



## The conceptual framework of AI literacy, applications, and ethics within the context of higher education

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### ABSTRACT

Artificial Intelligence (AI) has been increasingly integrated across all levels of education, from early childhood and primary education to secondary and higher education. Educational institutions must recognize the essential knowledge, skills, and attitudes individuals need to engage with AI effectively, including ethical awareness and critical evaluation of AI-generated information. This underscores the urgent need for AI literacy. However, research in this area remains limited, particularly within the context of Thai higher education, where concrete and context-sensitive applications are still lacking. This academic article aims to present 1. AI applications in higher education, 2. A conceptual framework of AI literacy for higher education, 3. Ethical considerations and human agency, and 4. Policy and practice recommendations for enhancing AI literacy. The analysis highlights that AI adoption in higher education primarily supports educational management, faculty development, and student learning. Therefore, promoting AI literacy at the tertiary level is essential. The article proposes a clear and comprehensive conceptual framework for AI literacy in higher education, emphasizing technical competence, ethical reasoning, and critical thinking. Seven key components of AI literacy are identified: 1. foundational AI knowledge, 2. technical understanding, 3. interaction with AI, 4. AI awareness and collaboration, 5. reasoning and responsibility, 6. ethics, and 7. impact. Higher education institutions should establish policies, guidelines, and ethical standards for responsible AI use to foster AI literacy in rapidly evolving, AI-driven educational environments. Emphasizing AI literacy education serves to prepare stakeholders in higher education with the essential knowledge, understanding, and mindset required to engage with AI ethically and responsibly. This foundation enables them to address professional and societal challenges more effectively and to enhance their quality of life through informed and conscientious use of AI.

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## Introduction

Artificial Intelligence (AI) has become increasingly influential across all dimensions of work, daily living, and especially education. Children, youth, and individuals of all genders and ages must develop a deep understanding of AI knowledge and skills, without such understanding, the impact on health, safety, learning effectiveness, and future career opportunities could be significant (Chiu, 2025). In today's world,

it is no longer sufficient to simply use AI proficiently; individuals must also become responsible citizens who are knowledgeable and ethically aware in a society where AI plays an ever-growing role (Chiu, 2025; Kong et al., 2024), yet how well the public understands AI technologies, and how researchers define AI literacy, both continue to be under-explored (Ng et al., 2021). The paradigm shifts in the use and understanding of AI in education, along with the development of Artificial Intelligence literacy, is critically important for transforming societal practices and enhancing individual and collective competencies. This transformation benefits education by promoting equity, participation, and lifelong learning through personalized learning experiences. It also supports the advancement of future professions and societies in alignment with the principles of sustainable development (Kong et al., 2024).

AI literacy is a set of competencies that enable individuals to critically evaluate AI technologies, communicate and collaborate effectively with AI, and use AI as a tool online, at home, and in the workplace (Long & Magerko, 2020). Educational institutions should recognize the essential knowledge, skills, and attitudes that learners must develop, including the effective use of AI tools, awareness of AI's ethical implications, and the ability to critically evaluate AI-generated information. These competencies are collectively referred to as AI literacy (Chiu, 2025; Long & Magerko, 2020). This concept is similar to the idea of Chan (2023), who stated that AI literacy for a typical individual is the ability to comprehend, interact with, and make informed decisions regarding artificial intelligence technologies in daily life. It involves understanding the basic principles of AI, recognizing its applications, and being aware of ethical, social, and privacy implications while responsibly engaging with AI systems. Based on the definition of AI literacy, a basic conceptual framework for AI literacy is proposed, consisting of 5 key elements: understanding the concept of AI, awareness of AI applications, the ability of AI to recognize and respond to human emotions, AI safety and security, and responsible use of AI. Given the growing importance of AI literacy in education, Pisica & Zaharia (2025) highlight that higher education institutions worldwide are actively responding to both the opportunities and transformative potential of AI technologies, as well as the challenges associated with their implementation. These challenges include ethical concerns and data protection issues. It is therefore essential to examine perspectives on AI literacy within educational contexts to understand how such technologies may negatively impact learners' critical thinking abilities and motivation.

