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KEY ACTION

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ACTION TYPE

Cooperation partnerships in higher education

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Work Package 2

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

National Report by Yeditepe University

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Executive Summary

This report provides a comprehensive analysis of Türkiye's national and institutional approaches to artificial intelligence (AI) in education, with a particular focus on higher education and the evolving landscape of AI competence frameworks. The study is structured in four main parts: a synthesis of Türkiye's AI policies and guidelines, a case study of Yeditepe University's (YU) AI-related practices, a comparative review of international AI competence frameworks, and a discussion of key findings and recommendations.

Türkiye's National Artificial Intelligence Strategy (2021–2025) sets out an ambitious vision to position the country as a regional leader in AI, emphasising research and development, workforce training, ethical AI adoption, and international collaboration. The strategy is supported by sector-specific guidelines, such as the Council of Higher Education's (CoHE) [YÖK] ethical guidance for generative AI in academia, the Ministry of National Education's AI handbook for K-12 teachers, and TÜBİTAK's (Türkiye Bilimsel ve Teknolojik Araştırma Kurumu) [The Scientific and Technological Institution of Turkey] AI literacy initiatives for middle schools. These documents collectively stress the importance of ethical principles, transparency, data privacy, and the responsible integration of AI into educational and research activities. However, challenges remain in areas such as critical thinking, quality assurance, financial incentives, and detailed implementation plans.

Yeditepe University has demonstrated a proactive approach to AI through the establishment of interdisciplinary working groups, dedicated research centres, and the integration of AI modules into its curriculum. The university has addressed issues such as AI and discrimination, academic integrity, and the ethical use of AI in both teaching and research. While YU has not yet published a comprehensive institutional AI policy, ongoing efforts are underway to develop university-wide guidelines, supported by workshops, seminars, and the activities of the Learning and Teaching Implementation and Research centre YU-LEARNT. In addition to campus initiatives, a MOOCs platform offered various courses on AI for faculty, students, administrative staff, and alumni, with access provided at no additional cost as a benefit arranged by the university.
The report reviews six influential international documents to provide a global perspective and inform the development of a competency framework. The frameworks analysed are:

1. AIComp: Future skills for a living and working world shaped by AI (2024)
2. Building Artificial Intelligence for Education (2024)
3. Educational Transformation in the Age of AI: A Framework and Implementation Path for AI Competency for University Instructors (2024)
4. A Review of AI Teaching and Learning from 2000 to 2020 (2023)
5. A Framework for the Learning and Teaching of Critical AI Literacy Skills (2025)
6. Artificial Intelligence and the Future of Teaching and Learning (2023)

These frameworks converge on the view that AI literacy is a multifaceted competence, encompassing not only technical knowledge and skills but also critical thinking, ethical awareness, and the ability to engage responsibly with AI systems. Key competencies identified include digital and data literacy, computational and algorithmic thinking, ethical AI awareness,

and human-AI collaboration skills. The frameworks emphasise the need for lifelong learning, interdisciplinary collaboration, and the integration of ethical and social considerations into AI education.

1. Introduction

The first part of this report provides an in-depth synthesis of Türkiye's policies, frameworks, and guidelines on artificial intelligence (AI). It analyses the objectives, methodologies, and implications of these documents, with a particular focus on their relevance to education, research, and public administration. The report is structured around guiding questions to ensure a detailed and comprehensive understanding of the subject matter. At the end of this section, examples of AI policies and guidelines from public and foundation universities across Türkiye have been compiled.

The second part provides a brief overview of the policies and practices at Yeditepe University regarding AI in learning and teaching, research, and other activities.

The third part examines six documents in total: two scholarly articles and four frameworks, policies, guidelines, and recommendations from around the world. This analysis aims to provide a better understanding of the global landscape and lay the foundation for the competency framework that will be developed as part of the project.

This analysis is followed by a brief discussion, concluding with recommendations.

2. National policy and practice regarding AI in HE in Türkiye

National Artificial Intelligence Strategy 2021–2025

Overview and Objectives

The "Türkiye Ulusal Yapay Zeka Stratejisi 2021–2025," published in 2021, serves as Türkiye's national roadmap for advancing AI technologies. Covering the period from 2021 to 2025, the strategy outlines a vision to position Türkiye as a regional leader in AI. It aligns with the “Digital Türkiye” vision and the “National Technology Initiative,” reflecting the country’s broader goals for digital transformation and technological innovation.

The primary objectives of the strategy include:

- Enhancing AI research and development (R&D).
- Training skilled professionals in AI-related fields.
- Increasing AI adoption across industries.
- Promoting ethical AI practices to ensure responsible usage.

The strategy identifies 24 objectives and 119 measures under six strategic priorities, which are designed to foster a sustainable AI ecosystem.

Strategic Priorities

1. **Training AI Experts and Increasing Employment:**
    - Developing academic and technical capacities in universities.
    - Creating new programmes to train AI specialists.
    - Increasing employment opportunities in AI-related fields.
2. **Supporting Research, Entrepreneurship, and Innovation**:
    - Encouraging startups and fostering public-private partnerships.
    - Providing incentives for AI research and innovation.
    - Promoting entrepreneurship in AI-related industries.
3. **Expanding Access to Quality Data and Technical Infrastructure**:
    - Building robust data ecosystems to support AI development.
    - Enhancing technical infrastructure for AI research and applications.
4. **Implementing Regulations to Accelerate Socioeconomic Adaptation**:
    - Establishing regulatory frameworks to ensure responsible AI integration.
    - Addressing societal challenges posed by AI technologies.
5. **Strengthening International Collaborations and Partnerships**:
    - Aligning national efforts with international standards.
    - Fostering global partnerships to share knowledge and resources.
6. **Accelerating Structural and Workforce Transformation**:
    - Preparing the workforce for AI-driven changes.
    - Ensuring structural readiness for AI adoption across sectors.

Development Process

The strategy was developed through a collaborative and consultative process involving multiple stakeholders. These included public institutions, universities, private sector representatives, NGOs, and international organisations. The development process incorporated:

- Workshops and interviews with experts from various disciplines.
- Benchmarking against international AI strategies, such as the OECD AI Principles, European Union strategies, and reports from the World Economic Forum.
- Stakeholder consultations to gather diverse perspectives and insights.

Ethical and Security Framework

The strategy places significant emphasis on ethical principles to guide AI development and deployment. Key principles include:

- **Human-Centric Approach**: Ensuring AI technologies enhance human well-being and societal welfare.
- **Transparency and Accountability**: Establishing mechanisms to explain AI decisions and processes.
- **Fairness and Non-Discrimination**: Preventing biases and ensuring equitable treatment for all individuals.
- **Privacy and Data Protection**: Safeguarding personal data and complying with data protection regulations.
- **Safety and Security**: Protecting AI systems from misuse and vulnerabilities.

Educational Implications

The strategy highlights the importance of integrating AI into education to build a skilled workforce. Specific measures include:

- Enhancing the academic and technical capacities of universities in AI.
- Providing pre-university students with algorithmic thinking, coding, and AI-focused education tailored to their developmental levels.
- Expanding curricula across disciplines to include AI-related topics, such as data science and machine learning.

Incentives

The strategy mentions general investments in AI-supported studies but does not provide specific details on financial incentives or funding mechanisms.

Council of Higher Education (CoHE [YÖK]) – Ethical Guidance for Universities

Purpose and Scope

The Council of Higher Education (YÖK) published its "Ethical Guidance for the Use of Generative Artificial Intelligence (GAI)" in 2023. This document addresses the ethical challenges posed by GAI technologies in academic research and publications. It aims to maximise the benefits of GAI while mitigating risks such as plagiarism, data privacy violations, and algorithmic bias.

Key Ethical Principles

The guideline outlines several ethical principles to ensure responsible AI use:

- **Transparency**: Researchers must disclose the extent and manner of GAI usage in their work.
- **Accountability**: Human oversight is essential to maintain responsibility for AI-assisted processes.
- **Academic Integrity**: Preventing plagiarism and ensuring proper attribution of AI-generated content.
- **Data Privacy**: Compliance with personal data protection laws and safeguarding sensitive information.
- **Avoiding Algorithmic Bias**: Using diverse datasets to minimise discrimination and bias in research outcomes.

Risks and Challenges

The guideline identifies several risks associated with GAI, including:

- Plagiarism and misuse of AI-generated content.
- Data privacy violations and unauthorised use of personal data.
- Algorithmic bias leading to discrimination.
- Ethical concerns related to the over-reliance on AI in research.

Quality Assurance

To maintain high standards in academic research, the guideline recommends:

- Implementing peer review processes.
- Using plagiarism detection tools.
- Establishing clear policies for GAI usage in research and publications.

The document highlights the potential of GAI to assist in technical processes such as data analysis, grammar checking, and translation. However, it cautions against using AI for high-level cognitive tasks, such as hypothesis development and interpretation.

K-12 Education: AI Tools and Policies

Handbook for Teachers

The Ministry of National Education (MEB) published the "Artificial Intelligence Tools – Handbook for Teachers" in May 2024. This document provides practical guidance for K-12 teachers on integrating AI tools into their teaching practices. It includes examples of AI applications for various subjects, such as:

- **Turkish Language Education**: AI tools to improve language skills.
- **Mathematics**: AI-based tools for problem-solving and analysis.
- **Science**: Applications to enhance understanding of scientific concepts.
- **Foreign Languages**: AI tools for language learning and pronunciation assistance.
- **Special Education**: AI-supported solutions for students with disabilities.

