Fostering Learners' Al Readiness

FLAIR



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KEY ACTION

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ACTION TYPE

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AI Competence Frameworks and Policies in Higher Education: Analysis and Recommendations

National Report by La Salle, Universitat Ramon Llull

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Executive Summary

Artificial Intelligence (AI) is transforming higher education globally, and Spain is no exception. This national report, part of the **FLAIR** (*Fostering Learners' AI Readiness*) project, examines Spain's policies, practices, and challenges in integrating AI into higher education. It highlights national strategies, institutional case studies, and international benchmarks to provide a comprehensive analysis of AI's role in shaping the future of learning.

1. National and Regional AI Strategies

Spain has taken significant steps to embed AI in higher education through structured policies. The **National Artificial Intelligence Strategy (ENIA, 2020)** serves as the cornerstone, backed by €600 million in EU recovery funds. ENIA focuses on six strategic pillars:

- 1. **Research and innovation** in Al.
- 2. Talent development to enhance digital skills.
- 3. Data infrastructure to support AI applications.
- 4. Economic integration of AI across industries.
- 5. **Public sector modernization** through Al.
- 6. Ethical and regulatory frameworks to ensure responsible AI use.

At the regional level, **Catalonia.AI (2021)** complements ENIA by positioning universities as hubs for ethical AI research and industry collaboration. The strategy emphasizes multilingual education, sustainable development, and public-private partnerships.

Additionally, Spain aligns with the **EU Digital Education Action Plan (2021-2027)** and the **DigCompEdu framework**, which promote digital and AI literacy among educators and students. These frameworks stress interdisciplinary learning, teacher training, and equitable access to technology.

2. Al Competences for Students and Teachers

The report identifies key AI competences necessary for both students and educators:

For Students:

- Foundational Al knowledge (e.g., understanding algorithms, machine learning).
- **Data literacy** (interpreting and critically assessing data).
- Algorithmic thinking (problem-solving using logical reasoning).
- Ethical and social awareness (addressing bias, privacy, and AI's societal impact).
- **Practical AI co-creation skills** (using AI tools like ChatGPT or coding assistants).

For Teachers:

- **Pedagogical integration of AI** (designing AI-enhanced lessons).
- Critical evaluation of AI tools (assessing biases and limitations).
- Ethical leadership (guiding students in responsible AI use).
- Continuous professional development (keeping pace with AI advancements).
- Policy awareness (aligning teaching with national and EU AI strategies).

3. Challenges in AI Adoption

Despite progress, several challenges hinder AI's effective integration:

- 1. Ethical Concerns Algorithmic bias, data privacy, and surveillance risks.
- 2. **Misinformation & Academic Integrity** AI-generated content raises plagiarism concerns.
- 3. Student Over-Reliance on AI Potential erosion of critical thinking skills.
- 4. Digital Divide Unequal access to AI tools and digital literacy.
- 5. **Teacher Preparedness** Many educators lack training in AI applications.
- 6. Institutional Policy Gaps Need for clear governance on AI usage in assessments.

The **CRUE** (Conference of Spanish University Rectors, 2024) report highlights these issues, urging proactive measures to balance AI's benefits with academic integrity.

4. Case Study: Universitat Ramon Llull (URL)

URL serves as a model for institutional AI adaptation. In response to ChatGPT's emergence, the university formed an **interdisciplinary working group** to develop ethical guidelines for AI use in teaching. Key initiatives include:

- **10 Ethical Recommendations** (e.g., transparency, critical thinking, human oversight).
- **Specialized Reports** on Al's impact on mental health, the environment, and legality.
- **Policy Development** on plagiarism, assessment methodologies, and Al-assisted learning.

URL's approach demonstrates how universities can **proactively integrate AI while upholding academic values**.

5. Future Trends in AI and Education

The report identifies emerging trends that will shape higher education:

1. **Generative AI in Learning** – Tools like ChatGPT will personalize feedback and content creation.

- 2. Adaptive Learning Platforms AI-driven systems will tailor education to individual needs.
- 3. Predictive Analytics Early warning systems to identify at-risk students.
- 4. Immersive Al Tools Virtual labs and Al tutors enhancing experiential learning.
- 5. Al in Competency Frameworks Al literacy becoming a core skill in curricula.
- 6. Stronger Ethical Governance Policies ensuring transparency and accountability.

6. Recommendations for Stakeholders

To maximize AI's benefits while mitigating risks, the report proposes:

For Policymakers:

- **Embed AI literacy in national curricula** (technical, ethical, and critical thinking skills).
- Invest in teacher training to enhance AI competency.
- **Develop ethical guidelines** for AI use in assessments and research.

For Universities:

- Establish Al governance committees to oversee implementation.
- Promote interdisciplinary Al research (e.g., Al in humanities, social sciences).
- Ensure equitable access to AI tools for all students.

For Educators:

- Adopt Al as a teaching aid, not a replacement for human interaction.
- Encourage critical engagement with AI-generated content.
- Stay updated on Al trends through continuous professional development.

Conclusion: A Human-Centric Approach to AI in Education

Al presents immense opportunities for higher education—personalized learning, administrative efficiency, and innovative research. However, its success depends on **responsible implementation**, ethical safeguards, and inclusive policies. Spain's multi-level strategies (national, regional, institutional) provide a strong foundation, but challenges like digital inequality and teacher readiness must be addressed.

The report underscores that **AI should enhance, not replace, human-led education**. By fostering AI literacy, ethical awareness, and collaborative governance, Spain can ensure that AI serves as a **transformative tool for equitable and future-ready education**.

1. Introduction

Artificial Intelligence (AI) has emerged as a transformative force across numerous sectors, and higher education is no exception. In recent years, the Spanish Higher Education system has increasingly recognised the strategic importance of AI, both as an object of academic study and as a driver of innovation in teaching, research, and institutional governance. This growing emphasis on AI reflects broader national and European trends, which identify digital transformation—and AI in particular—as key enablers of economic growth, social development, and scientific leadership.

This report is part of a series of reports from the FLAIR project analysing AI Competence Frameworks and Policies in Higher Education in the countries of the institutions participating in the project and focusses on Spain.

Spain's national strategy on AI, the *Estrategia Nacional de Inteligencia Artificial* (ENIA), launched in 2020 and aligned with the European Union's Digital Agenda, outlines clear commitments to AI research, talent development, and ethical governance. One of its pillars explicitly focuses on reinforcing Spain's capabilities in education and training, recognising universities as pivotal institutions in preparing the future workforce and fostering responsible innovation. Consequently, Spanish universities have begun to embed AI into curricula, expand specialised postgraduate programmes, and establish dedicated research centres focused on AI and data science.

Within this context, several universities have launched undergraduate and master's degrees specifically in Artificial Intelligence or related disciplines such as Machine Learning, Robotics, and Big Data. Moreover, AI is increasingly being integrated into existing programmes in engineering, computer science, economics, and even the humanities, signalling its interdisciplinary relevance. There is also a growing trend toward lifelong learning initiatives and micro-credentialing schemes designed to upskill professionals in AI-related competencies, often in partnership with industry and public agencies.

This document provides a comprehensive analysis of Spain's approach to AI integration, focusing on policy alignment, pedagogical innovation, and ethical governance. It situates Spain's efforts within broader European and global frameworks while highlighting localized practices, particularly through a case study of **Universitat Ramon Llull (URL)** in Catalonia.

Spain's engagement with AI in higher education is shaped by a multi-layered policy landscape. We find national strategies, such as the **National Artificial Intelligence Strategy (ENIA, 2020)**, backed by €600 million in EU recovery funds, which outlines six pillars—from research and talent development to ethical frameworks—explicitly linking AI to educational transformation. ENIA emphasizes interdisciplinary collaboration, teacher training, and equitable access, reflecting Spain's commitment to aligning AI with societal well-being. Spain is also bound to EU alignment, through the **National Digital Skills Plan (2021)** and adoption of the **DigCompEdu framework** demonstrate integration with European priorities, such as the EU Digital Education Action Plan. These efforts focus on embedding AI literacy across curricula while addressing digital divides. For Universitat Ramon Llull, the Catalan Government policy is also to be considered. The **Catalonia.AI** **Strategy** exemplifies regional leadership, positioning universities as hubs for ethical AI research and industry collaboration. This complements Spain's national goals while addressing local needs, such as multilingual education and sustainable development. Finally, we also find institutional responses from Spanish universities, guided by the **Conference of Rectors (CRUE)**, to navigate generative AI's disruptive potential. CRUE's 2024 report balances AI's opportunities (e.g., personalized learning) with warnings about academic integrity and bias, urging proactive institutional policies.

This report examines Spain's Al journey through four lenses, namely, policy analysis, a case study, global benchmarking together with stakeholder perspectives. The policy analysis reviews national and regional strategies (ENIA, Catalonia.Al) alongside EU directives, identifying synergies and gaps in implementation. The case study is centered on **Universitat Ramon Llull**, which serves as a microcosm of institutional adaptation, showcasing how universities translate policies into practice—from ethical guidelines for Al use to addressing mental health and environmental impacts. Global benchmarking is achieved by analysing frameworks like the **OECD Learning Compass 2030** and **Chiu et al.'s Al literacy model**, the report contextualizes Spain's progress within international best practices, emphasizing competencies such as critical thinking and ethical reflection. Finally, stakeholder perspectives are given by the **World Bank's 100 Student Voices** study, which injects grassroots insights, highlighting student concerns about equity, employability, and the risks of Al dependency.

The document underscores three cross-cutting themes.: ethics and equity where Spain's policies prioritize transparency, bias mitigation, and inclusivity, mirroring global calls for human-centric AI. However, challenges persist in bridging digital divides and ensuring AI tools serve diverse learners. Teacher empowerment as professional development emerges as a critical need, with frameworks like DigCompEdu providing scaffolding for educators to integrate AI pedagogically. Finally, systemic change, treating AI adoption as a **transformational process**, advocating for change management strategies that engage all stakeholders—from policymakers to students.

This report aims to map Spain's AI policy ecosystem and its alignment with global standards, evaluate institutional readiness through URL's pioneering initiatives and propose actionable recommendations for competencies, governance, and equity.