It can be concluded that AI literacy is essential for today's learners, who must adapt to new modes of learning while engaging with AI ethically and responsibly. Internationally, AI literacy has been studied across nearly all levels of education (Chan, 2023; Chiu, 2025; Kong et al., 2024; Long & Magerko, 2020; Ng et al., 2021), research on AI literacy has expanded its scope beyond primary, secondary, and higher education to include early childhood education (Lee et al., 2021). According to Yang et al. (2025), AI technologies have been increasingly integrated across diverse disciplines, underscoring the growing necessity to promote AI literacy. While interest in AI literacy has expanded, there remains a lack of comprehensive and concrete reviews in this area. In the context of Thai education, recent studies have explored various dimensions of AI literacy, including surveys of digital technology teacher students' AI literacy (Samngamjan et al., 2024), initiatives to enhance AI literacy among Thai educators (Chakamanont & Thabmali, 2025), and the development of AI literacy models in the era of generative AI as emerging guidelines for government, private sectors, and the general public (Taecharunroj & Karnchanapoo, 2025). However, there remains a lack of clearly articulated and practically applicable conceptual frameworks of AI literacy for higher education within the Thai educational context. Therefore, this academic article will present AI application in higher education, a conceptual framework of AI literacy in higher education, ethics and agency, and policy and practice recommendation for enhancing AI literacy. The concepts presented in this academic article will be useful in generating new perspectives on the conceptual framework of AI literacy, its application for educational institutions or related agencies, and laying the foundation for learning in educational institutions with assessment of AI literacy, including the potential impact on the

new generation from the rapidly changing educational environment under the challenges of AI technology and emerging technologies.

### **AI Application in Higher Education**

As the integration of AI across multiple disciplines progresses rapidly, promoting its application through knowledge-based AI in education becomes increasingly important. Artificial intelligence offers remarkable advancements in education, enhancing efficiency, streamlining administration, and personalizing learning experiences (Kelley & Wenzel, 2025). Notably, several studies and scholarly perspectives have explored the application of AI in higher education. One such contribution is by Neelakantan (2020), who summarized key insights from successful AI implementations in this context:

1. **Jill Watson**-A virtual teaching assistant developed at Georgia Tech by Professor Ashok Goel using IBM Watson. Jill Watson was deployed in a graduate-level AI course, where over 300 students posted more than 10,000 messages per semester on the course discussion board. Jill was able to respond to frequently asked questions with up to 97% accuracy, drawing from a database of questions accumulated over previous semesters. Most students were unaware that Jill was an AI, as her responses closely resembled those of a human assistant. Her presence significantly reduced the workload of human teaching assistants, allowing them to focus on more meaningful tasks such as providing in-depth academic guidance.

2. **Pounce**-A chatbot designed to reduce “summer melt” at Georgia State University. Pounce operates as a 24/7 automated messaging assistant that responds to student inquiries. In its first year, Pounce answered over 200,000 questions and helped reduce summer melt by 22%, resulting in an increase of 324 new student enrollments. Developed in collaboration with Admit Hub, the system was designed to address common queries related to scholarships, registration, and placement testing. Its implementation yielded labor savings equivalent to hiring ten full-time staff members.

3. **Cognitive Immersive Room**-An AI-powered Chinese language classroom developed by Rensselaer Polytechnic Institute in partnership with IBM. The classroom simulates real-world scenarios such as restaurants, gardens, or Tai Chi sessions, allowing students to practice speaking Chinese with AI agents in immersive virtual environments. Created by the Cognitive and Immersive Systems Lab, this initiative aims to enhance student engagement and experiential learning.

Challenges in scaling up AI Cost: Developing AI requires time and resources. For example, Jill Watson had to input over 40,000 posts. Staff workload: It took a team at Georgia State months to teach Pounce to answer questions correctly. Skills Gap: University staff must learn to use data and AI systems effectively. Managing Big Data: Scaling up AI across the university requires large databases and complex management.

Nguyen (2025) conducted a comprehensive study analyzing over 30 research articles published between 2020 and 2025 on the use of AI in universities. The key findings include:

1. **Personalized Learning**: AI enhances individualized learning through automated content recommendation systems, adaptive instruction, and real-time feedback mechanisms.

2. **Learner Engagement**: AI tools such as ChatGPT, Gemini, and interactive learning simulations significantly increase student engagement.

3. **Academic Performance**: The use of AI positively impacts educational outcomes, particularly in writing, summarization, analytical thinking, and self-directed learning.