The handbook also addresses the use of AI in pre-school education and information technologies, emphasising the importance of accessibility and inclusivity.

International Forum Report

The "Report of the International Forum on Artificial Intelligence Applications in Education," published in 2024, highlights the transformative potential of AI in education. It discusses:

- **AI Policies in Education**: Addressing issues such as equal opportunities, data privacy, and ethical standards.
- **AI Applications**: Exploring adaptive learning systems and AI-supported teacher assistants.
- **Ethical Considerations**: Emphasising transparency, data security, and combating misinformation.

The report underscores the need for regulatory frameworks to ensure the fair and ethical use of AI in education.

The handbook and report explicitly mention the use of AI as a teaching assistant, providing tools for lesson planning, assessment, and personalised learning. Specific examples include AI-powered grading systems and adaptive learning platforms.

TÜBİTAK (The Scientific and Technological Research Institution of Türkiye)– AI Literacy for Middle Schools

Framework and Objectives

TÜBİTAK published its "Artificial Intelligence Technology Workshops for Middle Schools" framework in 2023. This initiative aims to enhance AI literacy among middle school students. The programme focuses on:

- **Hands-On Learning**: Exercises in Python programming and computational thinking.
- **Ethical AI Education**: Teaching students about bias, fairness, and the societal impact of AI.
- **Interactive Activities**: Making AI concepts accessible and engaging for young learners.

Quality Assurance

While the framework aligns with national STEM education objectives, it lacks formal quality assurance mechanisms. However, it promotes practical applications of AI to prepare students for future challenges.

The framework encourages the use of AI tools to support personalised learning and problem-solving activities.

Artificial Intelligence Policies Association Türkiye (AIPA)

Policy Framework

The Artificial Intelligence Policies Association (AIPA) published its "Artificial Intelligence in Education – Policies" document in 2023. This comprehensive framework focuses on integrating AI into education. Key focus areas include:

- **Digital Literacy**: Equipping students and teachers with the skills to use AI tools effectively.
- **Ethical AI Practices**: Promoting responsible and transparent AI usage.
- **Adaptive Learning**: Leveraging AI technologies to personalise education.

Definitions of Competencies

AIPA defines several competencies related to AI, including:

- **Digital Literacy**: Using AI-powered tools effectively.
- **Algorithmic Literacy**: Understanding AI algorithms and their applications.
- **Computational Thinking**: Applying logical reasoning to solve problems.
- **Data Literacy**: Analysing and interpreting AI-generated data.
- **Ethical AI Awareness**: Recognising and addressing AI biases and ethical issues.

Ethical and Security Measures

The policy includes guidelines for data security, fairness, and transparency. It also addresses concerns about algorithmic bias and discrimination, ensuring that AI systems are designed inclusively.

The document highlights the potential of AI to assist in lesson planning, course design, and personalised instruction.

Policy and Guideline Examples from Universities across Türkiye

In Türkiye, the Council of Higher Education (CoHE) serves as the national governing body responsible for the planning, coordination, and supervision of higher education institutions. To provide a comprehensive overview, we have thoroughly examined all universities affiliated with YÖK. Currently, a total of 209 universities in Türkiye are officially registered under the CoHE. Within this scope, a study was conducted to identify documents such as AI-related frameworks, guidelines, and policies prepared by Turkish universities. To achieve this, university names were searched on Google in combination with keywords such as "Artificial Intelligence Policy," "Framework," and "Guideline." As a result, it was found that 12 universities in Türkiye have developed official documents related to AI. Examples of these documents are outlined below.

Boğaziçi University (BU) has developed an *"Academic Integrity and Artificial Intelligence Policy"* through its Writing and Academic Support Centre. The policy states:
"We aim to guide our students in the proper use of AI tools and raise awareness about their ethical dimensions. Our goal is to ensure that students use AI responsibly and in alignment with academic integrity, thus contributing to their success as ethical and competent individuals."
Although this policy is not highly detailed, it provides links to web pages created by the Writing and Academic Support Centre and the School of Foreign Languages, offering basic guidance on the use of AI tools. While the policy does not elaborate on specific AI systems, it references the AI use policies of several international institutions, including Cornell University, Boston University, Ohio State University, the University of Kansas, the University at Buffalo, and the University of Chicago. However, this resource remains at the level of a general website and does not separately address AI usage in teaching, learning, or research domains.

Burdur Mehmet Akif Ersoy University (BMAEU) has developed an *"Ethical Guide for the Use of Generative Artificial Intelligence (GAI),"* targeting academic and administrative staff as well as students. This guide addresses the use of GAI systems in the context of education, scientific research, and publication activities. The report outlines principles aimed at maximizing the benefits and minimizing the potential harms of GAI technologies. These principles are explained under the following core values: inclusiveness, accessibility, stakeholder participation, safety and privacy, transparency and explainability, accountability and auditability, academic integrity, and critical thinking. In addition to these principles, the document includes recommendations such as ensuring data security, maintaining impartiality in decision-making processes, compliance with legal regulations (such as the Personal Data Protection Law), cybersecurity, prevention of resource misuse, promotion of eco-friendly practices, and intellectual property protection. It also references relevant regulations and guidelines, including:

- Law No. 6698 on the Protection of Personal Data
- Law No. 2547 on Higher Education
- Law No. 5846 on Intellectual and Artistic Works
- Regulation on Graduate Education and Examination
- Directive on Scientific Research and Publication Ethics in Higher Education Institutions

- Ethical Guide on the Use of Generative AI in Scientific Research and Publication Activities in Higher Education Institutions

Burdur Teknik University's (BTU) Generative Artificial Intelligence Policy has been prepared by the School of Foreign Languages (SFL) and is a policy that applies exclusively to students. In this comprehensive document, which focuses on English language education, artificial intelligence is defined as *"Artificial intelligence is a machine or a computer system which is able to perform some of the activities our brains can do."* The document centres on the appropriate use of generative AI and outlines the following primary goals:

- To provide students with guidance on the use of GenAI through a clear directive,
- To ensure academic integrity (addressed under the values of honesty, trust, fairness, respect, responsibility, and courage),
- To encourage skills such as critical thinking and creativity,
- To promote ethical use of AI systems, addressing concerns such as plagiarism and cheating, bias and discrimination, and diminished critical thinking abilities.

Additionally, the policy includes measures for exam-based evaluations within the university and details appropriate ways students may use GenAI tools for content verification, idea generation for presentations or discussions, and research. It also provides instructions on how to properly cite sources when using GenAI tools. Furthermore, the document discusses how students can leverage AI technologies to enhance their own learning in areas such as Repetition Activities and Self-Assessment, Speaking Skills, Interaction, Pronunciation, Reading, Writing, Listening, Integrated Language Learning, and General Cultural Development. The protocol was prepared collaboratively by the BTU SFL administration, including the Director, two Vice Directors, student representatives, and a dedicated working group of instructors with expertise in GenAI tools; its updates are managed by this working group in coordination with the administration.

Gazi University's (GU) Ethical Guide on the Use of Generative Artificial Intelligence Tools has been prepared to encourage the informed use of generative AI (GenAI) tools by academic and administrative staff, as well as students, in educational and research activities. Within this context, the guide addresses key principles such as Responsibility, Accountability, Transparency, Academic Integrity, Critical Thinking, Accuracy, and Reliability. It also provides recommendations on conscious use, source verification, use of reliable sources, citation practices, accuracy, and documentation.

Hacettepe University's (HU) Policy on the Use of Generative AI in Educational and Instructional Processes aims to ensure the ethical, legal, and responsible integration of generative AI (GenAI) into all educational and instructional processes, enhancing learning experiences and supporting the development of interdisciplinary and professional competencies. It also aims to establish an inclusive ecosystem that promotes AI literacy for all stakeholders, safeguards academic integrity, and continuously monitors the impact of GenAI to foster sustainable improvement. The document includes specific recommendations for students, instructors, and administrative staff on how to use AI tools. These include cross-checking information, being aware of the limitations of AI tools, using critical thinking skills, and adhering to ethical

standards. Academic sources and national/international policies were used during the preparation of the document.

Istanbul Bilgi University's (IBU) Policy on Artificial Intelligence in Higher Education and Research encompasses all students, academic staff, administrative staff, and stakeholders involved in the use, development, and oversight of AI technologies for educational and research purposes. The policy addresses ethical use of AI tools, privacy and data protection, academic integrity, access and equity, innovation, continuous learning, and adaptability. It emphasises the responsibilities of students, educators, and administrative personnel, while noting that the policy may be updated as needed. However, it does not specify in detail who is responsible for these updates.

The academic integrity and artificial intelligence policy prepared by **Gedik University (GEU)** has short and limited information. This policy, which is less than a page long, addresses that AI applications can only be used in research support and design creation such as Grammar and Style Checks, finding sources within the university, and that the text should be presented as an original work and should not be used in homework and exams.

Kadir Has University (KHU Information Centre Generative Artificial Intelligence Policy broadly addresses ethical principles, responsible practices, transparency, and diversity in the use of generative AI. It also emphasizes the importance of digital literacy, critical thinking, privacy, data protection, intellectual property, and copyright. In this context, the policy states that the university is guided by principles that are ethical, responsible, user-centred, innovative, committed to continuous learning, human-centred, and transparent. The Kadir Has University Information Centre is responsible for preparing and updating this document.

