareness, adaptability, and responsible use. It is framed as a core educational competence essential for responsible citizenship in an AI-driven society.

2. The Critical Gap: The Absence of Change Management

Perhaps the most strongly emphasized point is the identification of a major strategic oversight in how educational institutions are approaching AI integration.

- **A Forgotten Process:** The text explicitly states, "It is however forgotten that incorporating AI in organizations should be viewed as a Change Management process." This is presented as a critical failure.
- **The Need for a Structured Approach:** The discussion dedicates significant space to outlining the core elements of change management (e.g., clear vision, stakeholder analysis, communication, training, and reinforcement), referencing established models from Kotter (1996) and Creasey (2023). This detailed explanation underscores its importance as a missing piece in the current approach to AI adoption in education.

3. The Challenge of Consensus and Practicality

The discussion repeatedly highlights the lack of agreement and practical guidance, which hinders effective implementation.

- **Very Little Agreement Beyond the Basics:** A key finding is that beyond a basic consensus on the need to understand how AI works, critically evaluate its outputs, and use it ethically, there is "very little agreement as to what competencies are needed for someone to be 'AI literate'".
- **Generic and Inapplicable Frameworks:** A strong critique is that many frameworks, particularly the high-level EU documents (Vuorikari et al. (2022); Regulation 2024/1689), are too generic, do not grasp the transformative power of AI, and have little to contribute to the specific discussion of AI in higher education. The framework from Moxie researchers is also described as "quite vague."
- **Lack of Standardized Guidelines:** The analysis underscores a "lack of standardized guidelines for the use of AI in teaching and learning processes," which reinforces the need for institutions to establish their own clear policies.

4. Core Principles and Recurring Themes

Despite the lack of consensus on details, the discussion identifies several consistently emphasized principles and challenges.

- **Human-Centricity and Oversight:** A common theme is the stress on maintaining human oversight and adopting a balanced, human-centric approach to AI in education. The "human-in-the-loop" model is highlighted as a way to ensure AI supports rather than replaces educators.
- **Ethics, Equity, and Integrity:** Ethical and social responsibilities are central. The need to address algorithmic bias, protect data privacy, and ensure equitable access is consistently raised. The challenge of maintaining academic integrity in the face of AI-

driven plagiarism is also a recurring concern noted in the Australian Department of Education framework (2023) and Chan (2023).

- **The Global Perspective:** The discussion emphasizes the importance of a global view, specifically citing the World Bank document (Cobo et al., 2024) for reminding us to "bridge the technology access gaps" and consider the perspectives of students outside the "northern hemisphere AI shockwave."

5. The Concluding Call to Action: A Blended, Contextual Approach

The final outcome of the discussion is a clear set of recommendations for moving forward.

- **Do Not Blindly Follow a Single Framework:** A direct piece of advice is that "it is never wise to blindly follow a single framework." Instead, institutions should build from a combination of existing frameworks, tailored to their specific context and needs.
- **Prioritize Hands-On, Experiential Learning:** To bridge the gap between abstract principles and practical engagement, the discussion advocates for hands-on approaches using real, "messy" data that connects to learners' lives, suggesting resources like Kaggle and World Bank Open Data.
- **Maintain a Critical Stance:** The discussion concludes by invoking the aphorism "not all that glitters is gold" as a useful reminder of AI's limitations, urging a balanced view that treats the challenges as opportunities to update and improve teaching and learning.

Conclusion and Recommendations

The overarching conclusion from the analyzed documents is that **AI literacy is a holistic, multifaceted, and dynamic competence** that must be deeply embedded within education. It is not a static set of technical skills but a continuously evolving disposition that integrates technical knowledge, critical evaluation, and profound ethical awareness. The recommendations strongly advocate for moving beyond a fragmented, tool-based view of AI towards an **integrated pedagogical framework** where human agency, ethical considerations, and social equity are central.

There is a clear emphasis that no single, universal framework for AI literacy exists; therefore, institutions must adopt a **flexible, adaptive, and interdisciplinary approach**, drawing from various sources to create context-specific guidelines. Key recommendations centre on fostering core competencies—including a foundational understanding of AI, critical evaluation of its outputs, and ethically informed decision-making—and fundamentally **rethinking pedagogy and assessment** to embrace responsible AI use rather than attempting to ban it.

Another key emphasized point is the urgent need for **clear institutional AI policies** and robust **professional development for educators** to guide responsible implementation. The discussion repeatedly highlights that AI literacy is not a static, one-time achievement but a **lifelong, adaptive process** for both students and teachers. Ultimately, the goal is to cultivate a culture of **lifelong learning** that empowers both educators and students to navigate the complexities of an AI-driven world responsibly and critically.

Finally, the synthesis advocates for a fundamental shift in mindset: treating AI integration as a formal **Change Management** process and ensuring that human agency, ethics, and pedagogical purpose remain at the core of this technological transformation.

Conclusion

The synthesis of existing frameworks reveals a strong and consistent consensus on the foundational pillars of AI literacy (see figure 10). Across the documents, there is clear overlap in defining this as a multifaceted competence built on a foundational understanding of how AI works, the ability for critical engagement with its outputs, the skill of practical application, and the capacity for communication and collaboration. This is demonstrated in recommendations for **Curriculum and Competency Development** that call for embedding AI literacy holistically across all disciplines and defining core competencies such as the ability to critically evaluate AI for accuracy and bias, understand ethical responsibilities like privacy and fairness, and develop practical skills like effective prompting. This shared understanding is underpinned by a universal set of ethical principles—fairness, transparency, human agency, and privacy—that position AI as a human-centric tool requiring a commitment to lifelong learning. This is directly supported by the **Guiding Philosophical Approach** found in the recommendations, which stresses that AI literacy is a continuous journey, that human agency must be prioritized over automation, and that the goal should be to advocate for responsible use, not impose bans.