Critical findings include students still lacking critical evaluation skills and ethical frameworks for use of AI. AI use also emphasizes efficiency rather than developing analytical and metacognitive skills. The emerging trend towards AI-human collaboration in learning suggests the establishment of systematic AI literacy programs in higher education. Nguyen's (2025) work explicitly supports the need to develop a conceptual framework of AI literacy for higher education, particularly in the areas of curriculum design that promotes the critical use of AI, developing digital ethics skills and human-centered learning, and creating practices that address the Thai context in both the public and private sectors.

Slimi (2023) analyzed the impact of AI on teaching, assessment, and career readiness, identifying several key areas of application:

1. **Personalized Learning:** AI enables tailored instruction for individual learners through systems such as automated lesson recommendations and behavioral learning analytics.
2. **Automated Assessment:** AI supports objective testing, automated feedback, and preliminary evaluation of written work, thereby reducing instructors' workload and accelerating the assessment process.
3. **Virtual Tutoring & Support:** AI-powered virtual assistants provide real-time academic support and guidance, enhancing accessibility to help without time constraints.
4. **Administrative Efficiency:** AI is employed in student data management, curriculum planning, and event coordination, contributing to more efficient university operations.

Critical findings reveal that some students lack a clear understanding of how AI functions and its ethical implications. Concerns have emerged regarding overreliance on AI and the diminishing role of human agency in learning. Slimi (2023) recommends promoting AI literacy in higher education, with a balanced emphasis on technical proficiency, ethical awareness, and critical thinking. The study advocates for the development of AI usage frameworks that prioritize human-centered learning over technology-centered automation.

In summary, the integration of AI in higher education has primarily focused on enhancing educational administration, faculty development, and student learning. However, several critical issues warrant further investigation. University personnel must develop the capacity to effectively utilize data and AI systems, while students continue to lack evaluative judgment and ethical frameworks in their use of AI. Moreover, the ability to engage with AI tools efficiently remains uneven. These challenges underscore the urgent need to promote AI literacy at the tertiary level. A clearly articulated conceptual framework of AI literacy is essential—one that encompasses technical competencies, ethical understanding, and critical thinking—to guide responsible and transformative adoption of AI in higher education.

### **Conceptual framework of AI Literacy in higher education**

As AI becomes increasingly embedded in educational ecosystems, higher education institutions face both unprecedented opportunities and complex challenges. While AI offers transformative potential in personalized learning, automated assessment, and administrative efficiency, its integration demands more than technical adoption; it requires a deep, critical understanding of its implications. A conceptual framework of AI literacy is essential to guide universities in cultivating responsible, ethical, and effective engagement with AI.

Research by Pisica & Zaharia (2025) suggests that most learners are familiar with AI technologies, although their levels of understanding and practical skills vary. As they navigate increasingly complex and evolving educational landscapes shaped by AI, students often seek further guidance from educators, university administrators, and policymakers to advance their AI literacy. In parallel, Baskara (2025) highlights the urgent need to redefine the conceptual framework of AI literacy in the digital age—an essential foundation for AI-driven education. The proposed framework comprises four core components: 1. technical understanding of AI systems, 2. practical application skills, 3. critical evaluation capabilities, and 4. ethical considerations. These elements are integrated with traditional digital literacy standards through a meta-layer of learning that emphasizes adaptability and lifelong learning. The framework also offers specific recommendations for curriculum design, instructional strategies, assessment practices, and teacher development, as illustrated in Figure 1.

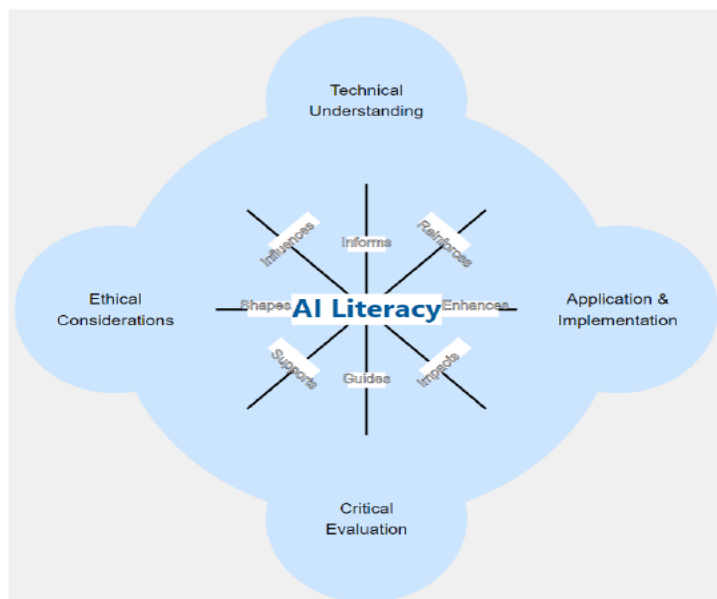


Figure 1. Component of AI literacy framework  
Source: Baskara (2025)