Koç University (KU) implements policies on artificial intelligence that are grounded in the principles of ethics, academic integrity, information security, and data privacy. The university expects its staff and students to ensure that any published or used content is of high quality and factually accurate, and it emphasises that content generated by AI systems must be verified. In this context, Koç University encourages users to engage with AI tools in a conscious, critical, and responsible manner. Given the ever-evolving nature of generative AI technologies, the university regularly updates its institutional policies in line with technological developments. Koç University classifies the use of generative AI based on user roles and develops specific guidelines accordingly. For faculty members, the university expects AI tools to be used in alignment with ethical standards, academic integrity, and information security. It provides guidance on how generative AI can be incorporated into educational and research processes. Faculty are expected to clearly indicate when these tools are used in course materials, inform students about their ethical use, and verify the accuracy of AI-generated content.
For students, Koç University promotes the conscious and ethical use of generative AI tools, noting that such technologies may be used to support learning needs such as transcription or text-to-speech applications. The university emphasizes that students must question the reliability of AI-generated information and assess it critically.
Regarding researchers, Koç University ensures that AI systems are used within ethical, legal, and academic frameworks. Project leaders are responsible for informing their teams about the proper use of AI tools and for verifying the accuracy and credibility of AI-generated outputs.

Furthermore, Koç University has established the Artificial Intelligence Governance Committee with the purpose of developing and implementing AI-related policies and procedures, supporting the Ethics Committee in reviewing the ethical implications of AI projects, and promoting awareness and education on AI-related issues.

MEF University's AI policy references sources including the OECD and the European Union. It adopts the definition of AI systems developed by the Organisation for Economic Co-operation and Development (OECD) and adapted by the European Union (EU). The policy embraces the AI principles set forth by the OECD, G20, EU, and UNESCO, and it also incorporates the risk levels discussed in the EU AI Act. The document aligns with Turkey's National Artificial Intelligence Strategy. The document explains how AI will be integrated into education, research, and administrative processes. In education, faculty members are encouraged to incorporate AI technologies into curricula, assessments, and teaching methodologies, while students are supported in using AI as a learning tool. In research, the policy provides guidance on the utilisation of AI by academics. For administrative processes, AI is planned to enhance efficiency, improve student experiences, and optimize resource management.
A dedicated AI Committee is responsible for the preparation, implementation, and updating of this policy. The committee includes AI researchers, data scientists, data security experts, an ethics board representative, a legal expert, a representative from the School of Foreign Languages, the Director of the Centre for Learning and Teaching, the Director of IT, the Library Director, student representatives, and industry stakeholders.
The policy addresses teaching, learning, research, and administrative processes separately, with individual responsibilities discussed in reference to national and international sources.

Özyeğin University's (ÖzU) AI policy has not been prepared in a highly detailed manner but considers the use of AI in education, research and development, social contribution, and administrative areas within a framework of fundamental principles. It includes topics such as ethics, data protection and privacy, as well as examples of various AI applications.

TED University's ethical and responsible use of generative AI in education policy aims at encouraging academic integrity, critical thinking, and ethical consciousness among students and faculty. The policy sets forth principles for using AI tools such as transparency, accountability, fairness, and inclusivity. The policy encourages the use of AI technologies to support learning and research while making it clear that AI-generated work should not replace original student work or intellectual effort. The university promotes the responsible use by requiring proper citation of AI tools and warning against misuse that could lead to plagiarism or discriminatory outcomes. The policy aims to create an equitable and ethical academic environment during the age of AI.

Conclusion

Türkiye's AI policies and guidelines reflect a comprehensive approach to integrating AI into education, research, and public administration. By prioritising ethical principles, stakeholder collaboration, and continuous improvement, these documents aim to foster a sustainable and inclusive AI ecosystem. However, gaps remain in areas such as quality assurance frameworks, financial incentives, and detailed implementation plans, which require further attention.

3. Policy and practice at Yeditepe University: case study

Yeditepe University has been actively involved in the field of Artificial Intelligence (AI) through various initiatives, research centres, and academic programmes. This section provides a chronological overview of the university's policies and practices related to AI, including the establishment of the AI Working Group, the activities of the YU-LEARNT centre, and other significant contributions.

2018-2019: Establishment of the AI Working Group

In the 2018-2019 academic year, Yeditepe University established an interdisciplinary AI Working Group. This group brought together experts from various fields such as computer engineering, physics, architecture, and literature. The primary aim of this group is to promote scientific studies on AI and organise symposiums, panels, and workshops. Additionally, the university introduced an interdisciplinary AI course open to all undergraduate students, emphasising the importance of equipping students with knowledge about future technologies.

2024: Addressing AI and Discrimination

In December 2024, Yeditepe University highlighted the role of AI in discrimination through a legal and ethical lens. Discussions focused on how AI algorithms could potentially lead to biases based on gender, age, or ethnicity. The university emphasised the need for ethical and fair development of AI systems and called for new legal regulations to address the challenges posed by AI.

2025: Academic Integrity Policy for Social Sciences Institute

In 2025, the Social Sciences Institute at Yeditepe University introduced an Academic Integrity Policy. This policy highlights the ethical considerations in academic and technological advancements, including AI. It highlights the importance of fairness, transparency, and accountability in the development and application of AI technologies. While currently specific to the Social Sciences Institute, the policy is part of a broader effort to establish a university-wide framework for ethical AI practices.

Research Centres and AI Initiatives

Yeditepe University hosts a dedicated Informatics and Artificial Intelligence Application and Research Centre. This centre focuses on both theoretical and applied scientific research in AI, organising seminars, training sessions, and projects to address the needs of various stakeholders.

YU-LEARNT: Learning and Teaching Implementation and Research Centre

YU-LEARNT, Yeditepe University's Learning and Teaching Implementation and Research Centre, has been instrumental in integrating AI into education. The centre has hosted workshops, webinars, and discussions on the impact of AI on learning methodologies. These initiatives aim to enhance the learning experience and prepare students for a technology-driven future.

Workshops, Webinars, and Seminars

The following events were organised by YU-LEARNT in 2024:

- Workshop on 'Artificial Intelligence Integration in Education' (December 19, 2024): This interactive workshop covered topics such as AI tools for personalised learning, automated assessment and feedback, and AI-assisted course development.
- Seminar by Dr Barbara Oakley: Titled 'Enhancing Education: Bridging Neuroscience, Traditional Learning, and Artificial Intelligence,' this seminar explored the connections between AI and neuroscience in education.
- Webinars on AI in education: These sessions focused on the ethical implications of AI, its applications in teaching, and strategies for integrating AI into educational practices.

AI Modules Designed by YU-LEARNT

YU-LEARNT has developed a series of AI modules to support students and academic staff:

- Module 1: Introduction to Artificial Intelligence – A beginner course providing a basic understanding of AI for both students and academics.
- Module 2: AI in Higher Education – Designed for academic staff, this module highlights the usefulness of AI in teaching and research.
- Module 3: AI Tools for Academic Studies – Aimed at students, this module introduces various AI tools that can be used as learning assistants in their academic work.

Yeditepe University has not yet published a comprehensive policy document or guidelines on the use of AI in learning, teaching, and research. However, a working group established by the Rector's Office is currently working on developing these policies and guidelines.

4. Analysis of AI competence frameworks

4.1. YU Methodology and documents included in the analysis

Document Title	**AIComp: Future skills for a living and working world shaped by AI**	**Building Artificial Intelligence for education**	**Educational Transformation in the Age of AI: A Framework and Implementation Path for AI competency for University Instructors.**	**A review of AI teaching and learning from 2000 to 2020. Education and Information Technologies 28 (7), 8445–8501.**	**A framework for the Learning and Teaching of Critical AI Literacy skills**	**Artificial Intelligence and the Future of Teaching and Learning**
Type of document (Framework, Policy, Guideline, ...)	Competence Model & Framework	Competence Framework	Scholarly Work	Scholarly Work	Skills Framework	Insights and Recommendations
Date of publication	2024	2024	2024	2023	2025	2023
Responsible Institution(s)	NextEducation: internationally active research collective at the Baden-Wuerttemberg Cooperative State University (Germany).	Ceibal: Uruguay digital technology centre for education innovation at the service of public education policies	Malaysian Journal of Social Sciences	University of Hong Kong	The Open University	U.S. Department of Education, Office of Educational Technology (OET)
Responsible Persons/ Authors (Position and Role)	Ulf-Daniel Ehlers, Martin Lindner, Emily Rauch	María Eugenia Curi, Víctor Koleszar, Germán Capdehourat, Emiliano Pereiro, Brian Lorenzo, Leandro Folgar	Xue Bai and Rosy Binti Talin	Davy Tsz Kit Ng, Min Lee, Roy Jun Yi Tan, Xiao Hu, J. Stephen Downie, Samuel Kai Wah Chu	Dr Mirjam Hauck (Academic Co-Lead for AI in LT&A) Eleanor Moore (Learning Designer) Carol Wright (L&T Librarian) Editor Nicki Sneath	Miguel A. Cardona, Roberto J. Rodríguez, Kristina Ishmael
Stakeholders who play a role in the frameworks/ policies	AI-Campus: funded by the Federal Ministry of Education and Research (BMBF): www.ai-campus.org	Educators & Teachers (implementing AI education in classrooms)	University instructors, educational policymakers, and AI tool developers		Educators, instructional designers, policymakers, and AI ethics specialists	Government bodies & policymakers,
Target group(s)	Students, teachers business world, civil society	Educators, researchers & developers, students, policymakers & governments, educational institutions &	University instructors, educational policymakers, AI tool developers, educational institutions	Academic researchers	Educators, instructional designers, policymakers, AI ethics specialists Curriculum developers, University ethics and governance committees	Government bodies & policymakers, educators & academic institutions, students & parents, AI & EdTech industry, researchers, advocacy & civil rights groups