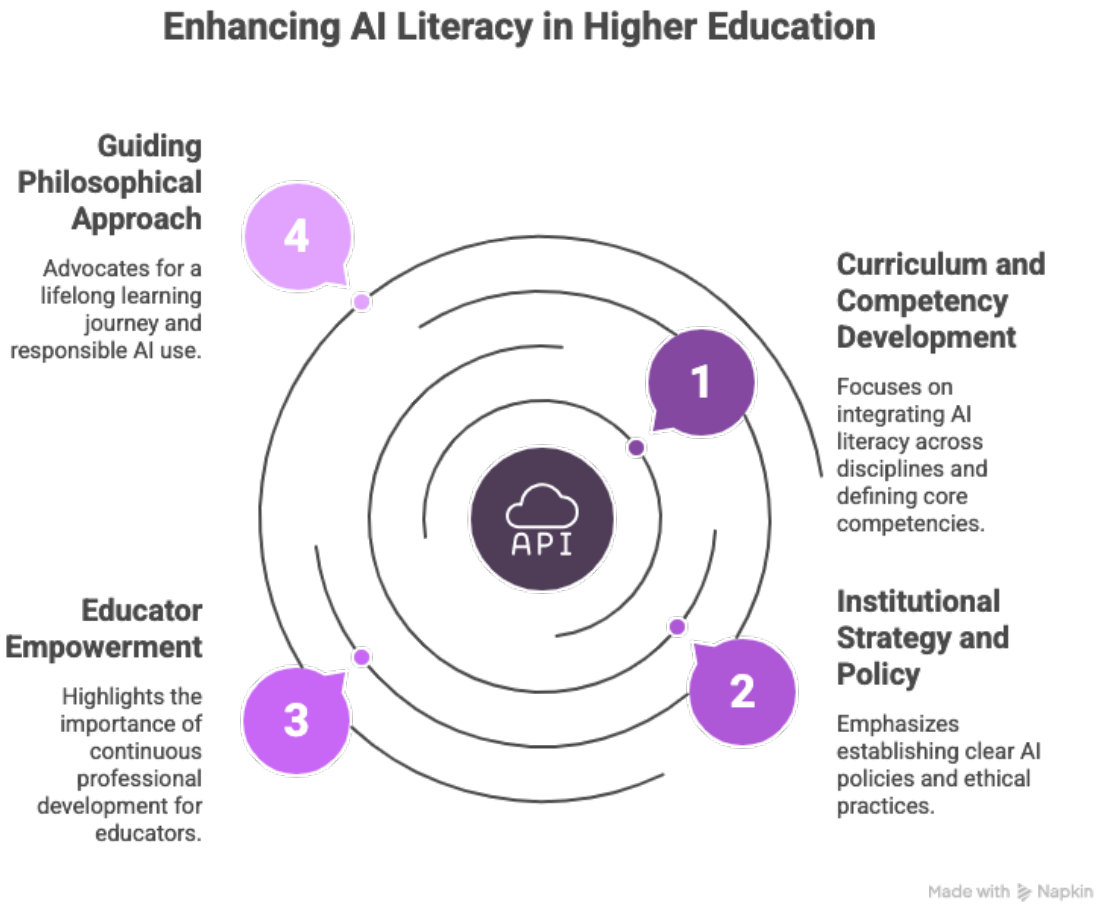

Figure 9 - Enhancing AI Literacy in Higher Education

However, despite this consensus on what AI literacy is, the analysis uncovers a critical gap concerning how to effectively implement it. The most significant missing approach is the treatment of AI integration as a formal **Change Management** process, leading to a disconnect between high-level principles and on-the-ground practice. This gap exists even though recommendations for **Institutional Strategy and Policy** explicitly call for this structured approach, alongside the establishment of clear institutional AI policies to ensure academic integrity, the fostering of ethical practices, and the creation of mechanisms to monitor and evaluate AI's impact. This is compounded by a lack of practical, actionable guidelines, particularly in the areas of cybersecurity and, crucially, the identification and mitigation of algorithmic bias at all stages of AI development. Furthermore, there is a recognized risk of curricular obsolescence, as educational systems are struggling to adapt quickly enough to the rapid pace of technological change.

To address these gaps, it is particularly important that any new AI skills framework for learning and teaching prioritizes a holistic set of core competencies that blend technical skill with ethical reasoning and data literacy. This must be paired with a fundamental shift in pedagogy towards active, experiential, and integrated learning, where AI is used as a tool for inquiry and creation. For higher education specifically, this requires a profound adaptation of didactics: moving curricula from content delivery to competency development, fundamentally rethinking assessment to value process over product, and recasting the educator’s role from a knowledge dispenser to a facilitator of critical discourse who models a "human-in-the-loop" approach. Realizing this vision depends entirely on **Educator Empowerment**, which the recommendations make clear must involve sustained investment in continuous professional development, training in new pedagogical integration skills, and active support for teachers to become confident co-creators of AI-based learning environments.

Ultimately, to structure this transformation, terms and concepts for a new, comprehensive framework is proposed. This framework is proposed to be built upon four interconnected dimensions presented in the following figure (Figure 10).