The methodology followed to elaborate the document has consisted in first spotting the key documents that frame Spain's policy, providing guidelines for higher education. Since Universitat Ramon Llull is in Catalonia, also their corresponding documents specific to Catalonia. Besides, four general documents selected from global organisations and research papers will also be included. The documents will be analysed along 7 key analysis vectors, agreed among the participants in the FLAIR project to help making the analysis uniform. These key analysis vectors are the following. What are the key concepts used in the document to define AI literacy both for students and teachers? What are the key AI competences both for students and teachers? What are the challenges of AI use for teaching and learning addressed in the document? What are the recommendations for using AI in the context of teaching and learning according to the document? Are there any examples of the use of AI in teaching and learning mentioned in the paper? How are values,

ethical principles and security frameworks addressed in the paper? Are there any future trends in AI and education described? After the analysis, Universitat Ramon Llull itself will serve as case study.

Following this introduction, the document delves into national policies (Section 2), URL's case study (Section 3), and a comparative analysis of AI frameworks (Section 4), culminating in conclusions tailored for Spanish and European stakeholders.

By grounding analysis in both local realities and global trends, this report seeks to inform Spain's next steps in AI education—ensuring innovation is ethical, inclusive, and pedagogically transformative.

2. National policy and practice regarding AI in Higher Education in Spain

The national policy and practice regarding AI in Higher Education in Spain can be shown at different levels: at the level of the Spanish government (ENIA); at the level of educators and based on the guidelines established by the EU (DigCompEdu); at the level of the Conference of Rectors of Spanish Universities (CRUE); at the regional level and, in this case, given that Ramon Llull University is located in Catalonia, we present the strategic plan at the level of the Catalan government (Catalonia.AI); and, finally, we find reports from educational foundations (for example, the Bofill Foundation).

National Artificial Intelligence Strategy (ENIA) (2020)

The National Artificial Intelligence Strategy (ENIA) was published on December 9, 2020, a fundamental piece to take advantage of the opportunities derived from this technology, the digital transformation and the data economy and to promote the modernization of the Spanish productive model.

ENIA has an initial allocation of more than €600 million in Next Generation EU funds from the <u>Recovery, Transformation and Resilience Plan</u> for the development of 20 measures structured around 6 strategic axes:

1. Promoting scientific research, technological development, and innovation in Al.

2. Promoting the development of digital capabilities, enhance national talent, and attract global talent.

3. Developing data platforms and technological infrastructure to support Al.

4. Integrating artificial intelligence into value chains to transform the country's economic fabric.

5. Enhancing the use of AI in public administration and national strategic missions.

6. Establishing an ethical and regulatory framework that strengthens the protection of individual and collective rights, ensuring inclusion and social wellbeing in a society where artificial intelligence is already becoming commonplace.

ENIA encourages universities and research institutions to actively participate in Al innovation by supporting cutting-edge research, interdisciplinary collaboration, and the integration of AI technologies into academic curricula and administration. Additionally, it highlights the importance of teacher training in digital and AI competencies, aligning with the broader goals of the Plan Nacional de Competencias Digitales (2021) and the Marco de Referencia de la Competencia Digital Docente (2022) (see next Section 2.2).

Furthermore, the strategy acknowledges the challenges AI poses in educational contexts such as ethical concerns, academic integrity, and the digital divide—emphasizing the need for clear governance frameworks, transparent AI systems, and human-centered design in educational tools. Through institutional funding, policy alignment, and stakeholder engagement, ENIA promotes a responsible and transformative use of AI in Spanish higher education institutions. Link to the Spanish version <<u>https://portal.mineco.gob.es/eses/digitalizacionIA/Documents/Estrategia_IA_2024.pdf</u>>.

Plan Nacional de Competencias Digitales (2021) and DigComp Framework

This national plan aims to foster digital literacy and competence among students, educators, and citizens. It builds on the DigComp framework, developed by the European Commission, which defines 21 digital competences grouped into five key areas.

DigCompEdu is a framework for integrating digital skills (including AI literacy) into education, targeting students, teachers, and professionals.

The DigComp project, implemented by the Joint Research Centre on behalf of the European Commission, started in 2010. Since then, awareness among Member States of DigComp as the EU-wide framework for framing digital skills policy, developing, and measuring digital competence, has consistently increased.

The DigComp framework remains crucial to the EU's objectives in enhancing digital skills. It supports the EU's Digital Education Action Plan 2021-2027, which in turn contributes to the Commission's priority 'A Europe fit for the Digital Age' and to Next Generation EU.

It serves multiple purposes, including designing competence assessment tools, creating training courses and materials, and identifying professional digital profiles within the realms of employment, education and training, and social inclusion (see DigComp Implementation Guides for concrete examples). Figure 1 shows the 21 key competences grouped in 5 essential categories from the DigComp Framework.



Figure 1. The 21 key competences of the DigComp Framework (page 9).

"Digital Competence Framework for Educators" (2022) was adapted from DigCompEdu. This framework targets all Spanish educators, aligning with the professional development stages of teachers.

The different links:

- See Spanish Version of "**Plan Nacional de Competencias Digitales**" (2021) <<u>https://portal.mineco.gob.es/recursosarticulo/mineco/ministerio/fichero</u> s/210127_plan_nacional_de_competencias_digitales.pdf>
- See "DigComp Implementation Guides" (2022) for concrete examples <<u>https://publications.jrc.ec.europa.eu/repository/handle/JRC110624</u>>

• See Spanish Version "**Marco de Referencia de la Competencia Digital Docente**" (2022). This is a proposed framework aimed at all teachers who teach courses regulated by the Organic Law on Education. It seeks to converge with the European frameworks for digital competence for citizens, educators, and schools, developed by the Joint Research Centre of the European Commission. Based on DigCompEdu, it has been adapted to the educational context of the Spanish State, and the criteria for establishing the levels of the European framework have been modified to adopt one that adapts to the stages of professional teacher development, from initial training and entry into the profession to expert, reflective, creative, and critical teaching, in which digital technologies are not an end, but rather another means for all students to improve their learning.

CRUE-Digitalización: Generative AI in University Teaching (2024)

The report from the Conference of Rectors of Spanish Universities (CRUE) "La Inteligencia Artificial Generativa en la Docencia Universitaria. Oportunidades, desafíos y recomendaciones / Generative Artificial Intelligence in University Teaching: Opportunities, Challenges, and Recommendations" explores the impact of Generative AI (GenAI) in higher education. It highlights opportunities such as enhancing creativity, personalizing learning, improving assessment, and supporting research and administration. However, it also warns of significant challenges, including ethical concerns, the need for digital literacy, the reliability of AI-generated content, and the risks of academic dishonesty. The document calls for institutional strategies that ensure responsible integration of GenAI in teaching, offering concrete recommendations for governance, training, transparency, and student engagement to foster a critical and informed use of these emerging technologies.

Link to the Spanish Version <<u>https://www.crue.org/wp-content/uploads/2024/03/Crue-</u> Digitalizacion_IA-Generativa.pdf>.

Catalonia.Al Strategy (2021)

In addition to the Spanish National AI Strategy (ENIA), Catalonia has developed its own regional roadmap through the "Catalonia.AI Strategy", promoted by the Department of the Vice Presidency and Digital Policies of the Generalitat de Catalunya. This strategy recognizes Artificial Intelligence as a transformative lever for economic development, digital sovereignty, and social progress. Higher education is identified as a key sector for the responsible deployment and advancement of AI in the region.

The Catalonia.AI Strategy emphasizes the importance of positioning Catalonia as a hub of AI talent and innovation, with universities and research centers at the heart of this ecosystem. Catalan universities are encouraged to expand AI-related programs and specializations, enhance interdisciplinary approaches combining AI with social sciences and humanities, and collaborate with public and private entities to drive applied research and innovation.

Specifically, the strategy proposes:

- The promotion of AI research and training in universities, especially in critical areas such as explainable AI, trustworthy AI, and AI ethics.
- Support for the integration of AI technologies into university curricula, administrative processes, and learning methodologies.
- Strengthening collaboration between academia and industry through Living Labs, research clusters, and innovation hubs.
- Fostering AI literacy and ethical awareness among students and teaching staff to ensure a human-centric, inclusive use of the technology.
- Increasing public investment in AI-related education, particularly in fields of strategic importance such as health, mobility, and sustainability.

Moreover, Catalonia.AI aligns with European frameworks like Horizon Europe, Digital Europe, and the European Commission's Coordinated Plan on AI, ensuring that local AI policies and educational priorities are integrated into broader continental goals.

Through this strategy, Catalonia seeks to bridge the gap between AI research, policy, and education, and to prepare higher education institutions to play a leading role in the development of a sustainable, ethical, and competitive AI ecosystem.

Link to the English version "CATALONIA.AI – Catalonia's Artificial Intelligence Strategy" <<u>https://politiquesdigitals.gencat.cat/web/.content/00-arbre/economia/catalonia-ai/Catalonia_IA_Strategy.pdf</u>>.

Fundació Bofill: "Algorithms Under Scrutiny" (2022)

The Fundació Jaume Bofill is a Catalan non-profit organization dedicated to research and advocacy in the field of education. Founded in 1969, the foundation aims to transform the education system in Catalonia to ensure equity, quality, and equal opportunities for all learners, especially those from vulnerable backgrounds. It conducts research, produces reports, and promotes policies and initiatives aimed at fostering inclusive, innovative, and high-quality education.

This report "*Els algorismes a examen: Per què la IA a l'educació?*" / "Algorithms Under Scrutiny: Why AI in Education?" (2022) critically examines the current and potential impact of Artificial Intelligence (AI) in education, including higher education in Spain. It provides a reflective and ethical perspective on the adoption of AI technologies within educational environments. Key aspects include:

• **Informed and participatory integration**: The report stresses that AI tools should be adopted in a way that is pedagogically sound and socially responsible, involving both teachers and students in the process.

• **Educational roles**: Teachers are positioned as key actors in helping students understand how AI works, their digital rights, and how to critically evaluate algorithmic systems.

• **Challenges and opportunities**: While AI can offer benefits such as personalized learning and improved administrative efficiency, the report warns of the risks of reinforcing inequalities if not implemented equitably.