4.2 YU Findings

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

AIComp: Future skills for a living and working world shaped by AI: Research report 2 (Empirical construction & description of the competence model AIComp)

The main concepts in the AIComp Future skills for a living and working world shaped by AI (2024) report were developed through a structured, empirical process combining theoretical foundations and data-driven analysis. The researchers began by reviewing existing literature and competence models (e.g., Bloom's taxonomy, DigComp 2.2) to establish a theoretical basis. They defined competences as "dispositions to act" and focused on skills needed for a world increasingly shaped by AI. The report does not explicitly use the term "AI literacy" as a standalone concept but provides a framework for understanding it through the competencies it identifies. AI literacy can be inferred as the combination of knowledge, skills, and attitudes required to:

- Understand AI systems: This includes the ability to critically evaluate the logic, data usage, and societal impact of AI systems (e.g., Critical Digital Competence).
- Use AI effectively: This involves applying AI tools for problem-solving, decision-making, and personal or professional development (e.g., Creative Problem-Solving Competence, Decision-Making Competence).
- Engage ethically with AI: This includes recognizing and addressing ethical issues related to AI, such as bias, privacy, and societal implications (e.g., Ethical Competence).
- Communicate about AI: The ability to discuss AI-related topics with others, including those with differing perspectives, and to collaborate on AI projects (e.g., Communication Competence, Cooperation Competence).

An iterative process followed, involving qualitative methods like semi-structured interviews and group discussions with experts to refine initial competence catalogues. These were then tested through a quantitative survey of 1,644 participants, who assessed 36 competence-related items. Using Principal Component Analysis (PCA), the researchers identified 12 competence fields grouped into three overarching areas: work-related, personal development, and social/organisational competences. This approach ensured the concepts were both theoretically grounded and empirically validated, reflecting real-world needs and future trends.

The model relies on scientific literature and empirical research.

Theoretical Foundations

- Pierre Bourdieu's Theory: The concept of "habitus" and its connection to competence development is discussed (Bourdieu, 1982; Bourdieu & Wacquant, 2013).
- Action Competence Theory: The work of Erpenbeck and Heyse (1999, 2015) is referenced to emphasize self-organized and value-oriented action in complex situations.
- Self-Socialisation Theory: Zinnecker (2000) and related works are cited to explain how individuals actively shape their competence development.
- Bloom's Taxonomy: The revised taxonomy by Anderson and Krathwohl (2001) is used to define competence levels and learning objectives.
- Future Skills Research: Ehlers (2020, 2022) provides the definition of "Future Skills" as competences for dynamic and complex problem-solving.

- Empirical and Methodological References: Principal Component Analysis (PCA). Methodological references include works by Jolliffe (1986), Jackson (1991), and Dunteman (1989) to explain the statistical approach used in the study.
- Competence Models: The report references earlier competence models, such as those by Boyatzis (1982) and Spencer & Spencer (1993), to contextualize the AIComp model.
- Competence Frameworks: DigComp 2.2: The European Digital Competence Framework for Citizens (Vuorikari, Kluzer & Punie, 2022) is referenced, particularly its inclusion of AI-related competences.
- Twenty-First Century Skills: The framework by Binkley et al. (2012) is cited to highlight the triad of knowledge, skills, and attitudes in competence development.

References to Policy Documents

The report also draws on policy documents and initiatives to align the AIComp model with broader educational and societal goals:

- European Union Initiatives: The Bologna Process is mentioned as a driver of competence-based education in Europe, emphasizing the shift from curriculum content to learning outcomes (Vare, 2022).
- The DigComp Framework (Vuorikari, Kluzer & Punie, 2022) is used as a reference for digital and AI competences.
- German National Policies: The report is part of the AI-Campus initiative, funded by the Federal Ministry of Education and Research (BMBF) and the Dieter Schwarz Foundation. This initiative aims to develop a national platform for AI learning content.

White Papers and Reports

- The Whitepaper on AI Competence Development by André and Bauer (2021) is referenced to highlight the importance of AI competences in professional contexts.
- Ethical and societal implications of AI are discussed with references to studies like Laupichler, Aster & Raupach (2023).

Integration of Scientific and Policy References

The report integrates these references to:

- Justify the competence-theoretical basis of the AIComp model.
- Align the model with international frameworks like DigComp and national initiatives like AI-Campus.
- Highlight the interdisciplinary nature of AI competences, drawing on both academic research and policy recommendations.

Building Artificial Intelligence for education

The second document analysed titled **"Building Artificial Intelligence for Education" (BAIFE)** from Ceibal (2024) discusses the integration of AI in education, focusing on how AI can be used in higher education to enhance learning. It emphasizes AI's potential to support computational thinking, ethical challenges, and the development of AI-related competencies. The framework is established to provide educators with guidance on integrating AI and computational thinking into the educational field. It adopts an integrated and interdisciplinary approach to develop AI

literacy and address ethical and social aspects associated with AI use. The terms and concepts used throughout the document can be summarised as the following:

- Computational Thinking: The document emphasises integrating computational thinking into education but does not provide a specific definition.
- Ethical AI Awareness: The document addresses ethical aspects associated with AI use, promoting informed and responsible reflection on its impact.
- Critical AI Literacy: The document aims to develop AI literacy and address ethical and social aspects associated with AI use but does not provide a specific definition for critical AI literacy.
- Responsible AI Competence: The document promotes informed and responsible reflection on AI's impact, aligning with responsible AI competence.

Educational Transformation in the Age of AI: A Framework and Implementation Path for AI competency for University Instructors.

The third documents analysed is Educational Transformation in the Age of AI: A Framework and Implementation Path for AI competency for University Instructors **(ETAAI)** outlines a framework for AI competency among university instructors, focusing on four key dimensions:

- **Knowledge:** Understanding AI fundamentals, including principles, development history, current applications, and future trends.
- **Skills:** Proficiency in utilizing AI tools and technologies effectively in educational settings.
- **Application:** Integrating AI into teaching practices to enhance instructional efficiency and student learning experiences.

Values: Comprehending AI ethics and social responsibilities, ensuring ethical use and addressing societal implications. The authors conducted a systematic literature analysis to identify the necessary competencies for university instructors in the AI era. This approach ensured a comprehensive understanding of AI integration in higher education, encompassing technical, pedagogical, and ethical dimensions.

The paper provides two definition both linked to the ethical and responsible use of AI:

- Ethical AI Awareness: Understanding the ethical implications and societal impact of AI technologies.
- Responsible AI Competence: Comprehending AI ethics and social responsibilities to ensure ethical use of AI technologies.

A review of AI teaching and learning from 2000 to 2020 **(ARAI)** (2023) primarily discusses AI in teaching and learning through a literature review approach. The authors developed the key concepts in this study through a systematic literature review of AI applications in teaching and learning from 2000 to 2020. They analysed trends, methodologies, and challenges by reviewing peer-reviewed journal articles and conference papers on AI in education. It does not explicitly define AI-related competencies such as digital literacy, algorithmic literacy, or AI literacy. Instead, it focuses on AI applications in education rather than competency frameworks.

The document examines AI's role in education through:

- AI for Teaching – Exploring how AI supports teachers in lesson planning, feedback, and instructional strategies.
- AI for Learning – Investigating AI-powered adaptive learning systems, intelligent tutoring, and personalised education.
- AI in Research – Analysing AI's impact on academic research and AI literacy development.

A framework for the Learning and Teaching of Critical AI Literacy skills

A framework for the Learning and Teaching of Critical AI Literacy skills **(AFLTOU)** (2025) prepared by the Open University presents a structured framework for developing and teaching Critical AI Literacy skills, focusing on competencies like critical evaluation of AI technologies and effective communication with AI. It also offers guidelines for educators on implementing AI literacy, including strategies for fostering critical thinking and addressing ethical considerations in AI usage. The framework was developed through a comprehensive analysis of existing digital literacy models, educational policies, and the unique challenges posed by AI technologies. It incorporates insights from UNESCO's competencies and aligns with the Open University's mission and strategic goals to ensure societal impact, equity, diversity, and social sustainability.

Artificial Intelligence and the Future of Teaching and Learning

Artificial Intelligence and the Future of Teaching and Learning **(AIFTL)** prepared by the U.S. Department of Education, Office of Educational Technology (OET) in 2023, which provides insights and recommendations and is structured around key concepts that shape AI's role in education. The key concepts are defined as follows in the document:

- AI in Education – The increasing role of AI in teaching and learning.
- Ethical and Equitable AI Policies – The importance of fairness, transparency, and inclusivity in AI-driven education.
- Learning with AI – The use of AI for personalized, adaptive learning.
- Teaching with AI – How AI can support educators in instruction and assessment.
- Formative Assessment – AI's potential for improving feedback and evaluation methods.
- Research and Development – The need for evidence-based AI implementation in education.

The above concepts were identified through listening sessions with over 700 stakeholders, including educators, researchers, policymakers, and AI experts. The report reflects their collective concerns, highlighting opportunities, risks, and the urgent need for well-defined policies to ensure AI's responsible integration in education.