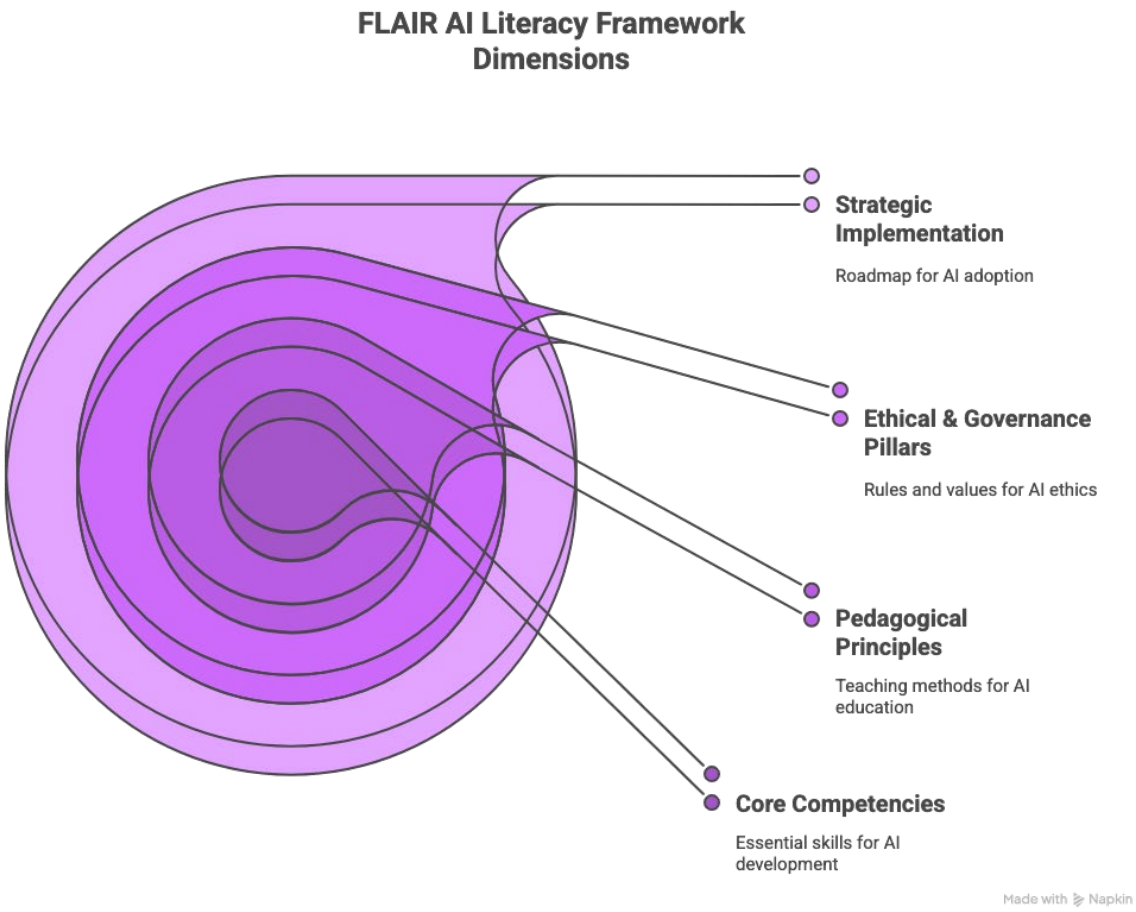

Figure 10 - FLAIR AI Literacy Framework Dimensions

By integrating these proposed concepts, terms, principles and approaches, the FLAIR AI Framework aims to provide a robust and actionable model to guide higher education away from fragmented adoption and towards a holistic, human-centric, and strategically managed integration of Artificial Intelligence.

In the following pages, detailed answers to the five main questions are presented, drawing on analyses conducted at the global, national, and institutional levels by the participating HEIs:

- Where are the overlaps in the frameworks?
- What competences/approaches are missing?
- What is particularly important for AI skills framework on learning and teaching?
- What is specifically relevant for (adapting) teaching/learning in higher education?
- What are the proposed concepts and terms for the framework?

Where are the Overlaps in the Frameworks?

The most prominent overlap is in the fundamental definition of AI literacy itself. Across the board, the frameworks define it not just as a technical skill, but as a multifaceted competence. The frameworks overlap in their high-level approach. They consistently advocate for a balanced, human-centric model where pedagogy leads technology, not the other way around. There is also a shared understanding that AI literacy is not a one-time achievement but requires a commitment to continuous, lifelong learning to adapt to the rapid pace of technological change.

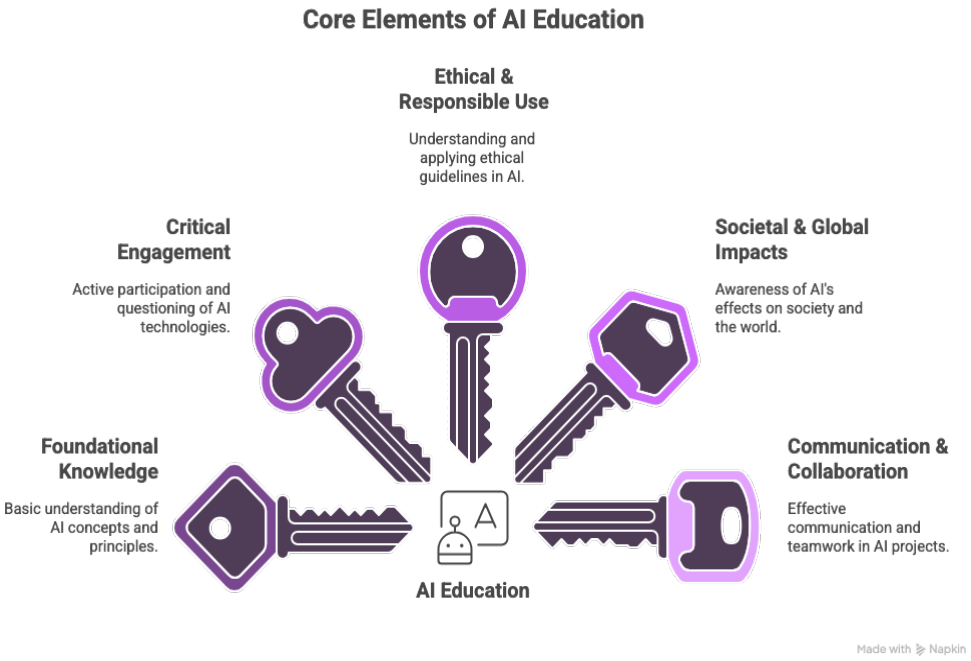

Figure 11 - Core Elements of AI Education

Figure 11 combines the elements from the global AI competency documents. It includes key competencies related to understanding, teaching, and using AI; pedagogical approaches; and its integration into education. It covers:

- Foundational Knowledge of AI (such as understanding how AI works, its capabilities and limitations, age-appropriate concepts, technical comprehension, and pedagogical implementation).

Foundational Knowledge of AI begins with understanding AI—its fundamental capabilities and limitations, its historical development, and the ways it is trained, including the importance of understanding data quality and practical skills for data preparation. At various age-appropriate levels, learners should focus on understanding AI training and data, while also keeping up with AI developments and adapting to changing AI capabilities.
Foundational knowledge also involves recognizing AI systems, being able to diagnose failure modes in AI systems, and identifying different types of AI technologies. Building mental models for AI supports deeper learning and responsible use. Educators play a key role in teaching

practices with AI tools, designing AI assessments and feedback, and guiding students in using AI for problem-solving and creative expression, while continuously adapting to new tools.

Teaching of foundational knowledge includes:

- assessing AI tools for educational purposes,
- teaching AI as a subject, and
- integrating AI into the curriculum by
- facilitating student AI projects and
- conducting assessment with AI-enhanced learning strategies.

In parallel, AI for administrative tasks can streamline institutional operations. To remain current, professionals engage in continuous professional development and embrace lifelong AI learning, including developing learning strategies, participating in communities of practice, building learning networks around AI, and pursuing self-directed exploration of AI tools. All of this support designing AI-enhanced learning experiences that prepare individuals for an AI-integrated future.

- Critical Engagement (focused on critical thinking, reliability, bias identification, and evaluating AI from interdisciplinary perspectives).

Critical engagement with AI begins with cultivating strong critical thinking skills, such as assessing the trustworthiness of AI systems and outputs, and understanding the black box problem, which refers to the lack of transparency in how many AI systems make decisions. It also requires a deep understanding of the societal impacts of AI, including how it affects equity, labor, and decision-making processes. Learners must be equipped to evaluate content, question AI-generated results, and actively identify bias in data, algorithms, or outcomes. This includes evaluating the reliability and validity of AI-driven information and applying an interdisciplinary lens to fully grasp the complex, cross-sector implications of AI technologies. Together, these competencies support responsible and informed engagement with AI in both academic and real-world contexts.

- Ethical & Responsible Use (covering ethical awareness, data privacy, fairness, human oversight, and transparency).