Figure 1. outlines the key components of AI literacy as follows:

1. **Technical Understanding of AI Systems** Learners should develop foundational knowledge of essential AI terminology and concepts, such as machine learning algorithms, neural networks, and natural language processing. They should also understand the material requirements of AI systems, including the use of large-scale data and the importance of data quality and diversity.

2. **Practical Skills in AI Use and Development** Learners should engage with various AI tools and platforms to identify appropriate solutions for different types of problems. This includes developing skills in using AI-powered software, programming basic models, and understanding the processes of model training and refinement. Additionally, learners must be capable of managing data effectively, collecting, preparing, and interpreting AI-generated outputs into actionable insights.

3. **Critical Evaluation of AI-Generated Information** Given AI's capacity to generate and filter vast amounts of information, learners must acquire skills to assess the credibility, bias, and limitations of AI-generated data. They should consider the origin and context of the data to make informed decisions in an AI-rich information environment.

4. **Ethical and Societal Considerations** Learners should be aware of fundamental ethical principles such as fairness, accountability, transparency, and data privacy. They must also understand the societal implications of AI use, including its impact on employment, social interaction, and democratic processes. As responsible AI citizens, learners should be equipped to engage in ethical reasoning and decision-making.

According to Chan (2023), an AI literate learner can: comprehend basic AI terminology and how AI systems function, utilize AI applications (e.g., chatbots and AI assistants), differentiate between realistic expectations of AI versus exaggerated hype, understand AI safety and security (e.g., awareness of potential risks, threats and misuse), and use AI responsibly (e.g., questioning reliability of AI-generated content and considering ethical implications), as illustrated in Figure 2.

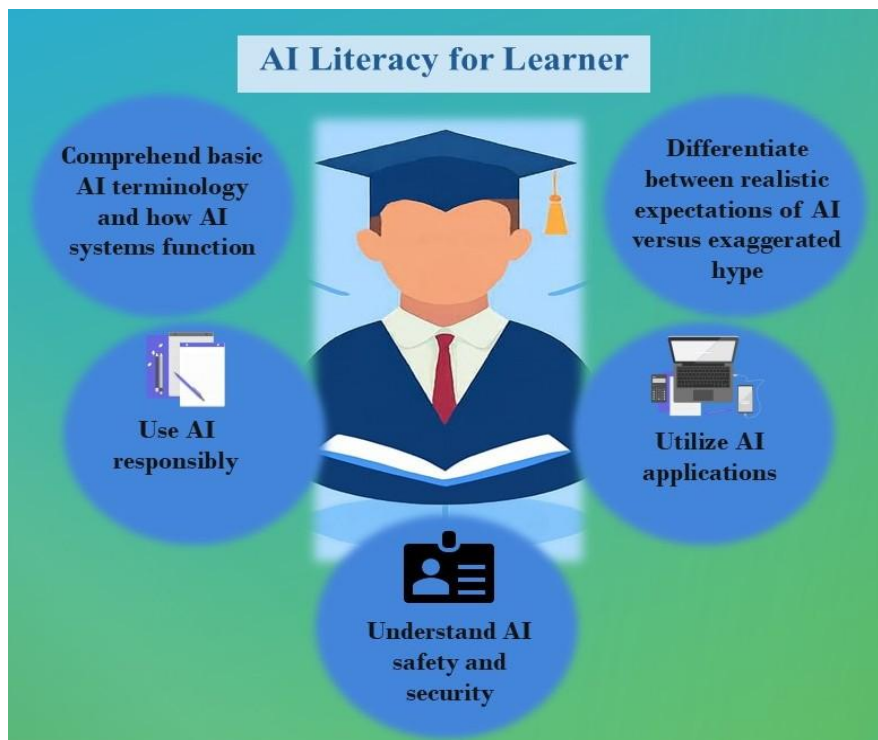


Figure 2. AI Literacy for Learner

Source: Holistic Competency &amp; Virtue Education (2025)

Since AI is rapidly developing and increasingly incorporated into daily routines, it is important for individuals to understand AI and be able to effectively utilize AI technologies. AI literacy is important because it encourages learners to: identify misconceptions related to AI, use AI ethically and responsibly, enhance career opportunities, develop innovative and creative products, and address opportunities and challenges in AI literacy (Holistic Competency & Virtue Education, 2025).