The document references several scientific and policy documents to support its discussions on AI in education. Some key references include:

Scientific References

- The AI Index 2023 Annual Report (Stanford Institute for Human-Centered AI) – Cited to show the rapid acceleration of AI research and ethics discussions.
- The Ethics of Artificial Intelligence in Education (Holmes & Porayska-Pomsta, 2022) – Addresses ethical concerns related to AI implementation in education.

- Research on Intelligent Tutoring Systems (ITS) – Various studies on AI-driven tutoring and its impact on personalised learning.

Policy References

- Blueprint for an AI Bill of Rights (White House Office of Science and Technology Policy, 2022) – Outlines principles for fair and transparent AI use.
- European Commission's Ethical Guidelines on AI in Education – Provides a framework for responsible AI adoption in teaching and learning.
- Executive Orders on AI and Racial Equity – U.S. government directives focusing on fairness and equity in AI applications.

AIFTL (2023) defines AI as an "umbrella term" and visualises its components through a diagram:

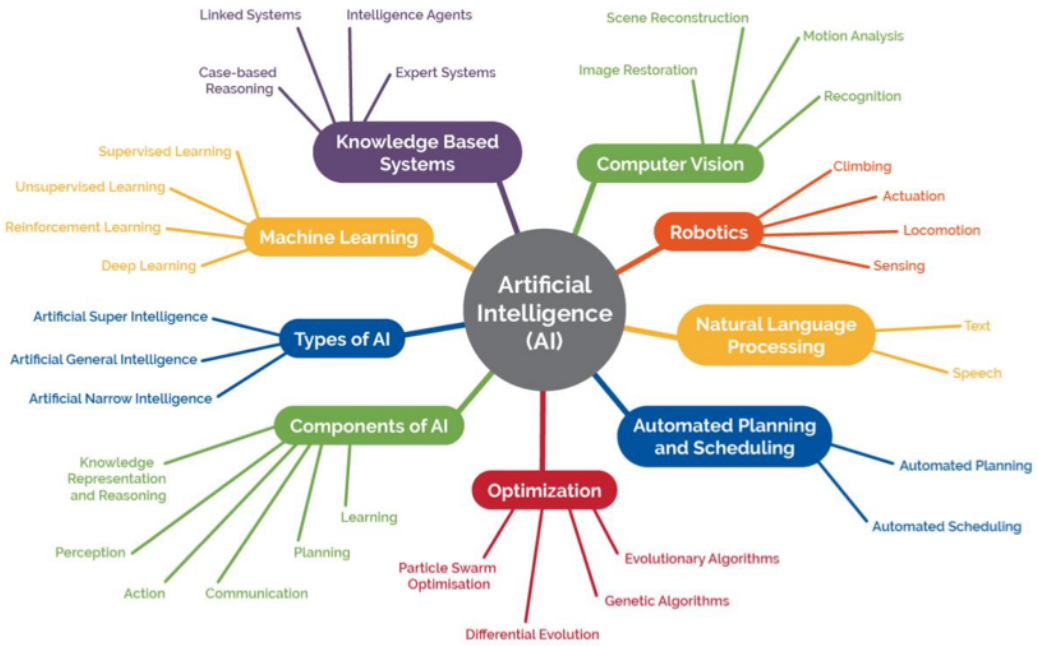

Figure 1: AI as an "umbrella term" by AIFTL

4.2.2 Key AI competences (for students and for teachers)

AIComp (2024) defines competency as a disposition to act that goes beyond the mere accumulation of knowledge or skills. Competency is described as a holistic structure that includes:

- Knowledge: Cognitive understanding of concepts and principles.
- Skills: Practical abilities to apply knowledge in specific contexts.
- Attitudes and Values: The motivation, willingness, and ethical considerations that guide actions.

Competency is framed as the ability to act successfully in complex, dynamic, and context-specific situations. It is not just about what a person knows or can do but also about their

readiness to act in alignment with their values and goals. The report emphasises that competency is demonstrated through performance in real-world actions.

The AIComp model specifically defines competencies as action dispositions that enable individuals to navigate and shape a world increasingly influenced by AI.

These dispositions are categorised into three overarching areas:

- Work-related competencies: Skills for professional tasks and activities.
- Personal development competencies: Skills for self-growth and learning.
- Social environment and organisational competencies: Skills for collaboration and ethical engagement.

Each area comprises several fields of competence defined by thematic action dispositions.

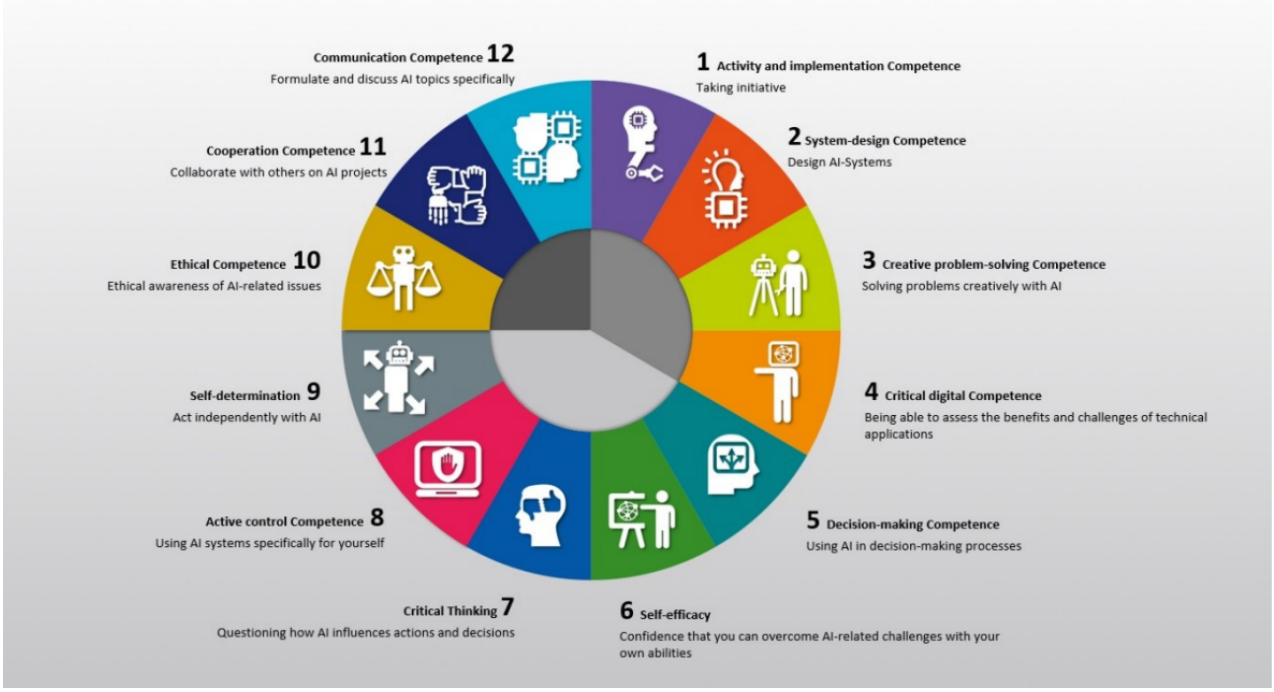

Figure 2: 12 fields of competence from AIComp

BAIFE (2024) framework encourages embedding AI in curricula, addressing the need for both technical and ethical understanding, and fostering critical thinking skills among students to navigate AI's societal impact. The work highlights the importance of AI competency in preparing students for a rapidly evolving technological landscape.

Competencies associated with these 3 central questions, to contemplate education today in the era of digital technologies and AI. What is AI? How does it work? How and why is it used?

Figure 3: Dimensions of the AI reference framework

What is AI?

The specific competencies highlighted within this dimension are:

- Understanding systems that include AI components.
- Identifying the properties that differentiate an AI-based system from a rule-based system.
- Understanding the basic functions of AI. Grasping the basic concepts of how machine learning works.
- Using AI tools. Knowing and being able to use different applications that use AI as an end user, with a particular focus on generative or playful tools.
- Analysing and critically discussing those characteristics that make an entity 'intelligent.'
- Distinguishing between general and narrow artificial intelligence.
- Distinguishing between technological artifacts that use and do not use AI.

Figure 4: What is AI: AI Literacy Competencies

How does it work?

The specific competencies to be promoted within this dimension are:

- Understanding basic concepts about data types.
- Gathering relevant information from a dataset for further processing with AI-based tools.
- Visualising data using AI Algorithms.
- Recognising that different sensors generate different data and identifying sensors in different devices.
- Understanding that computers perceive the world using sensors.
- Identifying different computational representations of knowledge and describing some examples.
- Explaining results, including errors, when analysing responses provided by AI, and challenging them with questions.
- Recognising the key role played by individuals in the computational representation of knowledge in AI-based solutions.