Ethical and responsible use of AI (see Figure 13) involves a strong foundation in ethical awareness and an understanding of key issues such as bias, fairness, privacy, data protection, and transparency. Practitioners and learners alike must be aware of compliance with legal and institutional regulations, while also emphasizing the need for human oversight in AI decision-making processes. Ethical use also entails recognizing potential harm that AI systems can cause, especially when unchecked. It includes understanding how AI affects different groups, particularly marginalized or vulnerable populations, and analyzing power dynamics that may be reinforced or disrupted by algorithmic systems. Together, these elements promote a culture of accountability, ensuring that AI is developed and used in ways that are socially just, inclusive, and aligned with human-centered values.

- Societal and Global Impacts (addressing issues such as inclusivity, accessibility, the digital divide, cultural and social implications of AI, and its impact on employment and sustainability).

Understanding the societal and global impacts of AI requires critical reflection on how these technologies shape and are shaped by human systems. On a societal level, it is essential to consider inclusivity, accessibility, and the digital divide, ensuring that AI does not reinforce existing inequalities but instead promotes broader participation and empowerment. Learners and practitioners should examine cultural differences and the broader social impact of AI, particularly by analyzing AI in sociotechnical systems where human and technological elements interact. On a global scale, fostering digital citizenship and engaging with AI governance are crucial for ensuring ethical and equitable deployment across borders. The role of AI in media and its influence on public discourse, employment, equity, and sustainability must be continually assessed, as these factors shape our collective future in an increasingly AI-driven world.

- Communication & Collaboration (which supports the teaching and sharing of all these competencies through inclusive, interdisciplinary, and effective dialogue).

Effective communication and collaboration are essential for building a shared understanding and ensuring the responsible use of AI in educational settings. Clear communication forms the foundation of this effort. Educators must be adept at communicating effectively about AI by explaining AI concepts to students and parents and translating technical and non-technical concepts to ensure accessibility. This extends to facilitating inclusive AI discussions and communicating across disciplines to build a common language. A key part of this is Sharing knowledge and practice, which involves sharing AI learning with peers and communicating AI experiences to create a collective understanding of AI's capabilities and limitations.

Building on this foundation, active collaboration drives progress. This means **collaborating with educators on AI** initiatives, actively **participating in AI policy discussions**, and engaging in hands-on **collaborating on AI projects**. Together, these communication and collaboration skills foster a transparent, informed, and unified approach to integrating AI into education, strengthening professional networks and advancing educational innovation.

What Competences/Approaches are Missing?

The global, national, and institutional reports, which were analyzed within the scope of the project, reveal that these documents contain certain gaps. While the analyzed documents provide a strong consensus on the high-level principles and ethical ideals for AI in education, they reveal significant gaps in practical, actionable guidance. The primary missing element is a structured, strategic approach to implementation. The documents are rich in defining *what* AI literacy should be (a holistic, ethical competence) but are often too generic, vague, or disconnected from the on-the-ground realities of educational institutions. There is a clear disconnect between the well-defined principles and the lack of clear, standardized, and practical

frameworks for how to actually implement, teach, and secure AI in a real-world classroom or institutional setting.

Further to this, there is a notable lack of information regarding potential biases, discriminatory outcomes, and unfair practices that may arise during the collection of AI data and the development of training models. Prejudices that may occur during the collection of data, model training and algorithm design stages of the artificial intelligence development process. Thus, it can be said that this is due to the lack of information about discrimination in the national and institutional-based policies, frameworks or guidelines examined. At this point, the prejudices caused by the data will also mean that some groups are underrepresented, incorrectly or stereotypically represented in the dataset on which the artificial intelligence system is trained. In addition, such an approach will cause a biased response if artificial intelligence systems are adjusted according to the behaviors of the majority group, or if performance is measured with a test set that excludes different scenarios. For all these reasons, it is necessary to specifically address assumption, representation and production biases in artificial intelligence policies. Figure 14 highlights the seven competencies and approaches which are largely missing or underdeveloped in the identified frameworks and document:

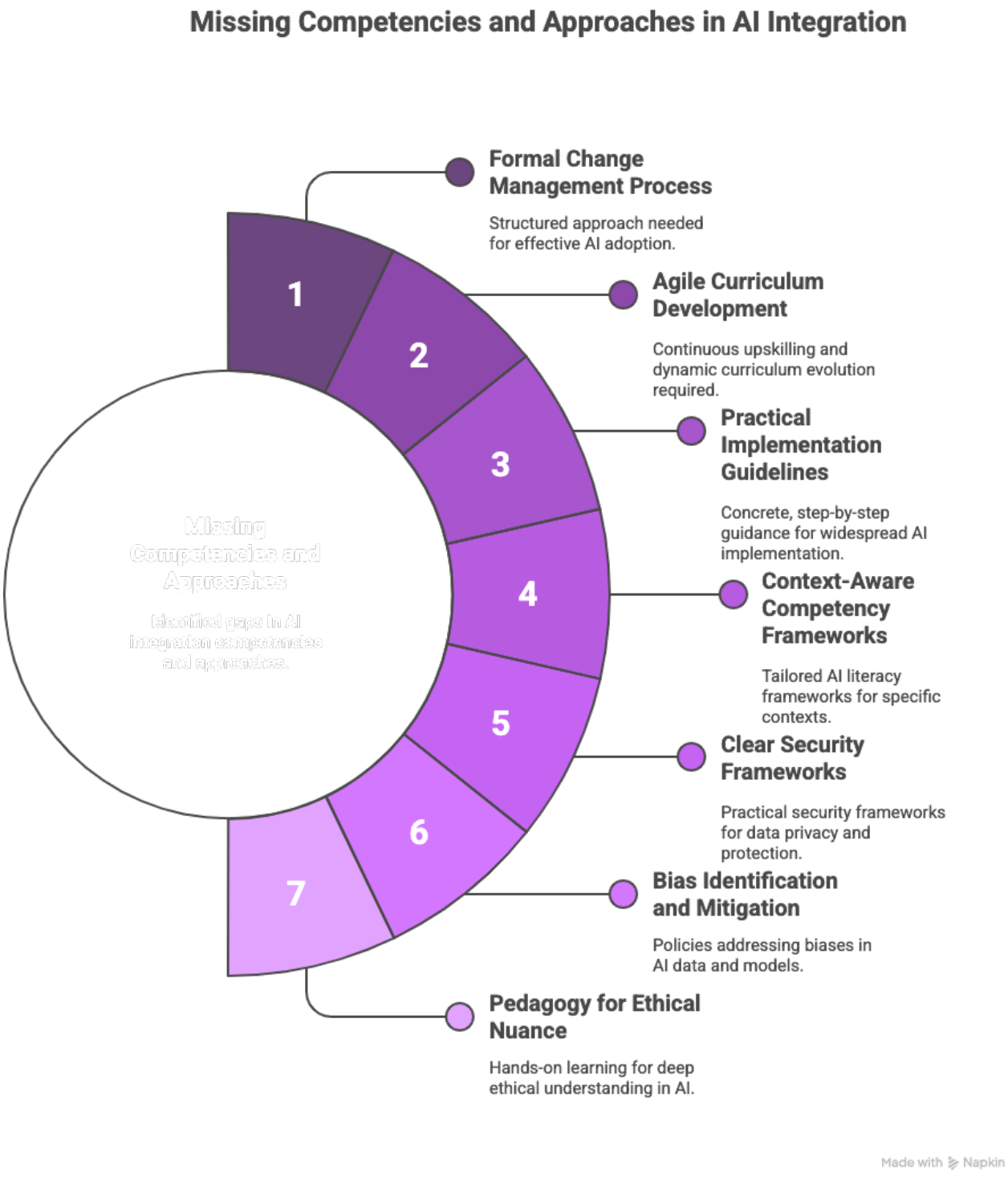

Figure 12 - Missing Competencies and Approaches in AI Integration

- **A Formal Change Management Process**

  The analyses explicitly show that the integration of AI is "consistently failing to be treated as a formal Change Management process," calling this a "critical failure" and a "forgotten process." It argues that without a structured approach that includes a clear vision, stakeholder engagement, and structured support, AI adoption will remain fragmented and ineffective.

- **An Agile Approach to Curriculum and Skills Development**

  The documents highlight a growing mismatch between the rapid advancement of AI and the pace at which education systems can adapt. This creates a significant risk of "curricular obsolescence," where students are taught outdated skills that are no longer aligned with labor market needs. A missing approach is a formal, agile strategy for the continuous upskilling of educators and the dynamic evolution of curricula, developed through collaboration between government, industry, and educational institutions to ensure alignment with future workforce demands.

- **Practical and Actionable Implementation Guidelines**

  A recurring critique is that the existing frameworks are "too generic" and that the examples provided "lack the detailed, practical guidance needed for widespread implementation." The overall analysis points out a "significant disconnect between the high-level principles and the practical realities," indicating a need for concrete, step-by-step guidance that educators and institutions can actually use. For example, none of the documents sets learning outcomes for testing prompting, data-protection risks, and bias detection. There are also competences which are not addressed, such as human-ai collaboration skills, digital wellbeing and inclusive-design thinking – these competences would also contribute to coping with practical realities.

- **Specific, Context-Aware Competency Frameworks**

  The framework analysis highlights that beyond the basics, there is "very little agreement as to what competencies are needed for someone to be 'AI literate'". It criticizes high-level frameworks for being inapplicable to specific contexts like higher education. This points to a missing competence in *designing* and *adapting* AI literacy frameworks that are relevant to specific disciplines, age groups, and institutional goals.

- **Clear and Applicable Security Frameworks**

  The outcome of the analysis identifies a "significant gap" and a "noted lack of clear, practical security frameworks." While principles like data privacy are mentioned, there is a lack of guidance on the technical and procedural safeguards (e.g., data anonymization, encryption, access controls) needed to create a secure environment, leaving a disconnect between principles and on-the-ground practice.

- **Specific Frameworks for Bias Identification and Mitigation**

  There is a notable lack of information on unfair practices that may arise during the collection of AI data and the development of training models. The policies examined fail to adequately address prejudices that occur during the data collection, model training, and algorithm design stages. This oversight means some groups can be underrepresented or stereotypically represented, leading to biased AI responses. Policies must therefore specifically address assumption, representation, and production biases.

- **Pedagogy for Fostering Ethical Nuance**

  While ethics is named as a core competence, the analysis suggests the *approach* to teaching it is underdeveloped. It advocates for moving beyond just discussing dilemmas to use "hands-on, experiential learning with real-world data" and engaging with "messy" datasets to truly understand concepts like algorithmic bias. The missing element is a well-defined pedagogical approach for cultivating a deep, practical ethical understanding.

What is Particularly Important for the FLAIR AI Competency/Skills Framework?

In Figure 15 we present what we consider to be an effective AI skills framework for teaching and learning. A framework must be holistic, moving beyond a narrow focus on technical tools to cultivate a deep, critical, and ethical understanding of Artificial Intelligence. The priority is to embed a set of core competencies directly into the curriculum that prepares both students and educators for an AI-driven world. This involves not only teaching foundational knowledge and practical skills but also fundamentally rethinking pedagogy and assessment. The framework should be built on a culture of continuous, lifelong learning and be supported by clear institutional policies that enable, rather than restrict, responsible innovation in the classroom. Based on the analysis, the following key areas and sub-areas are revealed to be important for the framework.

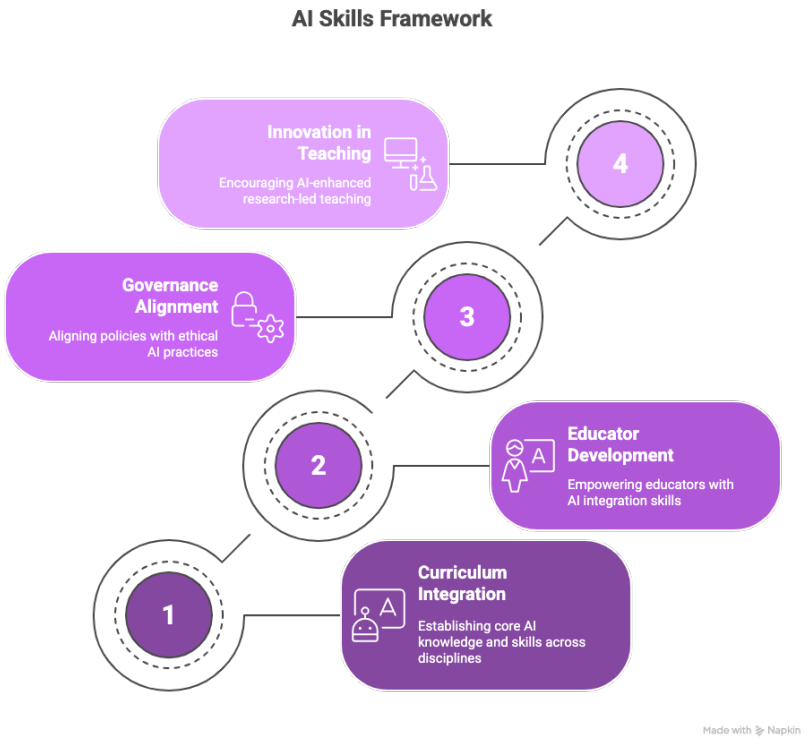

Figure 13 - AI Skills Framework

Curriculum Integration

This is the core of the framework, defining the essential knowledge and skills that must be taught. The emphasis is on creating a comprehensive and critical literacy that is woven throughout all disciplines.