• **Focus on higher education**: In the university context, the report calls for clear regulatory frameworks, specific training for teachers, and evaluation models that consider ethical and pedagogical impacts of AI, particularly generative AI tools.

• **Ethics and digital rights**: The foundation advocates for the use of Al systems in line with human rights, transparency, non-discrimination, and data protection principles, referencing the UNESCO Beijing Consensus on Al and Education.

Link to the Catalan Version in <<u>https://fundaciobofill.cat/uploads/docs/5/s/f/58v-e40_guia_digital_20042023_catala.pdf</u>>.

After this first overview, we shall proceed to the systematic review of a wide range of official policy documents, reports, and strategy papers from both national and regional bodies in Spain, as well as academic contributions. Key documents include the Spanish National AI Strategy (ENIA), the National Digital Skills Plan, the Catalonia.AI Strategy, and the "Artificial Intelligence in Catalonia" report by ACCIÓ. Other vital resources are contributions from the CRUE, the Fundació Bofill, and the Universitat Ramon Llull Working Group, among others.

These documents were analysed to extract references to AI literacy, competences, challenges, and recommendations, specifically related to higher education.

	Artificial Intelligence in Catalonia	BOE-A-2020- 7775	La Inteligencia Artificial Generativa en la Docencia Universitaria	DigComp into Action	Els algorismes a examen: Per què la IA a l'educació?
Type of document (Framework, Policy, Guideline,)	Report/Policy	Framework	Guideline	User Guide	Report/Study
Date of publication	2024	2020	2024	2018	2022
Responsible Institution(s)	ACCIÓ & Generalitat de Catalunya	Ministry of Education and Vocational Training, Spain	CRUE (Conference of Rectors of Spanish Universities)	European Commission, Joint Research Centre	Fundació Bofill
Responsible Persons/Authors (Position and Role)	Gibert, K. (Author)	General Directorate for Evaluation and Territorial Cooperation	CRUE Digitalisation Taskforce	Kluzer, S. & Pujol, L. (Authors)	Fundació Bofill Research Team
Stakeholders who play a role in the frameworks/policies	Catalan government, Al experts	Teachers, Education Inspectors	University faculty, administrators	Policymakers, educators	Researchers, educators, civil society
Target group(s)	Policy makers, Al developers	Teachers	University teachers	Education professionals	Education community in Catalonia

Table 1: Documents 1 to 5

Table 2: Documents 6 to 10

	CATALONIA.AI -	Marco de	Estrategia	Plan Nacional	Recommendatio
	Catalonia's	Referencia de	Nacional de	de	ns for the proper
	Artificial	la	Inteligencia	Competencias	use of Artificial
	Intelligence	Competencia	Artificial (ENIA)	Digitales	Intelligence-
	Strategy	Digital Docente			based tools
Type of document (Framework,	Strategy	Framework	Strategy	Strategy	Guideline
Policy, Guideline,)					
Date of publication	2021	2022	2020	2021	2023
Responsible Institution(s)	Generalitat de	INTEF,	Spanish	Spanish	Universitat
	Catalunya	Ministerio de	Government	Government	Ramon Llull
		Educación y FP	(Ministry of		
			Economic		
			Affairs)		
Responsible Persons/Authors	Department of	GTTA Working	Spanish Digital	Ministry of	Working Group
(Position and Role)	Digital Policies	Group	Strategy Team	Education and	on the Impact of
	and Public			Economy	AI Tools in
	Administration				Teaching,
					Academic
					Organization and
					Quality Office
Stakeholders who play a role in	Government	Teachers,	Public	Educational	Teachers,
the frameworks/policies	agencies, tech	policymakers	administration,	institutions,	students,
	companies		companies,	companies	academic
			academia		leaders
Target group(s)	Catalan	Teachers	General public,	Spanish	University
	society,		AI developers	citizens	teachers and
	industry				students

The documents included are:

- ACCIÓ & Generalitat de Catalunya (2024) Gibert, K. (autor). "Artificial Intelligence in Catalonia". Link to <<u>https://www.accio.gencat.cat/web/.content/bancconeixement/documents/pindoles</u> /<u>ACCIO-la-intelligencia-artificial-a-catalunya-en.pdf</u>>
- BOE (2020). "Resolución de 2 de julio de 2020, de la Dirección General de Evaluación y Cooperación Territorial, por la que se publica el Acuerdo de la Conferencia Sectorial de Educación sobre el marco de referencia de la competencia digital docente", BOE-A-2020-7775, «BOE» núm. 191, de 13 de julio de 2020, páginas 50638 a 50668, Ministerio de Educación y Formación Profesional. Link to https://www.boe.es/diario_boe/txt.php?id=BOE-A-2020-7775.
- 3. CRUE (2024). "La Inteligencia Artificial Generativa en la Docencia Universitaria", Conference of Rectors of Spanish Universities. Link to <<u>https://www.crue.org/wp-content/uploads/2024/03/Crue-Digitalizacion_IA-Generativa.pdf</u>>.
- European Commission (2018) Kluzer S.; Pujol L. (authors) "DigComp into Action: Get inspired, make it happen. A user guide to the European Digital Competence Framework", JRC110624, ISSN 1831-9424. DOI 10.2760/112945. Link to <<u>https://publications.jrc.ec.europa.eu/repository/handle/JRC110624</u>>.
- Fundació Bofill (2022). "Els algorismes a examen: Per què la IA a l'educació?". Link to <<u>https://fundaciobofill.cat/uploads/docs/5/s/f/58v-</u> <u>e40_guia_digital_20042023_catala.pdf</u>>.
- Generalitat de Catalunya (2021). "CATALONIA.AI Catalonia's Artificial Intelligence Strategy". Link to <<u>https://politiquesdigitals.gencat.cat/web/.content/00-</u> arbre/economia/catalonia-ai/Catalonia_IA_Strategy.pdf>.
- 7. Grupo de Trabajo de Tecnologías del Aprendizaje (GTTA) (2022). "*Marco de Referencia de la Competencia Digital Docente*". Link to https://intef.es/wp-content/uploads/2022/03/MRCDD_V06B_GTTA.pdf.
- 8. Spanish Government (2020). "*Estrategia Nacional de Inteligencia Artificial* (ENIA)". Link to the Spanish Version <<u>https://portal.mineco.gob.es/es-es/digitalizacionIA/Documents/Estrategia_IA_2024.pdf</u>>.
- 9. Spanish Government (2021). "Plan Nacional de Competencias Digitales". Link to the Spanish version <<u>https://portal.mineco.gob.es/recursosarticulo/mineco/ministerio/ficheros/210127_p</u> lan_nacional_de_competencias_digitales.pdf>

- 10. Universitat Ramon Llull (December 2023). "Recommendations for the proper use of Artificial Intelligence-based tools" Link to https://www.url.edu/sites/default/files/content/file/2023/12/13/36/recommendation s-proper-use-artificial-intelligence-based-tools.pdf
- 11. Universitat Ramon Llull (June 2024). "Artificial Intelligence and Mental Health". Link to https://www.url.edu/sites/default/files/content/file/2024/07/02/36/aimentalhealth.p df>.
- 12. Universitat Ramon Llull (May 2024). "Environmental Impact of Artificial Intelligence". Link <https://www.url.edu/sites/default/files/content/file/2024/05/15/36/aienvironmentali mpact.pdf>.
- Universitat Ramon Llull (May 2024). "Artificial Intelligence and the Digital Divide". Link to https://www.url.edu/sites/default/files/content/file/2024/05/15/36/aidigitaldivide.pdf
- 14. Universitat Ramon Llull (May 2024). "Artificial Intelligence and Creativity". Link to https://www.url.edu/sites/default/files/content/file/2024/07/02/36/iacreativity.pdf.
- 15. Universitat Ramon Llull (May 2024). "Artificial Intelligence and Legality". Link to https://www.url.edu/sites/default/files/content/file/2024/05/15/36/ailegality.pdf.

Key Concepts used in the documents to define AI literacy – for students and for teachers

Al literacy refers to the knowledge, skills, and attitudes necessary to understand, interact with, and critically evaluate Artificial Intelligence systems. While definitions vary slightly depending on the target audience (students vs. teachers), several key concepts are consistently highlighted across national strategies and institutional frameworks in Spain and Catalonia.

For Students:

Students are expected to be critical consumers and informed users of AI technologies. The main competencies outlined in various policy documents include:

- **Algorithmic thinking**: Understanding how algorithms work, how decisions are made by AI systems, and the implications of algorithmic bias or opacity.
- **Data literacy**: Being able to collect, analyse, interpret, and question data, especially when it is used to train or fuel AI systems.
- Awareness of AI applications: Recognizing where and how AI systems are embedded in everyday digital tools, platforms, and decision-making processes (e.g., recommendation systems, facial recognition, etc.).

• **Ethical and social understanding**: Reflecting on the ethical implications of AI, such as discrimination, surveillance, data privacy, and the digital divide.

According to the Fundació Bofill and CRUE reports, AI literacy for students should also include creativity, collaboration, and problem-solving in AI contexts, especially in the use of generative tools (e.g., ChatGPT, Midjourney) within the classroom.

For Teachers:

Teachers have a dual role in AI literacy: they are both learners and educators of AI-related competencies. Therefore, frameworks such as the "*Marco de Referencia de la Competencia Digital Docente*" (MRCDD) emphasise:

- **Understanding AI systems**: Developing a foundational understanding of AI technologies and their pedagogical potential.
- Instructional design with AI: Integrating AI tools responsibly into teaching, including for assessment, feedback, and content creation.
- **Guidance on ethical use**: Instructing students on critical and ethical use of AI, emphasizing issues such as plagiarism, bias, and fairness.
- Adaptation to emerging trends: Staying updated on AI developments and continuously adapting pedagogical strategies.

The Universitat Ramon Llull (URL) recommendations highlight the importance of interdisciplinary collaboration, reflective teaching, and the role of educators in establishing norms for AI use within academic communities.