Empirical research suggests that integrating ethics into AI education not only enhances learners' conceptual understanding of artificial intelligence but also promotes ethical awareness. Future educational initiatives should prioritize the ethical dimensions of AI learning by embedding ethical principles and critical thinking practices into the educational framework. Such integration is essential for cultivating comprehensive AI literacy that balances technical proficiency with moral responsibility (Lin et al., 2021; Williams et al., 2023; Zhang et al., 2022).

### **Ethics and Agency**

Understanding the ethical implications of AI is a critical component of AI literacy, as AI systems profoundly affect multiple aspects of our lives. Ethical concerns arising from AI include the dissemination of misinformation, violations of privacy, existential threats, and discriminatory outcomes (Long & Magerko, 2020). As AI systems collect, store, and analyze personal data, issues related to surveillance and privacy have become increasingly severe. Moreover, the rise of distorted information is often amplified by AI algorithms that promote emotionally charged content and echo chambers (Long & Magerko, 2020). Addressing these challenges requires a comprehensive understanding of AI ethics as an integral part of AI literacy. Such understanding enables users to operate within legal and ethical boundaries and to act with responsibility (Karaca et al., 2021). This article, therefore, proposes key considerations for the ethical and responsible use of AI:

1. Ethical Considerations: The Rome Call for AI Ethics (2024, as cited in Yang et al., 2025), a document endorsed by governments, institutions, and corporations emphasizes the importance of

transparency, inclusiveness, trustworthiness, impartiality, accountability, and safety in the development of AI systems. These principles extend to AI-related research, education, and workforce development. Additional ethical concerns include algorithmic bias, surveillance issues, unequal access, misuse of AI technologies, and intellectual property rights.

2. **Privacy, Data Security, and Bias:** The ways in which AI systems collect and utilize student data raise significant concerns regarding privacy, security, and bias. Although most AI systems request user consent to access personal information, many may lack clarity about the extent to which such data is shared. Akgun & Greenhow (2022) point out that AI algorithms relying on personal data for predictive purposes raise critical questions about autonomy and fairness. Therefore, it is essential to establish robust safety measures and policy frameworks to safeguard student privacy and data security in educational technologies. Such measures can also help reduce the workload of classroom teachers.

3. **Equity and Access:** Schools and students do not have equal access to AI-powered tools, which may exacerbate existing educational disparities. Ensuring equitable access must be a top priority across all levels of education. Providing foundational resources enables all learners to explore and engage meaningfully with AI technologies.

4. **Plagiarism and AI-Generated: Misconduct** Although academic dishonesty is not a new phenomenon, the rapid advancement of technology has intensified concerns in this area (Perry & Steck, 2015). Technology has consistently challenged the boundaries of ethical behavior, and AI-generated plagiarism—often referred to as Aigiarism—is particularly difficult to detect. While numerous AI-powered tools have been developed to identify academic misconduct (Agarwal, 2025), these tools can be costly and may lack precision. Xie et al. (2023) identified three major ways in which AI-enabled cheating undermines higher education: it degrades educational quality, creates unfair advantages for AI users, and erodes institutional credibility. These challenges have led to the emergence of anti-AI policies. However, Gillard & Rorabaugh (2023) argue that such policies are largely ineffective. Instead of blaming AI itself, they advocate for approaches centered on education, awareness, and the responsible and ethical use of AI.

5. **Impacts on Critical: Thinking Beyond** concerns about academic dishonesty, some educators worry that AI tools may diminish students' capacity for critical and independent thinking. Oravec (2023) recommends that educators promote AI literacy by teaching students to critically evaluate AI-generated content for flaws and inaccuracies. This includes verifying the credibility of AI outputs, cross-referencing claims with reliable sources, and understanding proper citation practices for AI-generated material. As part of this effort, educators should emphasize the limitations of AI systems—particularly the phenomenon of hallucination, in which AI fabricates information.