- **Holistic Competencies:** The framework must move beyond basic technical skills. It should define an interdisciplinary set of competencies that combines a foundational understanding of AI with ethical reflection, critical thinking, computational thinking, and data literacy. Students must learn not just how to use AI, but how to question it.
- **Robust Mental Models:** A key teaching goal is to ensure students and educators develop an accurate understanding of how AI systems function. This involves teaching the principles of how models are trained on data, how they generate outputs, and, crucially, where their limitations, potential for error, and inherent biases lie.
- **Rethought Assessment:** The framework must provide clear guidance on assessment. This includes teaching students the principles of academic integrity in an age of generative AI and teaching educators how to design new assessment methods that foster critical thinking and creativity, while allowing for the transparent and ethical use of AI tools.

Educator Development

The framework is only as effective as the educators who implement it. Therefore, a central component must be dedicated to the continuous empowerment of teaching staff.

- **Pedagogical Integration Skills:** The framework must define the competencies teachers need to effectively integrate AI into their practice. This includes the ability to design AI-enhanced learning activities, evaluate and select appropriate AI tools, and facilitate classroom discussions on complex topics like digital ethics and bias.
- **A Culture of Lifelong Learning:** AI technology evolves rapidly, so the framework must promote the disposition of lifelong learning as a core professional competence. This involves teaching educators how to adapt to new tools and engage in reflective practice, supported by professional learning communities and practical, up-to-date resources.

Governance Alignment

Institutional policies are not separate from teaching; they create the environment in which it happens. The skills framework must be aligned with, and inform, institutional governance.

- **Applied Ethical and Inclusive Practices:** The framework should teach students and staff how to understand and apply the institution's ethical guidelines. This means developing the competence to make decisions grounded in fairness, accountability, human dignity, and inclusivity when using AI for learning, teaching, or research.
- **Reflective Evaluation of AI Tools:** A key competence for both educators and students is the ability to critically evaluate the impact of AI. The framework should teach them how to assess the effectiveness, risks, and unintended consequences of the AI tools they use, fostering a culture of responsible and reflective practice.

Innovation in Teaching

The framework should encourage a dynamic and forward-looking approach to pedagogy, positioning AI as a tool for enhancing research-led teaching.

- **Active and Experiential Learning Methods:** The framework should prioritize teaching approaches that are hands-on and collaborative. This includes the competence to design project-based learning activities where students use AI as a tool for creative production, data analysis, and real-world problem-solving.
- **Pedagogical Experimentation:** The framework should empower and encourage educators to experiment with new applications of AI in their teaching. This involves fostering the skills of pedagogical creativity and supporting pilot projects to explore innovative ways AI can enhance student learning and engagement.

What Is Specifically Relevant for Integrating AI in Education?

As explained above, it is clear that a successful approach requires a multifaceted strategy. While areas like Governance, Professional Development, and Ethical Skills are all vital, adapting the core educational experience is paramount. **Didactics** involve a deep dive into three interconnected sub-areas: Curricula Design, Technical Skills, and Pedagogical Strategies. Based

on the original text, adapting these didactic elements is fundamental for transforming learning and teaching in higher education.

Curricula Design: Moving from Content Delivery to Competency Development

The most significant adaptation for higher education curricula is to shift the focus from *what* students know to *what they can do* with their knowledge in an AI-augmented environment.

- **Integrate AI Literacy Holistically:** The text strongly recommends against treating AI as a separate IT module. Instead, AI literacy should be embedded across all disciplines as a core competence, similar to writing or research skills. For example, a history course might explore how AI analyses historical texts, while a business course could use AI for market analysis, with both critically evaluating the tool's outputs and biases.
- **Fundamentally Rethink Assessment:** Traditional assessment methods, particularly the essay, are challenged by GenAI. Curricula must be redesigned to include assessments that evaluate the *process* of learning and critical thinking, not just the final output, to mention one of the main challenges in assessment. This could involve students submitting prompts and their critiques of AI responses, engaging in in-class debates, or completing project-based work where they must transparently document how they used AI as a tool for research and creativity.
- **Prioritize Interdisciplinary and Ethical Foundations:** Higher education curricula are uniquely positioned to explore the "why" behind AI. The design should intentionally combine technical concepts with humanities and social sciences, ensuring that every student, regardless of their major, engages with the ethical, societal, and philosophical implications of AI. This addresses the core purpose of higher education: developing critical and responsible citizens.

Technical Skills: Fostering Critical AI Users, not Just AI Consumers

The teaching of technical skills in higher education must go beyond surface-level use and aim to build deep, critical understanding.

- **Go Beyond Basic Prompting:** While prompt engineering is a useful practical skill, the didactic goal in higher education is to teach students how to "effectively communicate and collaborate" with AI systems. This means teaching them to construct queries that test the boundaries of AI, identify its weaknesses, and use it as a partner in a cognitive process, rather than as a simple answer machine.
- **Demystify the "Black Box":** A key didactic task is to provide students with a robust mental model of how AI works. This doesn't require every student to become a computer scientist, but it does mean teaching the foundational principles of machine learning, training data, and algorithms. This prevents misconceptions and enables students to understand *why* an AI might be biased or produce unreliable content.
- **Develop Data and Information Literacy:** The text highlights that AI literacy builds upon data literacy. Therefore, a crucial technical skill to teach is the ability to critically assess the data on which AI is trained. This involves teaching students to understand concepts like data bias and quality, and to question the origins and limitations of the datasets that shape AI's view of the world.

Pedagogical Strategies: Shifting the Educator's Role to Facilitator and Guide

The greatest change in teaching methods involves the educator moving from a "dispenser of knowledge" to a facilitator of critical inquiry and a guide for responsible AI use (Figure 16).

- **Champion Active and Experiential Learning:** The analyzed texts strongly advocate for moving away from passive lectures. Effective pedagogical strategies include hands-on, project-based learning where students use AI to solve problems or create something new. This could involve using "ethical matrices" to debate AI dilemmas, having students train their own simple models to understand bias firsthand, or using AI to simulate complex systems in science or economics.
- **Cultivate Critical and Ethical Discourse:** The role of the educator is to lead and moderate the crucial conversations about AI. This means designing learning experiences that require students to critically analyze AI-generated content, debate its ethical implications, and reflect on its societal impact. The educator acts as the "subject matter expert" who can guide discussions and challenge students' assumptions.
- **Adopt a "Human-in-the-Loop" Model:** This pedagogical stance is central. The educator must model best practices for using AI responsibly, demonstrating how to use it as a supportive tool while retaining human oversight, critical judgment, and control over the educational process. The teaching method here is one of scaffolding, where the educator guides students in their use of AI, helping them to recognize its limitations and ensuring it enhances, rather than undermines, their learning.