Key AI competences (for students and for teachers)

Developing AI competence is essential to prepare both students and teachers to navigate a world increasingly shaped by artificial intelligence. These competences encompass not only technical understanding but also ethical, social, and pedagogical dimensions. The following key AI competences have been identified for students and teachers:

For Students

- **Understanding AI Fundamentals**. Students should grasp the basic concepts of AI, including algorithms, data, machine learning, and neural networks. This includes recognizing how AI systems work and where they are applied in real life (e.g. recommendation systems, language models, autonomous systems).
- **Data Literacy**. A core competence is the ability to collect, interpret, and critically assess data. Students should understand data bias, the importance of data quality, and how data feeds AI systems.
- **Algorithmic Thinking**. Students need to develop problem-solving skills that reflect how algorithms operate: step-by-step logical reasoning, decomposition, and abstraction.
- **Ethical and Social Awareness**. Competence in identifying the ethical implications of AI is crucial. Students should be able to critically analyse issues such as privacy,

surveillance, algorithmic bias, and discrimination, as well as understand AI's societal and environmental impacts.

- Al Co-creation Skills. Beyond users, students are also seen as potential cocreators of Al applications. They should be able to participate in simple Al development environments (e.g., using educational tools such as Scratch with ML extensions or Al-assisted coding).
- **Digital and Media Literacy**. Understanding how AI affects media, search engines, and information flows helps students critically evaluate the credibility of online content, especially in a post-truth era.

For Teachers:

- Al Pedagogical Integration. Teachers should be competent in integrating Al tools into their teaching practices to enhance learning experiences. This includes understanding the potentials and limitations of AI in education (e.g., adaptive learning platforms, Al tutors).
- Instructional Design with AI. Teachers must be able to evaluate, select, and implement AI-driven educational technologies that align with curricular goals and learner needs.
- Ethical Use and Leadership. Educators have a leading role in modelling ethical AI use and guiding classroom discussions around the responsible use of AI technologies. They should promote awareness and foster a culture of critical thinking about AI.
- **Continuous Professional Development**. Al literacy for teachers involves ongoing learning. Teachers should engage with national or regional competence frameworks (e.g., DigCompEdu, CRUE, GTTA) to stay updated with technological trends and educational strategies involving Al.
- **Facilitating Student Competence Development**. Teachers play a crucial role in nurturing AI competences in students. This includes designing interdisciplinary projects, promoting inquiry-based learning, and encouraging co-creation with AI tools.
- Awareness of Policy and Frameworks. Teachers should be familiar with the main national and European strategies on AI and digital competences, such as ENIA, Catalonia.AI, or the National Digital Skills Plan, to align their teaching with current educational and technological developments.

Challenges of AI use for Teaching & Learning addressed in the documents

The integration of Artificial Intelligence in education brings significant opportunities but also presents a variety of challenges that must be carefully addressed to ensure responsible and effective use. Across the reviewed documents, several recurring challenges are identified, which call for both strategic planning and pedagogical adaptation.

1. **Misinformation and Al-generated Content**. The rise of generative Al models (such as ChatGPT or image generation tools) increases the risk of spreading false or misleading information. The CRUE (2024) report emphasizes the need to train

students and educators to identify AI-generated content and critically evaluate digital sources. Educational strategies must include media literacy and fact-checking skills.

- 2. Ethical Risks and Bias. Many documents, including the Fundació Bofill (2022) and ENIA (2020), highlight concerns related to algorithmic bias, discrimination, and fairness. Al systems trained on biased data may reinforce stereotypes or produce unequal outcomes. Addressing these risks requires educators and students to understand how bias can be embedded in Al and to develop strategies for mitigating its impact.
- 3. **Student Dependency on Al Tools.** The growing use of Al-based writing or problemsolving tools raises concerns about over-reliance. According to the Universitat Ramon Llull (2023) guidelines, students must be encouraged to use Al as a support, not as a substitute for critical thinking and creativity. Educators need to design activities that balance Al assistance with independent learning.
- 4. **Data Privacy and Surveillance.** Several frameworks, including "Catalonia.Al" (2021) and the European Commission's DigComp into Action (2018), stress the importance of protecting personal data. Al applications in education often involve data collection and analysis, raising concerns about consent, storage, and usage. Institutions must implement clear policies and ensure compliance with GDPR and other data protection regulations.
- 5. Lack of Preparedness and Training Among Educators. Both the CRUE (2024) report and national competence frameworks like the GTTA (2022) indicate a gap in teacher training regarding AI tools and their pedagogical implications. Without adequate support, educators may feel unprepared or resistant to integrating AI into their practice. Professional development and institutional support are essential.
- 6. Institutional Governance and Policy Gaps. Several documents, such as the ENIA strategy (2020) and Catalonia.AI (2021), emphasize the role of policy in guiding AI use in education. The absence of clear institutional frameworks may lead to uncoordinated or inequitable AI integration. Institutions must establish transparent governance models that consider pedagogical, technical, and ethical dimensions.
- 7. **Equity and Access.** There is a risk that AI technologies may widen existing digital divides. Not all students have equal access to the devices, connectivity, or digital skills needed to benefit from AI-enhanced learning. Policy documents advocate for inclusive digital strategies that promote equitable access and usage across diverse student populations.
- 8. Skills Gap and the Pace of Technological Change. The Future of Jobs Report 2025 (WEF, 2025) from the World Economic Forum highlights the growing mismatch between the rapid advancement of AI technologies and the pace at which education systems and workforces can adapt. While AI is increasingly present in workplaces, there is a lag in the acquisition of AI-related skills, both technical (e.g. data analysis, machine learning) and transversal (e.g. critical thinking, adaptability). This rapid evolution creates pressure on educational institutions and teachers, who may struggle to update curricula and methodologies quickly enough to prepare students for the future job market. It also exacerbates inequalities, as not all schools or regions have equal capacity to adapt. Implications for education include:

- The need for agile and continuous upskilling of educators, so they can integrate emerging technologies meaningfully into their teaching.
- The risk of curricular obsolescence, where students are taught outdated skills no longer aligned with labour market needs.
- The importance of foresight and collaboration between governments, industry, and educational institutions to ensure alignment between education and future workforce demands.

Recommendations for using AI in the context of teaching and learning

The effective integration of Artificial Intelligence in education requires thoughtful planning, ethical consideration, and ongoing support for teachers and learners. The reviewed documents converge on a set of key recommendations aimed at ensuring that AI tools are used responsibly, inclusively, and in ways that enhance—rather than replace—human-centred teaching and learning.

1. **Promote Al Literacy for both, Students and Educators.** Educators and students should be equipped with basic Al literacy, including an understanding of what Al is, how it works, and its limitations. This includes developing algorithmic thinking, data literacy, and awareness of how Al shapes information and decision-making. Documents such as DigComp into Action and the Fundació Bofill report emphasize embedding Al concepts into curricula across disciplines.

2. **Provide Ongoing Training and Professional Development.** Teachers must receive continuous professional development to stay updated on AI tools, their pedagogical uses, and ethical implications. The CRUE and GTTA documents recommend tailored training programs that address real classroom contexts, ensuring teachers feel confident in integrating AI meaningfully into their practice.

3. **Ensure ethical and transparent Use of AI Tools.** All AI tools used in education should comply with ethical standards, prioritizing transparency, fairness, and accountability. Educators should be aware of algorithmic biases and potential unintended consequences. The Universitat Ramon Llull's recommendations stress the importance of informed consent, clear communication about data usage, and transparency in AI-driven decision-making.

4. **Protect Student Data and Privacy.** Al systems must adhere to strict data protection regulations (e.g. GDPR). Institutions should adopt clear policies around data collection, storage, and sharing. The Catalonia.Al Strategy and ENIA documents emphasize the need for digital sovereignty and privacy by design, particularly when handling sensitive student information.

5. Encourage Critical Thinking and Reflective Use. Al should be used as a tool to support—not substitute—critical thinking, creativity, and human interaction. Students should be encouraged to question the output of Al systems, develop their own viewpoints, and use Al as a complement to their own reasoning. The Fundació

Bofill underlines this as essential to avoid cognitive dependency and passive learning.

6. **Foster Inclusive and Equitable Access.** To prevent digital divides, AI tools and related training must be accessible to all learners and educators, regardless of socio-economic background. National policies such as the Plan Nacional de Competencias Digitales recommend public investment in infrastructure, devices, and inclusive digital education programs.

7. Encourage Collaboration Between Stakeholders. Successful AI integration requires collaboration between policymakers, educators, technologists, families, and students. Joint initiatives—like those encouraged by the European Commission—can help align educational goals with technological innovation, ensuring that AI serves public interest and educational equity.

8. **Anticipate Future Skills Needs.** As highlighted in the Future of Jobs Report 2025 by the World Economic Forum, educational systems should proactively adapt to the evolving skills landscape shaped by AI and automation. This includes prioritizing soft skills such as adaptability, emotional intelligence, and problem-solving, which remain uniquely human and essential in the AI era.

Finally, it is very important to remember that all of us, in general, will be **users** of AI, and not experts or developers of AI.

Examples of the use of AI in teaching and learning

The integration of Artificial Intelligence in educational contexts is rapidly expanding, offering opportunities to personalize learning, support educators, and optimize administrative and instructional processes. Below are selected examples, drawn from policy documents, institutional reports, and international best practices, that illustrate how AI is currently being applied in teaching and learning:

1. Adaptive Learning Platforms

Al-driven platforms such as Socrative, Knewton, or Savia Digital are used in Spanish educational settings to personalize learning paths, offering tailored exercises based on students' performance. These systems analyze learners' progress and adapt content in real-time, helping students who struggle while challenging those who excel. Source: Plan Nacional de Competencias Digitales (2021)**2.** Automatic Feedback and Assessment Tools

Universities in Spain are incorporating AI tools to assist in the evaluation process. For instance, natural language processing algorithms can provide immediate feedback on written assignments, grammar, or citation use. Generative AI is also used to support formative assessment, providing students with constructive suggestions. Source: CRUE (2024), "La Inteligencia Artificial Generativa en la Docencia Universitaria".

3. AI Chatbots for Student Support

Chatbots like PauBot (a Catalan initiative) are used to answer frequently asked questions, guide students through administrative procedures, and provide 24/7 support. These tools free up time for teaching staff and improve responsiveness to student needs. Source: Artificial Intelligence in Catalonia – ACCIÓ (2024).