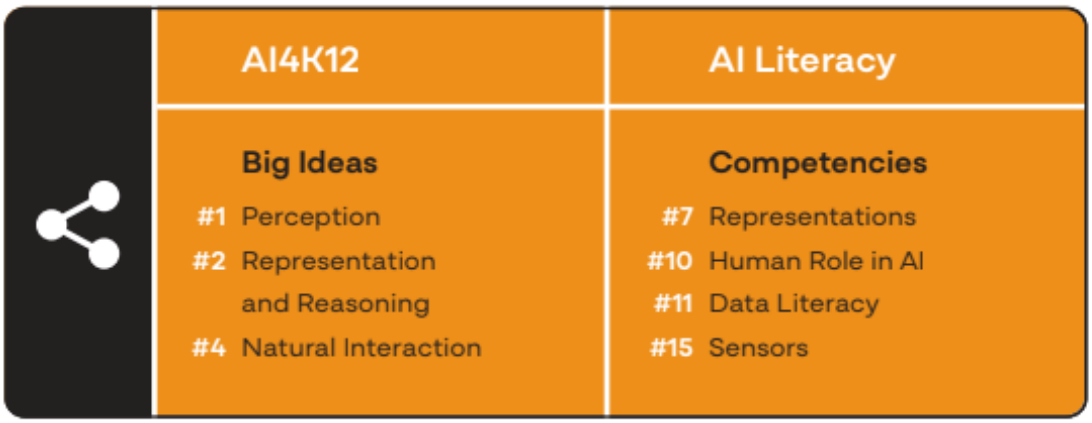

Figure 5: How Does AI Work: AI Literacy Competencies

ETAAI (2024) references UNESCO's AI competency framework for educators and various scholarly articles to support the development of the proposed AI competency framework. It focuses on higher education, specifically addressing university instructors' roles in integrating AI into teaching practices to enhance educational outcomes.

The paper argues that the rapid advancement of artificial intelligence (AI) has transformed the educational landscape, necessitating a redefinition of the competencies required by university instructors. This essay explores the AI competency framework for higher education instructors, its implementation pathways, and the strategies to integrate these competencies effectively.

The AI competency framework is multifaceted, encompassing four key dimensions:

- **Knowledge Dimension**: Instructors must understand the fundamentals of AI, including its principles, history, applications, and future trends. This includes knowledge of machine learning, natural language processing, and their applications in education.
- **Application Dimension**: Instructors should integrate AI tools into teaching practices, such as virtual labs, intelligent teaching platforms, and personalised learning systems, to enhance teaching effectiveness and student engagement.

- **Skills Dimension**: Proficiency in using AI tools, data analysis, and model training is essential. For example, instructors can use data science tools to analyse student performance and provide tailored learning recommendations.
- **Values Dimension**: Instructors must address ethical concerns, such as data privacy and algorithmic bias, while fostering students' awareness of AI ethics and social responsibility. To develop and implement AI competencies, the following pathways are proposed as pathways for HE instructors:

Construction of Interdisciplinary Knowledge Systems

- Integrate resources from disciplines like computer science, pedagogy, and ethics to create comprehensive AI-focused courses.
- Encourage professional development through workshops, seminars, and interdisciplinary research collaborations.
- Address challenges such as disciplinary barriers and resource allocation to foster collaboration and innovation.

Capacity Building and Practical Application

- Provide targeted training to enhance instructors' understanding of AI tools and their applications in teaching.
- Promote interdisciplinary collaboration to design AI-integrated courses and projects.
- Encourage practical experience through participation in AI research and initiatives, enabling instructors to apply AI in real-world educational contexts.

Moral Awakening and Responsibility

- Incorporate ethics education into curricula to raise awareness of AI's societal and ethical implications.
- Emphasise social and environmental responsibility, ensuring that AI technologies are used to promote equity and sustainability in education.

ARAI (2023) provides a framework on how AI has been used in teaching and learning, though it does not establish official policies or strict guidelines:
Framework: The study presents a systematic literature review of AI applications in education, categorising AI-based teaching and learning methodologies.
Guidelines (Implicit): While not an official guideline, it outlines AI's role in adaptive learning, intelligent tutoring, and personalised education, helping educators understand AI's potential.

The competencies referred in line with AI in the paper can be listed as the following:

- Understanding – AI's role in education is explored, emphasizing how students and educators can use it for learning and teaching.
- Analysis – The document discusses AI-driven data analytics and adaptive learning, requiring critical analysis skills.
- Designing – AI's use in intelligent tutoring systems and personalized learning environments suggests the need for instructional AI design skills.
- Ethics – Ethical concerns such as bias, fairness, and responsible AI usage in education are highlighted.
- Plagiarism – AI's role in detecting plagiarism and academic dishonesty is discussed.

- Academic Integrity – The document touches on concerns about AI-generated content and maintaining integrity in AI-assisted learning.

The **AFLTOU** (2025) was developed through a comprehensive analysis of existing digital literacy models, educational policies, and the unique challenges posed by AI technologies. It incorporates insights from UNESCO's competencies and aligns with the Open University's mission and strategic goals to ensure societal impact, equity, diversity, and social sustainability. The competencies are listed and defined as below:

- Digital Literacy: Competence in using digital technologies effectively and ethically.
- Algorithmic Literacy: Understanding how algorithms function and influence decision-making processes.
- Computational Thinking: Approaching problems methodically, enabling solutions executable by computers.
- Data Literacy: Ability to interpret, analyse, and use data critically.
- Ethical AI Awareness: Recognising and addressing moral implications in AI development and usage.
- Machine Learning Literacy: Understanding machine learning concepts and their applications.
- Human-AI Collaboration Skills: Effectively interacting and collaborating with AI systems.
- Critical AI Literacy: Evaluating AI technologies through the lens of equality, diversity, inclusion, and accessibility, focusing on ethical and social implications.
- Responsible AI Competence: Developing and deploying AI responsibly, considering societal impacts.
- Digital Fluency in AI: Proficiency in navigating and utilizing AI-driven digital environments.

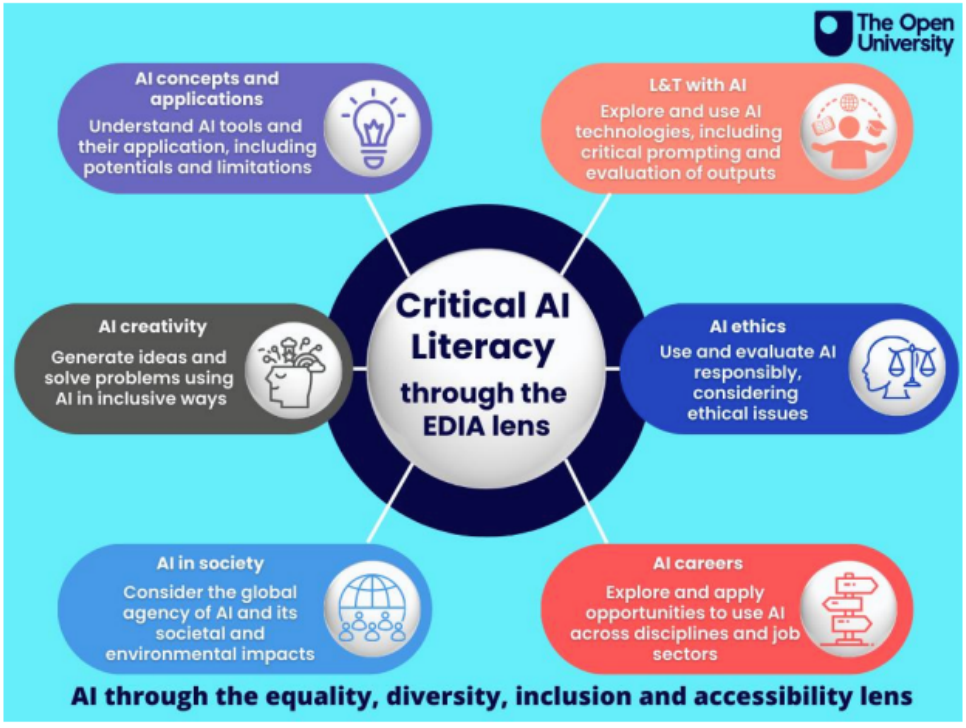

Figure 6: AFLTOU Framework

The competencies suggested by **AIFTL** (2023) can be summarised as below:

- Computational Thinking – The report discusses AI's role in problem-solving and adapting to learners' needs, emphasising structured, logical reasoning in education.
- Data Literacy – The document highlights the importance of understanding data quality, bias, and algorithmic decision-making in AI-driven educational tools.
- Ethical AI Awareness – It explicitly addresses AI ethics, fairness, bias mitigation, and transparency in AI-driven learning environments.
- Human-AI Collaboration Skills – The report emphasises "humans in the loop," ensuring AI supports rather than replaces educators.
- Critical AI Literacy – It discusses the need for students and educators to critically analyse AI-generated content and decisions.

4.2.3 Challenges of AI use for Teaching & Learning addressed in the document

AIComp (2024) discusses the recent developments through how The Bologna Process shifted the focus in education from curriculum content to learning outcomes, emphasising competencies across vocational, higher, and lifelong education, especially in Europe. It claims that this shift is grounded in educational psychology, vocational education, and pedagogy (e.g., Weinert, Winterton, Klieme, Mulder). EU initiatives have played a key role in driving this change, including the development of the DigComp competence framework, which since 2022 (version 2) incorporates 73 AI-related competence items. The report does emphasise the importance of competence-based learning and the alignment of learning objectives with competence levels (based on Bloom's taxonomy). This suggests an implicit need for coherence between broader program goals and specific course-level outcomes. Key points related to learning outcomes can be summarised as:

- **Competence Levels and Learning Objectives:**
  The report provides detailed competence levels for each of the 12 identified competencies, structured according to Bloom's taxonomy (e.g., knowledge, application, evaluation, and creation). These levels are described as examples of learning objectives that learners should achieve, which could be applied at both program and course levels.
- **Holistic Competence Development:**
  The report emphasises that competencies are dispositions to act that integrate knowledge, skills, and attitudes. This holistic approach implies that program-level outcomes should guide the development of course-level outcomes to ensure alignment with the broader goals of competence development.
- **Iterative and Structured Competence Models:**
  The AIComp model is described as a competence structure model, which organises competencies into overarching areas, fields, and specific items. This structured approach could serve as a framework for connecting program-level and course-level outcomes, though the report does not explicitly recommend this.
- **Implicit Recommendation:**
  While the report does not directly address the connection between program-level and course-level learning outcomes, its emphasis on structured competence models and learning objectives suggests that establishing a clear link between them would be beneficial.