6. **Proactive Approaches to Addressing AI Ethics:** Governments should establish policies governing the use of AI across all levels of education. The development and dissemination of AI-related policies create opportunities for public discourse and ethical awareness, fostering transparency and clear expectations. At the university level, institutions should not only provide guidelines for student access and use of AI but also incorporate language-specific guidance within curricula and offer professional learning opportunities for faculty. Online training programs for instructors are essential, focusing on how AI systems operate, ethical considerations, strategies for addressing emerging challenges, and pedagogical approaches for integrating generative AI into teaching and learning.

7. **Promoting AI Transparency:** Winkelmes et al. (2019) argue that when educators make learning processes more transparent, it benefits students and enhances their success in college. These benefits include a stronger sense of belonging, increased academic confidence, persistence, and metacognitive awareness. Transparency in AI not only fosters trust and ethical use but also improves learning outcomes by making educational processes clearer and more accessible to students. This approach ensures that AI is implemented responsibly and effectively within educational institutions.

Ethics and agency are foundational to responsible AI development and use. Ethics ensures that AI systems uphold fairness, transparency, and human dignity, while agency empowers individuals to critically

engage with AI rather than passively accept its outputs. Together, they safeguard autonomy, prevent harm, and promote trust in AI-driven environments especially in education and public policy.

### **Policy and Practice Recommendation for Enhancing AI literacy**

Pisica & Zaharia (2025) emphasize the urgent need to establish policies and regulatory frameworks for AI usage that prioritize responsibility and ethical practices. Universities are encouraged to collaborate with students in designing usage guidelines and to actively consider student perspectives when formulating such frameworks. One major concern is that AI algorithms are susceptible to biases embedded in internet data and may autonomously learn and replicate these biases. Therefore, human oversight of AI-generated content is essential. In terms of assessment, educators can empower learners to thrive in an AI-driven world by designing tasks that leverage uniquely human capabilities, focusing on cognitive strengths that surpass machine intelligence.

Different technologies are used in educational contexts. Chan (2023) identified ten key areas directly relevant to planning AI policies in higher education institutions, which highlight important considerations for the use of AI in teaching and learning:

1. Understanding, identifying, and preventing academic misconduct and ethical dilemmas.
2. Addressing governance of AI: data privacy, transparency, accountability, and security.
3. Monitoring and evaluating AI implementation.
4. Ensuring equity in access to AI technologies.
5. Attributing AI technologies.
6. Providing training and support for teachers, staff, and students in AI literacy.
7. Rethinking assessments and examinations.
8. Encouraging a balanced approach to AI adoption.
9. Preparing students for the AI-driven workplace.
10. Developing student holistic competencies/generic skills.

Taecharungroj & Karnchanapoo (2025) in collaboration with ETDA (Electronic Transactions Development Agency), propose the “Six E’s Model for AI Literacy,” which offers a comprehensive framework for developing AI literacy across individual and organizational levels. The model includes six interconnected dimensions:

1. Essential Knowledge – foundational understanding of AI concepts and terminology
2. Exposure to Tools – hands-on experience with AI platforms and applications
3. Evaluation Skills – critical thinking and assessment of AI-generated content
4. Ethical Awareness – understanding ethical implications and responsible use
5. Empowerment – fostering confidence and agency in AI engagement
6. Ecosystem Readiness – preparing institutions and policies to support AI literacy

This model aligns closely with the four core components outlined in Baskara’s framework-technical understanding, practical skills, critical evaluation, and ethical considerations-while adding layers of empowerment and systemic support. In the context of Thai higher education, integrating the Six E’s Model can help bridge the gap between conceptual understanding and institutional practice. It also provides actionable insights for curriculum design, teacher development, and policy formulation tailored to local needs. By incorporating this model into the proposed conceptual framework, this research of Taecharungroj & Karnchanapoo (2025) to offer a more holistic and context-sensitive approach to AI literacy-one that not only equips learners with essential competencies but also fosters ethical agency and institutional transformation in response to emerging technologies.

The development of policies, guidelines, and regulations regarding the use of AI must prioritize responsible and ethical practices. Universities should actively collaborate with faculty and students to co-design usage frameworks that reflect the perspectives of all stakeholders. They may also partner with external organizations to jointly develop these standards and recommendations. In terms of assessment,

instructors can foster learners' ability to thrive in an AI-driven world by designing tasks and activities that emphasize uniquely human strengths, particularly those where the human brain surpasses machines. Such approaches can significantly enhance AI literacy.