4. AI for Learning Analytics and Early Warning Systems

Al is used to analyse learning management system (LMS) data (e.g., Moodle, Blackboard) to detect students at risk of dropping out or underperforming. These analytics allow teachers to intervene early with personalized support strategies. Source: European Commission (2018), "DigComp into Action".

5. AI-Assisted Language Learning

Language learning apps like Duolingo and Lingvist use AI to adjust difficulty, improve pronunciation, and track progress. The Fundació Bofill notes that these tools, when used critically, can support multilingualism and autonomous learning in diverse classrooms. Source: Fundació Bofill (2022), "Els algorismes a examen".

6. Generative AI in Creative and Analytical Tasks

University students are beginning to use generative tools such as ChatGPT or DALL-E to brainstorm ideas, summarize texts, or create visuals. The document provides guidelines to ensure ethical and transparent use, and to prevent overreliance or academic dishonesty. Source: Universitat Ramon Llull (2023), "Recommendations for the proper use of Al tools".

7. Teacher Support through AI-Enhanced Content Creation

Educators are using AI-based platforms to co-create lesson plans, quizzes, and multimedia content. Tools like EdPuzzle or Khanmigo support teachers by saving time and offering differentiated materials adapted to different learner profiles. Source: GTTA (2022), Marco de Referencia de la Competencia Digital Docente.

8. Inclusive Education through AI Tools

Al applications are also enhancing accessibility. Speech-to-text systems, real-time translation, and screen readers powered by Al support students with disabilities and non-native language speakers, making learning more inclusive. Source: UNESCO (2021), "Al and Education: Guidance for Policy-makers"

9. AI in Vocational Education and Career Guidance

Al-based systems are used to suggest career paths and training programs aligned with emerging labor market trends. Platforms can analyze individual skills and job profiles to recommend upskilling opportunities or relevant academic programs. Source: World Economic Forum (2025), "Future of Jobs Report".

Conclusion. These examples demonstrate that AI is not limited to futuristic visions but is already reshaping classrooms, curricula, and administrative processes. However, effective implementation requires digital literacy, ethical governance, and a clear pedagogical framework to ensure AI adds value to human-led education rather than replacing it.

Values, ethical principles, and security framework

The integration of Artificial Intelligence (AI) in education necessitates a robust ethical and security framework that aligns with fundamental values such as **human dignity**, **transparency**, **equity**, and **inclusiveness**. As highlighted across the reviewed documents, ensuring the ethical use of AI is essential not only for protecting learners and educators but also for maintaining the integrity and democratic nature of education systems.

1. Core Values and Principles. Several core ethical principles emerge consistently:

- **Transparency**: Al systems must be explainable and understandable by educators and students. As per the *Universitat Ramon Llull (2023)* recommendations, users should be aware when Al is used and how decisions or suggestions are generated.
- **Human-centeredness and Dignity**: According to the UNESCO Beijing Declaration on AI and Education, AI must respect human autonomy, placing people especially learners — at the core of decision-making processes.
- Equity and Inclusion: The Fundació Bofill (2022) and Spanish Government's Digital Competence Plan (2021) emphasize that AI must reduce —not widen— digital divides. Special attention should be paid to underrepresented groups, students with disabilities, and those from disadvantaged socioeconomic backgrounds.
- Accountability and Responsibility: Documents such as *DigComp into Action* (*European Commission, 2018*) and *CRUE* (2024) stress the need for clear attribution of responsibilities when AI tools are implemented, particularly in content creation, grading, or student monitoring.
- **Sustainability**: The *World Economic Forum (2025)* ties AI use in education to broader sustainable development goals (SDGs), advocating for responsible digital innovation that contributes to social and environmental progress.

2. Institutional Governance and Ethical Oversight. Several institutions propose ethical guidelines and governance structures:

• Universitat Ramon Llull (2023) provides a code of good practices for the responsible use of AI in academic contexts, calling for institutional oversight, transparency in usage, and training for staff and students.

- Generalitat de Catalunya (2021), CATALONIA.AI promotes the creation of ethical committees and auditing processes to ensure algorithmic fairness and regulatory compliance. The Observatory for Ethics in Artificial Intelligence of Catalonia (OEIAC) is part of the Artificial Intelligence (AI) Strategy promoted by the Government of Catalonia under the name CATALONIA.AI (link to oeiac.cat). CATALONIA.AI includes an axis on "Ethics and Society", which is where the OEIAC is located, in order to promote the development of an ethical AI, which respects the current legality, which is compatible with our social and cultural norms, and which is centred on people.
- **GTTA's Digital Competence Framework (2022)** includes ethical use of digital technologies as a key competence for educators, integrating data protection, digital wellbeing, and bias awareness into professional development.

3. Privacy and Data Security. Across all documents, **data protection and security** stand out as a major concern:

- The *BOE (2020)* and *Plan Nacional de Competencias Digitales (2021)* explicitly mention the importance of aligning AI use with the **General Data Protection Regulation (GDPR)**.
- Al tools that process student data —including learning behaviors, biometric data (voice, typing rhythm), or performance metrics— must ensure **confidentiality**, **informed consent**, and **data minimization**.
- The *CRUE (2024)* paper warns about the risks of using third-party AI tools (e.g. ChatGPT) without clear data policies, recommending institutions establish internal usage protocols.
- 4. Ethical Risks Identified. Multiple challenges and ethical dilemmas are highlighted:
 - **Algorithmic bias**: Poorly designed or trained AI models can perpetuate stereotypes or reinforce systemic inequalities (e.g., biased grading or content filtering).
 - **Over-surveillance**: Learning analytics and automated monitoring systems risk infringing on student privacy if not transparently governed.
 - **Intellectual integrity**: Generative AI tools may blur authorship boundaries, requiring updated policies on plagiarism, citation, and co-creation.

Conclusion. Ensuring that AI in education is aligned with democratic values and human rights requires a multi-level approach:

- Embedding ethics and digital citizenship in curricula.
- Establishing institutional policies and audit mechanisms.
- Promoting **interdisciplinary dialogue** between educators, technologists, policymakers, and students.
- Aligning national strategies (e.g. ENIA, Catalonia.AI) with **international declarations** such as the UNESCO Beijing Declaration and the OECD AI Principles.

By embracing this value-based framework, education systems can foster innovation without compromising ethical integrity or social justice.

Future trends in AI and education

The intersection of Artificial Intelligence (AI) and education is evolving rapidly, reshaping how we teach, learn, and assess. Across the reviewed documents —including the *World Economic Forum's Future of Jobs Report (2025), CRUE (2024),* and *Catalonia.AI (2021)* several key trends emerge that point to a transformation of educational ecosystems driven by emerging AI technologies, new pedagogical models, and strengthened ethical frameworks.

1. Rise of Generative AI in Learning and Teaching

Generative AI (GenAI), such as large language models and multimodal systems (e.g. ChatGPT, DALL·E, among others), is increasingly being integrated into educational contexts:

- **CRUE (2024)** emphasizes GenAl's potential to support **personalized feedback**, content creation, and academic writing, while also acknowledging the need for clear usage guidelines and teacher training.
- GenAl tools are expected to evolve toward **co-creative agents**, supporting students in ideation, research, and reflection rather than simply providing answers.

2. Adaptive and Personalized Learning Environments

Al is enabling **adaptive learning platforms** that respond to individual learners' needs, pacing, and preferences:

- According to *DigComp into Action (2018)* and the *Plan Nacional de Competencias Digitales (2021)*, Al-powered tools can facilitate **micro-learning**, **formative assessment**, and **competency-based progression**.
- Such systems adjust instructional content in real time, allowing differentiated instruction that supports inclusive education and mitigates learning gaps.

3. Predictive Analytics and Learning Data

The use of AI to interpret large-scale educational data is gaining traction:

- Al-driven **learning analytics** can predict student performance, dropout risks, or engagement trends, enabling **early intervention**.
- As outlined in *Gibert (2024)* and *Catalonia.Al (2021)*, these tools are becoming essential in data-informed decision-making at institutional and policy levels.

However, predictive systems must be governed carefully to avoid reinforcing existing inequalities or compromising data privacy, as warned by *Fundació Bofill (2022)* and *CRUE (2024)*.

4. Immersive AI-Powered Tools and Interfaces

Future classrooms may be enriched by immersive AI technologies:

• **Conversational AI**, such as chatbots and virtual tutors, are supporting student queries 24/7, offering scalable and on-demand support.

- **Immersive environments** powered by AI (e.g. virtual labs, AI-enhanced VR simulations) can transform experiential learning in STEM, healthcare, and vocational education.
- The *World Economic Forum (2025)* points to **mixed reality tools** as critical to preparing students for the "skills of tomorrow."

5. Integration of AI in Competence Frameworks and Curricula

Educational institutions are moving toward formally integrating AI literacy in teacher training and school curricula:

- The *GTTA (2022)* and *BOE (2020)* frameworks highlight AI-related competencies such as algorithmic thinking, digital ethics, and data awareness— as fundamental for both students and educators.
- **Al literacy** is expected to become part of national and European digital competence frameworks, aligning with lifelong learning strategies.

6. Strengthened Ethical Regulation and Governance

With the rapid deployment of AI tools in classrooms, there is a parallel trend toward **regulatory oversight and ethical governance**:

- Universitat Ramon Llull (2023) and Generalitat de Catalunya (2021) call for clear institutional policies on AI usage, ethics committees, and regular audits.
- The *World Economic Forum (2025)* and *UNESCO* foresee global efforts to standardize **AI ethics in education**, promoting rights-based, inclusive and accountable implementation.

The future of AI in education is defined by a dual trajectory: **technological sophistication** and **ethical maturity**. From GenAI and adaptive learning to predictive insights and virtual tutors, these innovations offer powerful tools to enhance teaching and learning. Yet, as education systems adopt these technologies, **human agency, pedagogical purpose, and social equity** must remain central.

By aligning innovation with values, educators and policymakers can ensure that AI becomes a **transformative ally** in building inclusive, sustainable, and future-ready education.