ETAAI (2024) highlights that university instructors must adapt to AI-driven changes in education by updating their knowledge, embracing new teaching methods, and addressing ethical and privacy concernsIn the age of AI, the role of university instructors is undergoing significant transformation. With the rapid advancement and widespread use of AI in education, instructors must not only possess traditional teaching skills but also develop AI competencies to meet evolving educational demands. The integration of AI into education presents unique challenges, including the urgent need for knowledge updates. Instructors must continually learn about AI principles, its development history, and future trends to keep pace with technological advancements, which can be demanding in terms of time and energy.

AI is also revolutionising traditional teaching methods through intelligent teaching systems and personalised learning platforms. Instructors must adapt to these new approaches, requiring a shift from long-standing teaching habits and the acquisition of skills to effectively use AI for instructional design and delivery. Additionally, the use of AI in education raises ethical and privacy concerns. Instructors must ensure the protection of students' personal data and educate them on data privacy and cyber ethics.

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

ARAI (2023) provides examples for using AI in learning and teaching as following:

- AI-Assisted Lesson Planning: AI tools help generate lesson plans based on curriculum standards and student needs.
  Example: ChatGPT, IBM Watson Education, and other AI models suggest content ideas, quizzes, and exercises.
- AI-Assisted Course Redesign: AI analyses student performance data to recommend curriculum adjustments. Adaptive learning platforms help educators identify gaps in teaching materials.
- Course Development and Design: AI-driven content recommendation systems help design engaging and structured courses.
  Example: Coursera's AI-powered course recommendation engine suggests personalised pathways for students.
- Assessment and Evaluation: AI provides automated grading for assignments, essays, and multiple-choice questions.
  Example: Turnitin AI, Gradescope, and AI plagiarism detection tools assess student work efficiently.
- Other AI Teaching Assistant Applications: Automated student progress tracking – AI detects struggling students and suggests interventions. AI-generated lecture summaries AI tools like Otter.ai transcribe and summarise class discussions.
- AI-powered classroom engagement tools – Platforms like Socratic AI and Edmodo help track student participation.

AIFTL (2023) highlights the following regarding AI, learning and teaching and research on AI in education:

- AI's Role in Learning – The report discusses how AI can support adaptive learning, personalised instruction, and formative assessment.

- AI's Role in Teaching – It emphasises that AI should assist, not replace, educators, helping with lesson planning, workload reduction, and instructional design.
- Research on AI in Education – The report highlights the importance of AI-driven research and development (R&D) for improving educational outcomes.
- Ethical AI Use in Education – AI in teaching and learning should align with ethical, fair, and transparent practices. The report primarily focuses on K-12 education but also includes discussions relevant to higher education (university level).
- University-level references include AI's impact on research, academic policies, and the preparation of future educators.

4.2.5 Examples of the use of AI in the teaching and learning

AIComp (2024) provides specific use cases and examples related to AI's use in learning and teaching. These examples are used to illustrate how AI can enhance educational processes and support the development of competences.

BAIFE (2024) give examples such as "Smile, you are being trAIned" Activity: A hands-on exercise where students train their own machine learning model using Teachable Machine and "Create your own story" Activity: Students use generative AI tools to enhance storytelling.

ARAI (2023) supports personalised and customised learning through AI-based teaching approaches. The paper highlights several AI-driven methods for customising learning experiences:

- Adaptive Learning Systems: AI adjusts the difficulty of learning materials based on student performance. Intelligent tutoring systems provide real-time feedback and personalised study plans.
- Natural Language Processing (NLP) for Personalised Learning: AI chatbots and virtual assistants help answer student queries and adapt responses based on individual needs.
- Data-Driven Learning Analytics: AI analyses student progress and recommends personalised learning pathways. AI detects struggling learners and suggests targeted interventions.
- Gamification & AI-Based Motivation: AI enhances student engagement by tailoring game-based learning experiences.

AFLTOU (2025) emphasises specific areas for AI's use in learning and teaching.

- AI-assisted lesson planning: Mentioned as a way to help educators organize and structure course content more effectively.
- AI-assisted course redesign: Described in terms of using AI analytics to improve existing course materials based on student performance data.
- Course development and design: AI's role is noted in assisting the creation of new, data-informed educational resources.
- Assessment and evaluation: The document highlights how AI can automate grading, provide real-time feedback, and help measure learning outcomes accurately.
- Curriculum planning: Includes integrating AI insights into curriculum planning and supporting teachers with time-saving automated tools.
- Student progress and success: Using AI to identify at-risk students early and suggest targeted interventions.

- Personalised learning: Using AI as a tool to customise learning paths and provide tailored recommendations to help students achieve better outcomes.

AFLTOU also includes examples such AI-assisted assessments, automated feedback systems, and the integration of ethical AI discussions into course materials.

AIFTL (2023) refers to several uses of AI in learning and teaching and research:

- AI-Enabled Personalised Learning: AI systems can adapt to students' needs, adjusting the difficulty level and pace of instruction.
- Intelligent Tutoring Systems (ITS): AI-powered tutors provide real-time feedback and step-by-step guidance in subjects like math and language learning.
- Speech Recognition for Accessibility: AI supports students with disabilities (e.g., text-to-speech and voice recognition for visually impaired or dyslexic learners).

4.2.6 Values, ethical principles, and security framework

In addition to what is outlined as part of **AIComp (2024)** competency framework the following ethical principles and values are included in the report:

- Ethical competence is one of the 12 identified competencies, emphasising the ability to recognise, articulate, and critically reflect on ethical issues related to AI.
- The framework highlights the importance of responsible action and decision-making in AI-related contexts.

References to ethical considerations include:

- The impact of AI on privacy and data protection.
- The ecological and societal consequences of AI systems.
- The need for transparency and fairness in AI decision-making processes.

While ethical issues are discussed, the report does not explicitly address a comprehensive security framework for AI. Topics such as cybersecurity, data protection, and mitigating AI bias are mentioned only indirectly.

BAIFE (2024) points out the following issues:

- Equity & Inclusion: Ensuring AI does not reinforce biases and promotes fair access to education.
- Transparency & Accountability: Encouraging educators and policymakers to understand AI decision-making processes.
- Human Oversight: Emphasizing that AI should support, not replace, human educators.
- Critical Thinking & Digital Citizenship: Teaching students to use AI responsibly and ethically.
- Data Privacy & Protection: Addressing the risks of student data collection and AI-driven decision-making.
- Bias & Fairness in AI Models: Discussing how AI systems can reinforce social inequalities and the importance of ethical AI development.
- Regulation & Policy Development: Highlighting the need for AI governance in education systems.

In the **ETAAI** (2024), ethics is considered a core component of the competency framework, emphasising the importance of understanding AI ethics and social responsibilities.

ARAI (2023) document highlights ethical concerns such as bias, fairness, and responsible AI usage in education, discusses AI's role in detecting plagiarism and academic dishonesty, and addresses issues related to AI-generated content and maintaining academic integrity in AI-assisted learning.

AFLTOU (2025) underlines three major ethical pillars for AI's use in learning and teaching:

- Use key criteria to evaluate AI tools (e.g. functionality, accessibility, privacy, security, copyright).
- Engage with ethical issues related to AI, such as bias, deepfakes, copyright infringement, data security and privacy, with a focus on AI-based creativity.
- Consciously take account of ethical issues by acting in a way that promotes responsible use of AI, e.g. asking for consent before using personal data, refraining from spreading misinformation.
- AI in Academic Research: AI models assist researchers in analysing large datasets, detecting trends, and automating repetitive research tasks.
- AI for Plagiarism Detection: AI-based tools (e.g., Turnitin, GPT detectors) help detect AI-generated content and plagiarism in academic writing.
- AI for Literature Reviews: AI tools can summarize academic papers, generate citations, and analyse trends in research fields.

AIFTL (2023) recommends following regarding ethical and responsible use of AI in learning and teaching:

- Transparency: AI decision-making should be explainable and understandable to educators and students.
- Fairness & Equity: AI should not reinforce biases or discrimination and must be accessible to all students.
- Human Oversight (Human-in-the-Loop AI): AI should assist, not replace teachers, ensuring educators remain in control of instructional decisions.
- Accountability: Institutions should audit AI systems for potential bias, errors, or unintended consequences.

4.2.7 Future trends in AI and education

AIComp (2024) is a forward-looking document, addressing the dynamic and evolving nature of AI in education and the workplace, which discusses the following as key elements for the future:

- Future Skills Focus: The framework identifies competences that are essential for navigating a world increasingly shaped by AI, such as critical thinking, ethical awareness, and creative problem-solving.
- Lifelong Learning: Emphasizes the need for continuous upskilling to keep pace with rapid technological advancements.
- Interdisciplinary Collaboration: Recognizes the importance of working across disciplines and cultural boundaries, which aligns with the globalized nature of AI development.

- Ethical and Social Implications: Anticipates the growing importance of addressing ethical dilemmas and societal impacts of AI.
- AI as a Learning Tool: Suggests that AI systems can be used to enhance learning experiences, though specific examples are limited.