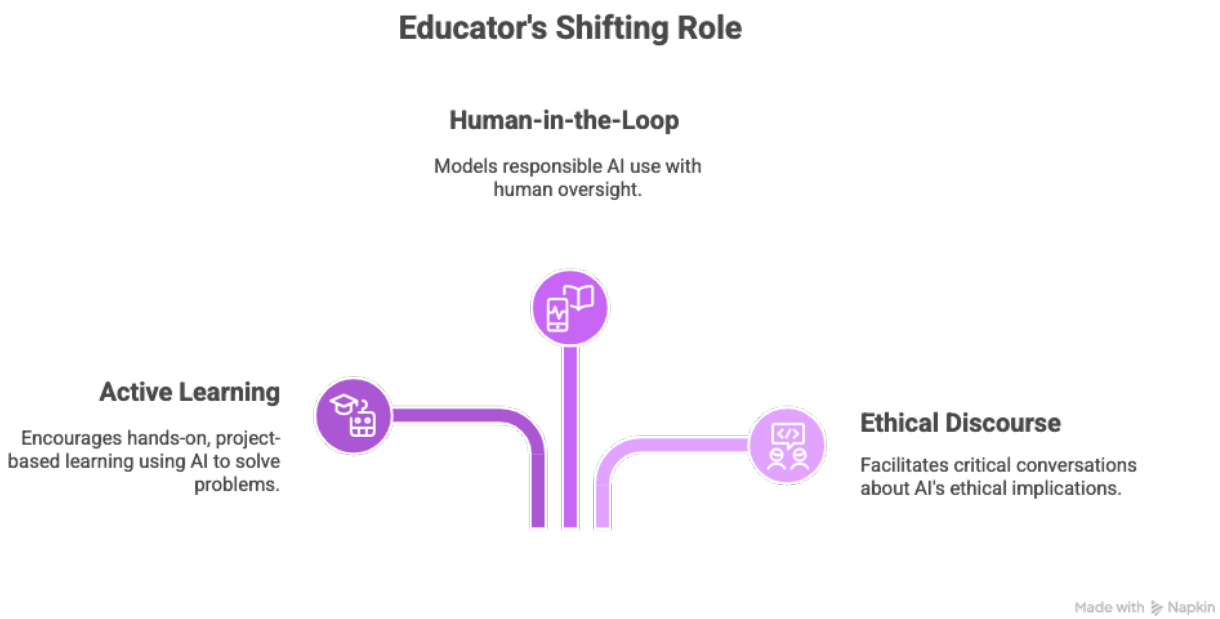

Figure 14 - Educator's Shifting Role

Proposed Concepts and Terms for the FLAIR AI Literacy Framework

The proposed concepts and terms for the **FLAIR AI Literacy Framework (see Figure 1)** synthesizes the core strengths of the analyzed documents while directly addressing their most significant gaps. It moves beyond a simple list of skills to present an integrated model with four key dimensions: Core Competencies (the *what* to learn), Pedagogical Principles (the *how* to teach), Ethical & Governance Pillars (the *why* and the rules), and Strategic Implementation (the *process* for adoption) (see Figure 17). This structure ensures that AI literacy is not treated as a mere technical add-on but as a fundamental, institution-wide transformation that is practical, ethically grounded, and strategically managed.

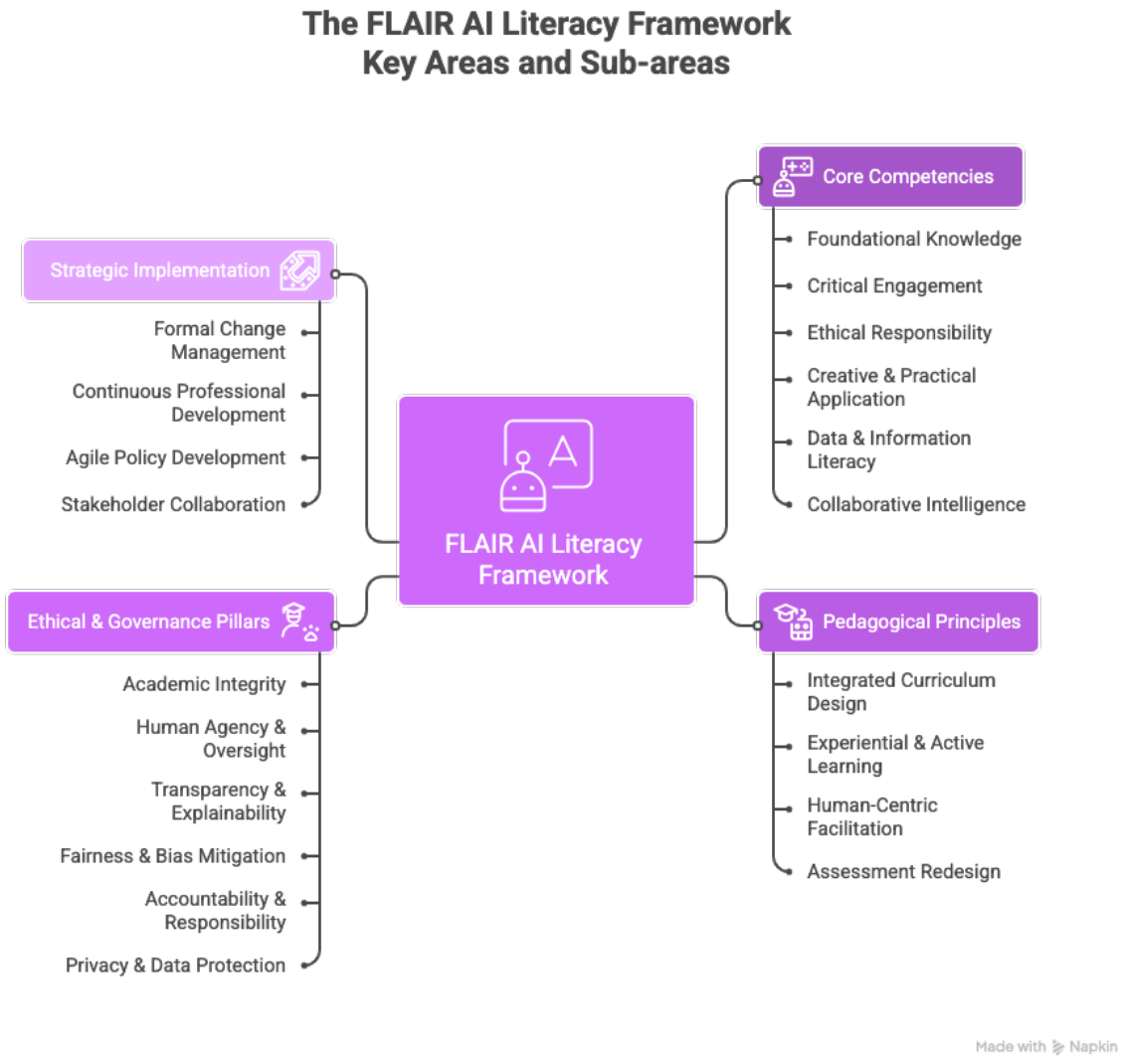

Figure 15- The FLAIR AI Literacy Framework Key Areas and Sub-areas

Main Area: Core Competencies

This area defines the essential, multifaceted knowledge and skills that all learners and educators must develop.