3. Policy and practice at Universitat Ramon Llull: case study

The emergence of ChatGPT at the end of 2022 burst with great force into society and, especially, into education. It was the moment when generative AI entered our homes and our schools and called into question the current educational system. Both the way of teaching and the way of assessing. Beyond all the issues of plagiarism and/or fraud. The news showed dismay: "New York City schools ban AI chatbot that writes essays and answers prompts" (The Guardian, Jan 6, 2023); "Singapore open to ChatGPT use in schools, but urges caution" (NDNET, Jan 6, 2023); "ChatGPT: A Threat to Higher Education?" (Forbes, Jan 10, 2023); "Australian universities to return 'pen and paper' exams after students caught using AI to write essays" (The Guardian, Jan 10, 2023); among others. In the context of our university, we created an interdisciplinary working group (led by the Academic Organisation and Quality Office of the URL) on the Impact of Artificial

Academic Organisation and Quality Office of the URL) on the Impact of Artificial Intelligence-based Tools Applied to Teaching, as we observed that it was necessary to: know what AI was, know the knowledge and use of AI in the different areas of knowledge of the university and, if possible, establish guidelines. Therefore, we began by developing 10 recommendations (December 2023), very common sense, which would allow us to establish ethical criteria and good practices to ensure that the use of AI-based tools is beneficial and respectful of the values of the university community. These recommendations are (see Figure 2):

- Act respectfully and responsibly
- Protect privacy
- Look after the environment
- Promote knowledge of AI-Based tools
- Cultivate critical thinking
- Grant fairness and non-discrimination
- Encourage human interaction
- Use AI as a tool
- Assure information's veracity
- Advocate for transparency



Figure 2. **Recommendations for the proper use of Artificial Intelligence-based tools**. The file can be downloaded from this <u>link</u>

The working group developed other more specific recommendations in the context of the whole university community:

• Artificial Intelligence and Mental Health (June 2024). According to the World Health Organization (WHO), mental health is the state of well-being in which a person can cope with the daily challenges, develop, learn, and work effectively. It is a fundamental part of overall health and well-being, supporting the abilities to make decisions and establish healthy relationships. The use of Artificial Intelligence (AI)-based tools can have both positive and negative repercussions on people's mental health and in healthcare relationships, which are those between healthcare professionals and users. Link to https://www.url.edu/sites/default/files/content/file/2024/07/02/36/aimentalhealth.pdf.

• Environmental Impact of Artificial Intelligence (May 2024). Every action done with technology, its fabrication, installation, Artificial Intelligence (AI) training, its maintenance and use, have an impact on the environment. Each search on the Internet, every click, all interactions with AI-based tools generate digital footprints stored in databases and physical information processors that consume power and water, generate residues, and emit greenhouse gases. An impact of which, often, no one is aware of. Link to https://www.url.edu/sites/default/files/content/file/2024/05/15/36/aienvironmentalimpact.pdf>

• Artificial Intelligence and the Digital Divide (May 2024). In the last twenty years, society has adapted to many technological breakthroughs such as computers, mobile phones, email, the Internet, telecommuting and Artificial Intelligence (AI)-based tools. Digitalization has progressed at such a fast pace that

the population's digital skills must be updated, but there are various factors (socioeconomic level, education, age, gender) that make access, use, and knowledge of technology inequitable. The digital divide is the inequality between those who can keep up digitally and those who cannot, posing an access barrier to fundamental rights such as education, employment, and banking and healthcare services. To narrow the divide, it is essential to guide individuals in comprehensive, critical, responsible, ethical, and secure digital education. Link to https://www.url.edu/sites/default/files/content/file/2024/05/15/36/aidigitaldivide.pdf>.

• Artificial Intelligence and Creativity (May 2024). Creativity is the human ability to generate new ideas, relationships amongst elements, and the expression of creativity is art. Artificial intelligence (AI) is able to produce, design, or elaborate, through computer processes and algorithms, images and other content from initial input. The intention with which art is made is an inalienable human characteristic without which art wouldn't evoke, connect with us. Thus, it is the human element that is essential to making art that fulfils its purpose: to evoke emotions. This is why some industries like design have adapted to this technological change adopting a "collaborative" spirit between humans and machines. Al-based tools need to be used to shape the message artists and professionals want to share. Link to <<u>https://www.url.edu/sites/default/files/content/file/2024/07/02/36/iacreativity.pdf></u>.

• Artificial Intelligence and Legality (May 2024). The rise of Artificial Intelligence (AI)-based tools has brought up legal and ethical concerns in some scopes of society. The debate is centred around how to correctly manage AI tools in order to grant human rights, justice, and safety whilst encouraging innovation. On March 13, 2024, the European Parliament approved the first AI law (AiAct), which regulates its uses to limit the risks that arise from it. Link to <<u>https://www.url.edu/sites/default/files/content/file/2024/05/15/36/ailegality.pdf</u>>.

Currently, the working group is focusing on sharing good practices proposed by different schools and faculties, regarding **plagiarism and copying** of work; and how it affects **assessment methodologies**.

4. Analysis of AI competence frameworks

4.1 Methodology and documents included in the analysis

This section analyses four general frameworks following the 7 key analysis vectors, agreed to help making the analysis uniform as explained in the introduction. These seven points have been extracted for each of the documents individually and will be combined and summarised in the following section.

The documents included are the following:

Document 1: Cobo, C., Munoz-Najar, A., Bertrand, M. (2024). *100 StudentVoices on AI and Education*. In Digital Innovations in Education. World Bank.

Document 2: Organisation for Economic Co-operation and Development [OECD]. (2019). *OECD learning compass 2030: A series of concept notes.* OECD Publishing.

Document 3: European Commission. (2020). *Digital Education Action Plan 2021–2027: Resetting education and training for the digital age* (COM(2020) 624 final).

Document 4: Chiu, T. K. F., Ahmad, Z., Ismailov, M., & Sanusi, I. T. (2024). What are artificial intelligence literacy and competency? A comprehensive framework to support them. *Computers and Education Open, 6*, 100171.

The World Bank report **100 Student Voices on AI and Education** (2024) explores the transformative impact of Artificial Intelligence (AI) on higher education across 10 countries. Through student perspectives, it highlights AI's dual role as both an enabler—enhancing personalized learning, research, and administrative efficiency—and a disruptor, raising concerns about academic integrity, bias, job displacement, and digital divides. The document emphasizes the need for ethical frameworks, equitable access, and institutional reforms to foster AI literacy among students and educators. Recommendations include updating curricula, faculty training, and policy collaboration to balance innovation with human-centered values. Ultimately, it calls for a proactive, inclusive approach to harness AI's potential while mitigating risks in global education systems.

The **OECD Learning Compass 2030** is a forward-looking framework developed by the OECD's Directorate for Education and Skills, published in 2019, to guide education systems in preparing students for an unpredictable future. Co-created with governments, educators, students, and experts, it emphasizes **transformative competencies** like creativity, critical thinking, and ethical judgment, alongside foundational skills in literacy, numeracy, and digital fluency. The framework advocates for **student agency**, personalized learning, and human-centric values, cautioning against over-reliance on technology while integrating AI and data-driven tools responsibly. It addresses equity, teacher empowerment, and global citizenship, aiming to balance innovation with well-being. Designed for policymakers, schools, and learners, it serves as a non-binding but influential reference for 21st-century education reform.

The EU Digital Education Action Plan 2021–2027, published by the European Commission on 30 September 2020, outlines a strategic framework to modernize

education through digital technologies, emphasizing inclusivity, ethics, and innovation. It addresses challenges like the digital divide, teacher preparedness, and AI integration while promoting **high-quality**, **accessible education** for all learners. Key priorities include fostering digital literacy, enhancing infrastructure (e.g., broadband access), and developing ethical AI guidelines for educators. The plan targets **students**, **teachers**, **policymakers**, **and industry stakeholders**, advocating for cross-sector collaboration and EU-funded initiatives like **Erasmus+** and the **Digital Europe Programme**. Its goal is to equip Europeans with digital competencies for a **fair**, **sustainable**, **and competitive future**, aligning with broader EU agendas like the **European Green Deal** and **Digital Single Market**.

Document 4 is an article published in the journal Computers and Education Open (March 2024). It proposes a comprehensive framework for fostering Al literacy and competency in K-12 education. In the study we find definitions of AI literacy (understanding AI's workings and societal impact) and AI competency (applying knowledge ethically and confidently). The two main goals of this paper are to define AI literacy and competency for a nontechnical audience, i.e., K-12 education, and suggest a more comprehensive framework for Al education. The study used a co-design approach to propose the framework with the participants, 30 teacher participants involved in this study, split evenly between 15 Hong Kong middle schools. The framework emphasizes five pillars: technology, impact, ethics, collaboration, and self-reflection, advocating for hands-on, student-centered learning. Targeting educators, policymakers, and students, it addresses challenges like teacher training gaps, algorithmic bias, and equity in access. The authors recommend integrating generative AI tools (e.g., ChatGPT) with critical thinking exercises, while calling for future research on prompt engineering, data literacy, and ethical frameworks. The document underscores the need for inclusive, ethically grounded AI education to prepare learners for an AI-driven future.

Table 3 summarises the type of document, the sources and the targets included.

	Document 1	Document 2	Document 3	Document 4
Type of document (Framework, Policy,	Other: results of	Framework	Policy Guideline	Academic
Guideline,)	a focus group		with a strategic	Research Article
	analysis		framework	proposing a
				conceptual
				framwork.
Date of publication	2024	2019 with	2020	2024
		ongoing updates		
Responsible Institution(s)	World Bank	Organisation for	European	The Chinese
		Economic Co-	Commission:	University of
		operation and	Directorate-	Hong Kong
		Development	General for	(CUHK), with
		(OECD).	Education,	contributions
		Directorate for	Youth, Sport and	from Qatar
		Education and	Culture (DG	University,
		Skills (lead	EAC), in	University of
		department).	collaboration	Tsukuba, and
			with DG	University of
			CONNECT for	Eastern Finland.
			digital aspects	
Responsible Persons/Authors (Position	Cobo, C., Senior	Andreas	European	Thomas K.F.
and Role)	Education	Schleicher,	Commission, led	Chiu, Zubair
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	Eucation	2030 Working	Culture,	academic
	Specialist.	Group.	Education, and	researchers.
		-	Youth	
Stakeholders who play a role in the	Higher	Governments,	Governments,	Educators,
frameworks/policies	Education	Educators,	Educational	Policymakers,
	Institutions,	Students,	Institutions,	Researchers,
	Governments,	Academics and	Teachers and	Tech Developers,
	International	Social Partners	Trainers,	Students,
	Organisations,	such as NGOS,	Students and	Parents and
	Private Sector	edtech firms and	Learners, Private	communities
		employers	Secioty Ell	
			Bodies	
Target group(s)	Higher	Education	Students	K-12 students
	Education	systems, schools.	Educators.	focussed on ages
	students.	students.	Policymakers.	11-14, teachers.
	faculty, officials.	researchers.	Industry.	teacher
			,.	educators and
				Curriculum
				designers

Table 3 – Summary features of the four documents under analysis.