ETAI (2024) addresses the need for ongoing professional development and awareness of emerging AI trends but does not detail specific future trends.

AFLTOU (2025) framework highlights the importance of adaptive learning technologies, the role of AI in future assessments, and the integration of ethical AI considerations as the future trends in HE.

AIFTL (2023) framework anticipates future AI trends in education by emphasizing ethical AI policies, adaptive learning technologies, and human-in-the-loop AI models. It highlights the need for continuous research, equity-focused AI integration, and safeguards against bias, ensuring AI evolves responsibly to support personalised learning, teacher assistance, and secure educational environments.

The other documents do not explicitly refer to any future trends.

4.3 Discussion

The analysis of the documents reveals that AI literacy is a multifaceted competence that integrates knowledge, skills, and attitudes. This understanding aligns with frameworks such as the AIComp model, which defines competencies as "dispositions to act" in complex and dynamic contexts. AI literacy extends beyond technical proficiency, encompassing critical thinking, ethical awareness, and the ability to engage responsibly with AI systems. This broader interpretation highlights the importance of a holistic approach to AI literacy, where learners are not only equipped to use AI tools but are also prepared to critically evaluate their societal and ethical implications.

AI Literacy as a Core Educational Competence

AI literacy holds transformative potential for education, both as a tool for teaching and learning and as a subject of study. Frameworks such as BAIFE (2024) and AFLTOU (2025) advocate embedding AI literacy into curricula, focusing on competencies like computational thinking, data literacy, and ethical AI awareness. These competencies are essential for preparing students and educators to navigate a world increasingly shaped by AI. Interdisciplinary approaches, as highlighted in ETAAI (2024), further emphasise the importance of integrating technical, pedagogical, and ethical dimensions into AI literacy education. This integration ensures that learners and educators are equipped to address the complexities of AI in real-world contexts.

Ethical and Social Dimensions of AI Literacy

Ethical and social responsibilities emerge as central themes in the discussion of AI literacy. Frameworks such as AIComp (2024) and AIFTL (2023) stress the importance of ethical AI awareness, responsible AI competence, and human-AI collaboration skills. These competencies are critical for addressing challenges such as bias, privacy, and the societal impact of AI. The focus on ethical considerations aligns with the broader discourse on AI

literacy, which advocates for transparency, fairness, and inclusivity in AI-driven education. This emphasis ensures that learners and educators are not only technically proficient but also equipped to engage with the ethical dilemmas posed by AI technologies.

Challenges and Opportunities in AI Integration

The integration of AI into education presents both significant opportunities and challenges. AI offers tools for personalised learning, adaptive teaching, and efficient assessment, as discussed in ARAI (2023) and AFLTOU (2025). However, it also raises concerns about data privacy, algorithmic bias, and the potential for AI to reinforce existing inequalities. Addressing these challenges requires a combination of technical expertise, ethical awareness, and policy interventions. For example, the emphasis on "human-in-the-loop" AI models in AIFTL (2023) reflects the need to ensure that AI supports rather than replaces educators. This approach highlights the importance of maintaining human oversight and control in AI-driven educational environments.

Implications for AI Skills Frameworks

The findings contribute to the ongoing development of AI skills frameworks by providing both empirical evidence and theoretical insights. The AIComp model, for instance, offers a structured approach to defining AI-related competencies, grounded in scientific literature and policy documents. This model, along with others like AFLTOU (2025), provides a roadmap for aligning educational objectives with the demands of an AI-driven world. Lifelong learning and interdisciplinary collaboration emerge as key elements, highlighting the need for flexible and adaptive frameworks that can evolve alongside technological advancements. These frameworks ensure that learners and educators remain prepared for the dynamic and rapidly changing nature of AI technologies.

Future Directions

Several key trends in AI literacy and education emerge from the analysis. Adaptive learning technologies, the integration of ethical AI considerations, and the need for continuous professional development stand out as critical areas for future focus. Frameworks such as AIComp (2024) and AIFTL (2023) anticipate a future where AI literacy becomes not only a prerequisite for employability but also a critical component of responsible citizenship. This vision aligns with the broader discourse on AI literacy, which emphasises the role of education in shaping a fair and equitable AI-driven society. Preparing learners to engage with AI responsibly and critically will remain a priority as AI continues to transform education and society.

5. Conclusions and recommendations

A comprehensive and interdisciplinary approach to AI literacy is essential for preparing learners to navigate the complexities of an AI-driven world. By integrating technical, ethical, and social dimensions, education systems can ensure that learners and educators are equipped to address the challenges and opportunities presented by AI. The alignment of these findings with existing AI skills frameworks and the broader discourse on AI literacy highlights their relevance

and applicability. As AI continues to reshape education and society, fostering AI literacy will play a crucial role in ensuring that its benefits are realised equitably and responsibly.

The analysis of the documents highlights several key elements that should shape an AI Competency Framework. These recommendations focus on creating a framework that addresses the technical, ethical, and pedagogical dimensions of AI literacy while remaining adaptable to the evolving nature of AI technologies. The aim is to ensure that both learners and educators are equipped with the skills, knowledge, and values needed to navigate and shape an AI-driven world responsibly.

Define Core Competency Areas

An effective framework should organise AI competencies into clear and interconnected areas to provide a holistic approach. These areas include:

- **Knowledge**: Understanding the fundamentals of AI, such as its principles, history, applications, and future trends. This includes concepts like machine learning, natural language processing, and ethical considerations in AI.
- **Skills**: Developing practical abilities to use AI tools effectively, such as analysing data, training models, and integrating AI into teaching or professional contexts.
- **Attitudes and Values**: Fostering ethical awareness, critical thinking, and a commitment to using AI responsibly, ensuring alignment with societal and environmental values.

Embed Ethical and Social Dimensions

Ethical and social considerations must be at the heart of the framework. These include:

- **Ethical AI Awareness**: Building an understanding of the societal implications of AI, including issues like bias, fairness, and transparency.
- **Responsible AI Competence**: Encouraging the ethical use of AI technologies, with a focus on privacy, data protection, and inclusivity.
- **Human-AI Collaboration**: Ensuring that AI supports human decision-making rather than replacing it, with an emphasis on maintaining human oversight and control.

Focus on Interdisciplinary Competencies

AI literacy requires a blend of technical, ethical, and pedagogical skills. The framework should encourage:

- **Computational Thinking:** Developing structured, logical problem-solving skills that can be applied to AI-related challenges.
- **Data Literacy**: Building the ability to interpret, analyse, and use data critically, including recognising bias in datasets.
- **Algorithmic Literacy**: Understanding how algorithms function and influence decision-making processes.
- **Critical AI Literacy:** Evaluating AI technologies through the lens of equity, diversity, and inclusion, with a focus on ethical and social implications.

Address Competencies for Both Students and Educators

The framework should clearly outline the competencies required for students and educators, ensuring alignment between the two groups.

- **For Students**:
    - Develop an understanding of AI systems and their societal impact.
    - Learn to use AI tools for problem-solving and personal development.
    - Engage critically and ethically with AI technologies.
- **For Educators**:
    - Integrate AI into teaching practices to enhance learning outcomes.
    - Use AI-powered tools for instructional design, adaptive learning, and personalised feedback.
    - Address ethical concerns in AI use and foster critical thinking among students.

Promote Lifelong Learning and Professional Development

AI competencies must evolve alongside technological advancements. The framework should:

- Encourage continuous upskilling for both students and educators.
- Provide opportunities for professional development, such as workshops, certifications, and interdisciplinary collaborations.
- Emphasise adaptability and resilience to help individuals keep pace with the rapidly changing AI landscape.

Integrate AI Competencies into Curricula

The framework should offer clear guidance on embedding AI competencies into educational curricula. This includes:

- **Curriculum Design**: Align AI competencies with learning objectives and outcomes at both course and programme levels.
- **AI-Assisted Learning**: Leverage AI tools for personalised learning, adaptive teaching, and efficient assessment.
- **Practical Applications**: Incorporate hands-on activities, such as training machine learning models or using generative AI tools, to enhance engagement and understanding.

Align with Policy and Global Frameworks

The framework should align with existing policy documents and global initiatives to ensure relevance and applicability. For example:

- Reference UNESCO's AI competency framework for educators.
- Align with national and regional policies, such as the AI-Campus initiative in Germany or ethical guidelines from the European Commission.
- Incorporate insights from global reports, such as **AIFTL** (2023), to address international trends and challenges.

Address Challenges and Risks

The framework should directly address the challenges associated with AI integration in education. These include:

- **Data Privacy and Security**: Establish robust protections for student and educator data.
- **Bias and Fairness**: Mitigate algorithmic bias and promote equitable access to AI tools.
- **Ethical Use of AI**: Provide clear guidelines for responsible AI use, including transparency in decision-making and accountability for outcomes.

Anticipate Future Trends

The framework should remain forward-looking, preparing learners and educators for emerging trends in AI. Key areas to focus on include:

- Adaptive learning technologies and AI-driven assessments.
- The integration of AI into interdisciplinary research and innovation.
- The role of AI in fostering global collaboration and addressing societal challenges.

Provide Practical Implementation Pathways

To ensure effective adoption, the framework should include practical recommendations for implementation, such as:

- **Capacity Building**: Offer training programmes and resources to help educators develop AI competencies.
- **Resource Development**: Create accessible materials, such as toolkits and case studies, to guide the integration of AI into teaching and learning.
- **Evaluation and Feedback**: Establish mechanisms to assess the effectiveness of AI competency development and refine the framework over time.

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