- **Sub-area: Foundational Knowledge**
    - A baseline understanding of the core principles of how AI systems work, including algorithms, machine learning, and data.
- **Sub-area: Critical Engagement**
    - The ability to actively question, analyze, and evaluate AI systems and their outputs for accuracy, bias, and reliability with healthy skepticism.
- **Sub-area: Ethical Responsibility**
    - The capacity to understand, reflect upon, and act in accordance with the ethical principles governing AI, including fairness, privacy, and societal & environmental impact.
- **Sub-area: Creative & Practical Application**
    - The skill of using AI tools effectively and creatively for problem-solving, content creation, and collaboration while maintaining independent thought.
- **Sub-area: Data & Information Literacy**
    - The competence to critically assess the data that underpins AI, including understanding concepts like data bias, quality, and provenance.
- **Sub-area: Collaborative Intelligence**
    - The ability to effectively communicate about AI concepts and work alongside both humans and AI systems as partners in complex tasks.

Main Area: Pedagogical Principles

This area outlines the core teaching methods and didactic approaches required to effectively cultivate AI competencies.

- **Sub-area: Integrated Curriculum Design**
    - The practice of embedding AI literacy holistically across all disciplines rather than teaching it as a standalone, isolated subject.
- **Sub-area: Experiential & Active Learning**

- An active learning approach that uses real-world data and simulations to move beyond passive knowledge acquisition.

- **Sub-area: Human-Centric Facilitation**
  - A shift in the educator's role from a dispenser of knowledge on AI to a guide who models responsible AI use and facilitates critical discourse.

- **Sub-area: Assessment Redesign**
  - The need to redesign assessment practices to ensure they remain valid, fair, and aligned with the intended learning outcomes. It involves balancing when and how AI tools may be used, restricted, promoting transparency in their use, and placing greater emphasis on the learning process, rather than just the final output.

Main Area: Ethical & Governance Pillars

This area defines the core values that the project members consider non-negotiable in the context of AI in education.

- **Sub-area: Academic integrity**
  - Specially for the academic environment

- **Sub-area: Human Agency & Oversight**
  - The foundational principle that AI must always augment and assist human decision-making, with educators retaining ultimate control over the learning environment.

- **Sub-area: Transparency & Explainability**
  - The commitment to using and promoting AI systems whose decision-making processes are understandable, avoiding opaque "black box" technologies.

- **Sub-area: Fairness & Bias Mitigation**
  - The explicit requirement to address and mitigate assumption, representation, and production biases at all stages, from data collection to algorithm design.

- **Sub-area: Accountability & Responsibility**
  - The principle that institutions and developers and users are answerable for the impact and consequences of the AI systems they deploy in education.

- **Sub-area: Privacy & Data Protection**

- The strict adherence to secure and ethical protocols for the collection, use, and protection of all student and educator data.

Main Area: Strategic Implementation

This area addresses the critical, often-missing process of how to successfully integrate the framework into the institution.

- **Sub-area: Formal Change Management**
  - The structured process of guiding the institution through the transition, including establishing a clear vision, engaging stakeholders, and providing structured support.
- **Sub-area: Continuous Professional Development**
  - The commitment to providing comprehensive, ongoing training for educators in AI tools, pedagogical strategies, and digital ethics.
- **Sub-area: Agile Policy Development**
  - The practice of creating clear institutional guidelines that are regularly reviewed and adapted to keep pace with rapid technological change.
- **Sub-area: Stakeholder Collaboration**
  - The fostering of partnerships between educators, students, policymakers, and industry to ensure the framework remains relevant and effective.

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Appendices

Appendix 1. Frameworks Included in the Document Analysis

Author / institution and publication year	Title	Analyzed by
Punie & Redecker (2017)	European Framework for the Digital Competence of Educators: DigCompEdu	UT
OECD (2019)	OECD Learning Compass 2030	URL
Faruqe et al. (2021)	Competency model approach to AI Literacy	TiU
Vuorikari et al. (2022)	DigComp 2.2: The Digital Competence Framework for Citizens	UCC
Australian Department of Education (2023)	Australian Framework for Generative Artificial Intelligence in Schools	WU
Allen & Kendeou (2024)	ED-AI Lit: An Interdisciplinary Framework for AI Literacy in Education	UCC
Becker et al. (2024)	Framework for the Future: Building AI Literacy in Higher Education	UCC
Center for Curriculum Redesign (2024)	Four-Dimensional (4D) Competencies Framework	UT
Curi et al. (2024)	Building Artificial Intelligence for Education	YU
Ehlers et al. (2024)	AIComp: Future skills for a living and working world shaped by AI	YU
Hervieux & Wheatley (2024)	Building an AI Literacy Framework	WU
Miao & Shiohira (2024a)	[UNESCO] AI competency framework for students	TiU
Miao & Shiohira (2024b)	[UNESCO] AI competency framework for teachers	TiU
The Open University (2025)	A framework for the Learning and Teaching of Critical AI Literacy skills	YU

Appendix 2. Scholarly Works Included in the Document Analysis

Author / institution and publication year	Title	Analyzed by
Long & Magerko (2020)	What is AI literacy? Competencies and design considerations	UT
Chan (2023)	A comprehensive AI policy education framework for university teaching and learning	WU
Ng et al. (2023)	A review of AI teaching and learning from 2000 to 2020	YU

Bai & Talin (2024)	Educational Transformation in the Age of AI: A Framework and Implementation Path for AI competency for University Instructors	YU
Chiu et al. (2024)	What are artificial intelligence literacy and competency? A comprehensive framework to support them	URL
Velander, J. et al. (2024)	What is Critical (about) AI Literacy? Exploring Conceptualizations Present in AI Literacy Discourse	TiU

Appendix 3. Reports, Regulations, and Other Types of Documents Included in the Document Analysis

Document type	Author / institution and publication year	Title	Analyzed by
Insights & recommendations	U.S. Department of Education, Office of Educational Technology (2023)	Artificial Intelligence and the Future of Teaching and Learning	YU
Policy guideline	European Commission (2020)	Digital Education Action Plan 2021–2027	URL
Regulation	The European Parliament and The Council of the European Union (2024)	Regulation 2024/1689 (The EU AI Act), and its proposal	UT, UCC
Report	Cobo et al. (2024)	100 Student Voices on AI and Education	URL
Report	World Economic Forum (2025)	Future of Jobs Report 2025	WU