4.2 Findings

4.2.1 Key Concepts used in the documents to define AI literacy – for students and for teachers

The documents collectively define **AI literacy** as a blend of technical understanding, ethical awareness, and practical application, tailored to both students and educators. Below are the core concepts, first those common to all documents, followed by unique additions from specific frameworks. Common concepts found across all four documents are the following.

1. Foundational Knowledge of AI

- Understanding basic AI concepts (e.g., algorithms, machine learning, datadriven systems).
- Recognizing AI applications in daily life (e.g., recommendation systems, chatbots).

2. Critical Engagement with AI

- Evaluating AI outputs for accuracy, bias, and reliability (e.g., detecting misinformation or algorithmic discrimination).
- Balancing Al use with independent thinking to avoid over-reliance.

3. Ethical and Responsible Use

- Addressing biases (e.g., gender, racial) in AI systems.
- Prioritizing transparency, accountability, and privacy (e.g., GDPR compliance, data security).

4. Practical Application

- Using AI tools effectively (e.g., prompt engineering for generative AI, coding with AI assistants).
- Integrating AI into learning or teaching (e.g., adaptive platforms, automated feedback).

5. Societal and Global Impacts

- Analyzing Al's role in employment, equity, and sustainability.
- Distinguishing between Al's opportunities (e.g., personalized learning) and risks (e.g., job displacement).

Besides, each document includes unique concepts that are described as follows. The **OECD Learning Compass 2030** emphasizes **student agency**—empowering learners to harness AI purposefully—and introduces the **Anticipation-Action-Reflection Cycle**, a framework for iterative learning amid AI advancements, while urging teachers to master **pedagogical strategies** for human-AI collaboration. The **EU Digital Education** Action Plan stands out for its policy-driven rigor, advocating interdisciplinary AI fluency (e.g., ethics in humanities, algorithms in STEM), institutional safeguards against surveillance AI, and inclusive design principles to ensure accessibility for marginalized learners. The World Bank's "100 Student Voices" report highlights cultural and labormarket realities, stressing AI's role in preparing students for emerging careers (e.g., prompt engineering) and amplifying grassroots perspectives—such as advocating for localized AI tools in multilingual or low-resource settings. Finally, Chiu et al.'s framework (2024) introduces meta-cognitive dimensions, like self-reflection and lifelong learning, alongside collaborative AI use (e.g., treating AI as a co-creator), while calling for teacher training through community-industry partnerships. Together, these unique additions reveal how AI literacy adapts to contexts: the OECD's future-ready competencies, the EU's regulatory and equity focus, the World Bank's pragmatic emphasis on student voices and employability, and Chiu et al.'s holistic blend of technical, ethical, and reflective practice.

For students, AI literacy focuses on understanding core concepts (e.g., algorithms, data privacy), critically evaluating AI outputs, and using tools ethically and creatively (e.g., prompt engineering, detecting bias). For teachers, it extends to pedagogical integration—designing AI-enhanced lessons, assessing tools for bias, and guiding ethical discussions—while also requiring professional adaptability to stay updated on AI trends. Students learn to engage with AI as responsible users, while teachers must scaffold that learning, model best practices, and navigate policy challenges (e.g., plagiarism, equity). Both groups need ethical awareness, but teachers bear the added responsibility of fostering AI literacy systemically.

4.2.2 Key AI competences (for students and for teachers)

Regarding competences, all four documents point out that both students and teachers require foundational AI understanding, including how algorithms and machine learning work. Critical thinking skills are essential to evaluate AI outputs for accuracy and bias. Ethical awareness is crucial, covering privacy, transparency, and responsible use. Practical application skills, such as interacting with AI tools and adapting to new technologies, are emphasized. Additionally, understanding AI's societal impacts - both opportunities and risks - forms a core competence.

Regarding **student specific** competences, they need technical skills like basic coding and prompt engineering to effectively use AI tools. They must develop discernment to balance AI assistance with independent thinking, particularly in academic work. Creative application of AI for problem-solving and projects is highlighted, along with awareness of career implications in an AI-driven workforce. As for **teachers**, they require advanced pedagogical skills to integrate AI into curricula across subjects. They must be able to critically assess and select appropriate AI tools while addressing potential biases. Professional competencies include staying current with AI developments and leading discussions on ethical dilemmas. Teachers also need skills to design assessments that account for AI use and to mentor students in responsible AI practices.

The OECD emphasizes fostering student agency in AI use. The EU framework stresses policy awareness and inclusive design for diverse learners. The World Bank report highlights

cultural relevance and local adaptation of AI tools. Chiu's model adds reflective practice for continuous learning and human-AI collaboration skills.

Both, students and teachers, must balance technical proficiency with human-centric values, though teachers bear additional responsibility for systemic implementation and creating ethical learning environments. The competences evolve from basic understanding for students to multifaceted integration skills for educators.

4.2.3 Challenges of AI use for teaching and learning addressed in the document

Challenges appearing in all documents point to ethical concerns, including data privacy, algorithmic bias, and accountability for AI-generated errors. There are pedagogical risks, such as over-reliance on AI diminishing critical thinking and human interaction. Equity gaps persist, with disparities in access to technology and digital literacy creating uneven learning opportunities. Additionally, rapid AI advancements outpace institutional readiness, leaving educators and students struggling to keep up.

More specifically, students face threats to academic integrity through AI-assisted plagiarism, while also grappling with the cognitive impact of AI dependency on problemsolving skills. Many lack guidance to discern quality AI outputs from misinformation or biased content. In developing contexts, basic infrastructure limitations (e.g., unreliable internet) compound these issues. On the educators' side reports mention inadequate training to effectively implement AI tools or address their ethical dilemmas, and the increase of workload pressures as they balance AI integration with traditional teaching demands. Resistance to change among faculty and rigid curricula further slow adoption are also difficulties that may be faced. The OECD notes particular difficulty in preserving mentorship roles amid automation.

Institutional challenges are also pinned in the texts. The EU highlights policy fragmentation across regions, while the World Bank emphasizes cultural mismatches with globally designed AI tools. Higher education institutions (per the World Bank report) face acute tension in preparing students for AI-disrupted job markets. Chiu et al. identify assessment redesign as a key hurdle, as traditional methods fail to capture AI-augmented learning.

All documents warn of a growing divide between tech-enabled and traditional classrooms, urging immediate action on teacher support, ethical guidelines, and equitable access to harness AI's potential responsibly.

4.2.4 Recommendations for using AI in the context of teaching and learning

All frameworks emphasize developing clear ethical guidelines for AI use, prioritizing transparency, fairness and accountability. They advocate for comprehensive teacher training programs to build AI literacy and pedagogical integration skills. Student-centered approaches are universally recommended, focusing on developing critical thinking alongside technical AI skills. The documents stress the need for equitable access to AI tools and infrastructure to prevent digital divides. Human oversight is positioned as essential, with AI augmenting rather than replacing educator roles.

For learners, the reports suggest structured AI literacy curricula covering technical fundamentals, ethical use, and societal impacts. They recommend project-based learning

with AI tools to develop practical competencies while maintaining academic integrity. The OECD specifically highlights fostering student agency in AI-augmented learning processes.

Educators should receive ongoing professional development on evaluating and implementing AI tools. The EU framework emphasizes creating educator communities for sharing best practices. The World Bank report suggests involving teachers in AI tool development to ensure classroom relevance. Chiu's model adds the importance of reflective practice for continuous improvement.

The EU strongly advocates for national AI education strategies and quality standards for edtech tools. The World Bank highlights the need for localized solutions in developing contexts. All documents recommend establishing cross-sector partnerships between educators, policymakers and tech developers. The OECD suggests implementing monitoring frameworks to assess AI's educational impact over time.

Short-term goals would include teacher training initiatives and pilot programs, while longterm strategies focus on curriculum redesign and systemic policy changes. A balanced approach is urged - leveraging AI's efficiency benefits while preserving essential human elements of education. The recommendations collectively aim to create ethical, equitable and effective AI integration across educational contexts

4.2.5 Examples of the use of AI in teaching and learning

Examples provided in the documents are very generic and in no case they

The **OECD Learning Compass 2030** does not specifically provide any examples of use of AI in teaching and learning.

The **EU Digital Education Action Plan** mentions *SELFIE for Teachers:* An AI selfassessment tool helps educators evaluate digital/AI readiness and the use of *Assistive Technologies* such as AI-powered speech-to-text or translation tools support inclusive learning.

The students interviewed in the **World Bank's "100 Student Voices"** mention the following applications :

- *Research Assistance:* Use ChatGPT to simplify complex articles or debug code.
- *Creative Projects:* Create design video game assets with generative AI tools like Midjourney.
- *Early Warning Systems:* Deploy AI to predict student dropout risks.

In **Chiu et al. (2024) Framework** again, no direct examples are mentioned although although some examples might be inferred.

By distillating some of the inputs one might of course think of the typical examples regarding:

• Generative AI: ChatGPT for drafting/writing exercises.

- Coding Assistants: GitHub Copilot for programming education.
- Ethical Simulations: Role-playing AI dilemmas (e.g., self-driving car ethics)

The approaches of the documents are probably too generic to mention concrete examples of use.

4.2.6 Values, ethical principles, and security framework

The documents present a unified vision for AI in education grounded in human-centric values and ethical responsibility. At their core is the principle that AI should enhance rather than replace human educators, preserving the irreplaceable role of teacher mentorship and student critical thinking. Across all frameworks, fairness emerges as a non-negotiable requirement, with calls for rigorous bias audits of AI systems and inclusive design to serve diverse learners. Transparency is equally paramount, particularly for AI-driven decisions that affect student outcomes, with strong emphasis on explainable algorithms and GDPR-compliant data practices.

Security considerations form a critical pillar of this ethical framework. The documents advocate for robust institutional policies, including AI review boards to evaluate tools against established ethical standards. Technical safeguards like data anonymization and encryption are highlighted as essential, alongside explicit prohibitions against intrusive surveillance technologies. The EU framework goes further by integrating environmental sustainability into its security paradigm, addressing the ecological impact of AI systems.

What distinguishes these guidelines is their contextual adaptation. While the OECD embeds AI ethics within broader competencies like responsibility-taking, the EU anchors its approach in legal frameworks like the AI Act. The World Bank brings crucial perspective from developing economies, emphasizing cultural sovereignty and locally relevant AI solutions. Chiu's model introduces an important metacognitive dimension, encouraging continuous self-reflection about one's AI use.

Together, these principles create a comprehensive ethical ecosystem for educational AI one that balances innovation with accountability, global standards with local needs, and technological capability with human wisdom. The consistent message is clear: AI's role in education must be carefully scaffolded with values-driven guardrails to ensure it truly serves learners and society.

4.2.7 Future trends in AI and education

All four documents mainly are proposing frameworks and define how AI in education should be. From this point of view, all they provide are what the future trends of AI in education should be.

In any case, the documents collectively forecast an education landscape increasingly shaped by AI, and where **AI literacy as a core competency**, with curricula evolving to teach not just technical skills but also ethical reasoning and critical evaluation of AI outputs. Micro-credentials and lifelong learning pathways will proliferate as institutions respond to AI's disruption of job markets, emphasizing skills like prompt engineering and

Al-augmented problem-solving. Teacher should both be able to keep up with the technology and acquire the skills to both teach it and use it to prepare materials.

Ethical and regulatory frameworks will mature, with the EU leading in policy development around algorithmic transparency and data sovereignty. Developing nations, per the World Bank, will focus on **localized AI solutions** that address infrastructure gaps and cultural relevance.

Ultimately, these trends point to a **hybrid future** where AI enhances human potential without replacing the relational essence of education, provided institutions prioritize ethical integration and systemic adaptability.

4.3 Discussion

The policies in the Spanish and Catalan framework that have been reviewed demonstrate a coherent and multi-level effort to incorporate AI into education, from national to institutional levels. However, implementation gaps, unequal access, and ongoing ethical debates remain significant. URL's proactive strategy offers a promising model that combines innovation with a strong ethical foundation.

As for the general documents, two are generic guidelines for the future education (OECD and EU) in which AI is mixed with the rest of digital competencies. From our point of view, they do not get to grasp the full potential of AI in education or its transformative power. They were both designed and issued before the Generative AI universalisation. The world bank document is interesting because it portrays actual considerations, worries and uses of higher education students in countries that seem out of the northern hemisphere AI shockwave. Finally, Chiu et al. is the only document facing the problem straight.

In any case, from the information that can be extracted from the documents, it may be inferred that AI literacy transcends technical skills, encompassing **critical thinking, ethics, and adaptability** for students, while teachers require **pedagogical strategies, policy awareness, and continuous upskilling**. Common themes stress **human oversight** and **equity**, while unique additions reflect contextual priorities—such as the EU's policy focus or the World Bank's emphasis on student voices in Global South contexts. Together, these frameworks advocate for a **balanced, human-centric approach** to AI in education.

Regarding the definitions of AI literacy and competences, probably the most interesting discussion is found in **Chiu et al.** (2024) since they navigate through several definitions and they end up co-designing a framework, that, although aiming at the K-12, can be extended to higher education, especially for non-AI-technical profiles. It is worth quoting the used definitions:

"Al literacy is defined as "an individual's ability to clearly explain how Al technologies work and impact society, as well as to use them in an ethical and responsible manner and to effectively communicate and collaborate with them in any setting. It focuses on knowing (i.e. knowledge and skills)." "AI competency is defined as "an individual's confidence and ability to clearly explain how AI technologies work and impact society, as well as to use them in an ethical and responsible manner and to effectively communicate and collaborate with them in any setting. They should have the confidence and ability to self-reflect on their AI understanding for further learning. It focuses on how well individuals use AI in beneficial ways."

The 5 key components that are extracted to be the foundation of the comprehensive framework (figure 2) are worth being considered in the design of a framework for higher education.



Figure 3: The five key components in the comprehensive framework from **Chiu et al.** (2024)

Those are well in line with the 5 blocks of the key competencies for an AI literacy framework namely, the foundational knowledge of AI, the critical engagement with AI, the ethical and responsible use aspects and its practical application.

The documents provide an analysis of what students should know about AI and how syllabus should be changed, and what skills teachers should have for a proper teaching. It is however forgotten that incorporating AI in organisations should be viewed as a Change Management process. Change management is a systematic process designed to guide individuals, teams, and organizations through transitions from a current state to a desired future state. At its core, it begins with establishing a clear vision and strategy that articulates the purpose of the change and aligns it with broader organizational objectives. For instance, a company adopting remote work might frame its vision around enhancing flexibility and

productivity. This foundational step ensures all stakeholders understand the "why" behind the change, which is critical for fostering buy-in and direction.

Central to successful change management is stakeholder analysis and engagement. Identifying key groups—such as leadership, employees, and customers—and assessing their unique concerns and levels of influence allows for tailored communication and support strategies. Leaders play a pivotal role as visible sponsors of the change, while middle managers act as champions to address team-specific challenges. Research by Kotter (1996) emphasizes that lack of leadership commitment is a primary reason change initiatives fail, underscoring the need for active and consistent advocacy.

Communication is another critical element, requiring a well-structured plan to deliver clear, consistent messages across multiple channels. Whether through town halls, emails, or FAQs, transparency about the change's benefits, timeline, and expectations helps mitigate uncertainty. For example, during a merger, a CEO might use video announcements supplemented by team Q&A sessions to reinforce trust and clarity. Equally important is addressing resistance, which often stems from fear of job loss, increased workload, or distrust. Involving skeptics early in the process and highlighting quick wins can help shift perceptions and build momentum.

Training and support ensure that employees have the skills and resources needed to adapt. This might include workshops for new software or mentorship programs to ease transitions. A phased implementation approach, such as piloting changes with a small group before organization-wide rollout, allows for adjustments based on early feedback. Monitoring progress through KPIs (e.g., adoption rates or employee sentiment surveys) and maintaining feedback loops enable continuous improvement.

Finally, sustaining change requires reinforcement mechanisms, such as recognizing early adopters and embedding new practices into policies and performance metrics. Postchange evaluation is essential to document lessons learned and measure outcomes against initial goals. According to Prosci (2023), organizations with effective change management are six times more likely to meet objectives, highlighting the importance of this structured approach.

In summary, successful change management balances clear vision, stakeholder engagement, robust communication, and adaptive execution—treating change as a people-centric journey rather than a one-time event.

From the World Bank document, we get reminded of the importance of having a global view on the impact of AI in higher education and make sure to bridge the technology access gaps.

Finally, one can wonder if we may speak of a future of AI in education while we are still building a possible present.

5. Conclusions and recommendations

Conclusions

The integration of Artificial Intelligence (AI) in education is no longer a distant prospect but a present and expanding reality. The reviewed documents —including institutional strategies (e.g., *Catalonia.AI, ENIA*), academic reports (e.g., *CRUE 2024, Fundació Bofill*), and international frameworks (e.g., *DigComp, World Economic Forum 2025*)— converge on a shared understanding: AI has significant potential to transform educational experiences, but its impact depends on how it is implemented. Key takeaways include:

- Al is reshaping education through personalized learning, generative tools, and datainformed decision-making.
- Al literacy is essential for both students and teachers, requiring a combination of technical, ethical, and critical thinking skills.
- Ethical and governance frameworks are vital to ensure responsible, inclusive, and transparent use of AI technologies.
- Challenges such as misinformation, algorithmic bias, data privacy, and teacher preparedness must be proactively addressed.
- There is a pressing need for institutional policies, teacher training, and curriculum integration to prepare the educational community for AI adoption.

Recommendations

Based on these findings, we propose the following recommendations for policymakers, educational institutions, and educators:

1. **Embed AI Literacy in Curricula**. Introduce AI-related content across all education levels, focusing not only on technical skills but also on ethical reflection, critical use, and social implications. Promote interdisciplinary approaches that combine computer science, humanities, and social sciences.

2. **Invest in Professional Development for Educators**. Provide continuous training in AI tools, pedagogical strategies, and digital ethics. Support educators in becoming confident users and co-creators of AI-based learning environments.

3. **Establish Clear Institutional AI Policies**. Develop usage guidelines for AI in teaching and learning, ensuring transparency, academic integrity, and data protection. Encourage participatory governance involving teachers, students, and families in the decision-making process.

4. **Foster Ethical and Inclusive AI Practices**. Ensure AI systems used in education are aligned with core values such as fairness, accountability, inclusiveness, and human dignity. Adopt frameworks like the UNESCO Beijing Declaration and EU AI Act as references for ethical implementation.

5. **Encourage Innovation and Experimentation**. Support pilot projects and research initiatives that explore the educational applications of AI, particularly in underserved and diverse contexts. Promote collaboration between schools, universities, public administration, and the private sector.

6. **Monitor and Evaluate AI Impact in Education**. Create mechanisms to assess the effectiveness, risks, and unintended consequences of AI integration. Use both qualitative and quantitative metrics to ensure that AI supports learning outcomes and reduces inequality.

7. **Change Management**. Implementing AI use in higher education might benefit from the change management strategies studied for organisations and well established in the management literature.

Final Reflection

Al in education is not just a technological issue —it is a cultural and ethical one. The future of learning will be shaped by how we balance innovation with responsibility, efficiency with empathy, and automation with human agency. With thoughtful design, inclusive policy, and pedagogical vision, Al can become a powerful tool for educational transformation —but only if we place people, not machines, at the centre.

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