### Originality and body of knowledge

The application of artificial intelligence (AI) in higher education spans three core domains: institutional management, personnel support-including both academic and administrative staff-and student support. To ensure effective and responsible implementation across these areas, users must possess a foundational level of AI literacy. Emerging research identifies seven essential components of AI literacy within the higher education context, as illustrated in Figure 3.

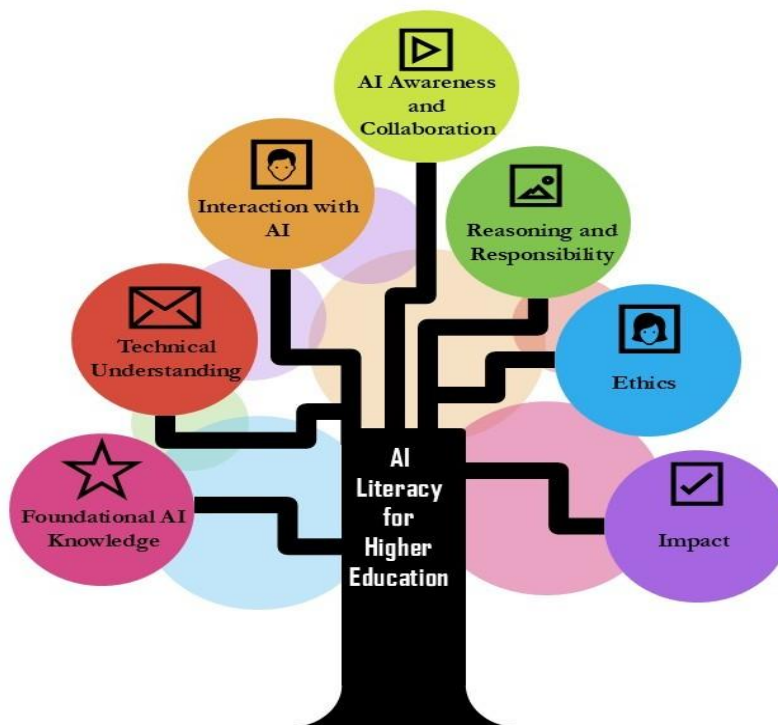


Figure 3. AI Literacy for Higher Education

Figure 3. AI literacy for higher education is described as follows:

1. **Foundational AI Knowledge:** Understanding core concepts of AI, such as machine learning, big data, and natural language processing, as well as recognizing various applications and the underlying infrastructure of AI systems.

2. **Technical Understanding:** Possessing technical knowledge of AI technologies, including system mechanisms, algorithms, and computational processes, which enables users to analyze and utilize AI tools effectively.

3. **Interaction with AI:** Demonstrating the ability to communicate and collaborate with AI systems efficiently, for example, using chatbots or automated response platforms.

4. **AI Awareness and Collaboration:** Understanding how AI collects data from the external world, such as through sensors or image and sound analysis and applying the necessary skills to engage and collaborate with AI across diverse contexts.

5. Reasoning and Responsibility: Grasping how AI models the world and makes decisions, such as predicting outcomes based on data analysis and applying these insights responsibly and with critical judgment.

6. Ethics: Recognizing ethical considerations related to AI, including transparency, fairness, privacy, algorithmic bias, safety, and broader societal impacts.

7. Impact: Understanding how AI affects individuals, communities, and the global landscape, both positively and negatively.

AI literacy is not merely about using AI tools; it also involves cultivating critical thinking grounded in a deep understanding of AI. This empowers individuals to design and lead authentic human lives in the age of artificial intelligence.

## Conclusion

AI literacy refers to an individual's ability to clearly explain how artificial intelligence technology's function and how they impact society. It also encompasses the capacity to use AI ethically and responsibly, and to communicate and collaborate effectively with AI across diverse contexts. To apply AI appropriately within higher education, individuals must develop cognitive capacities, core values, and shared knowledge. Strong AI literacy requires demonstrated proficiency across seven domains: 1. foundational AI knowledge, 2. technical understanding, 3. interaction with AI, 4. AI awareness and collaboration, 5. reasoning and responsibility, 6. ethics, and 7. impact. To cultivate AI literacy, education must prioritize learners' conceptual frameworks over the role of AI itself as a central actor. AI is no longer a tool reserved for experts—it has become embedded in everyday life and human experience. The foundation of AI literacy is rooted in competencies and educational goals defined within broader literacy frameworks. It begins with understanding the nature of AI and the societal contexts in which it operates, followed by identifying the competencies and learning objectives essential for future learners. AI enables humans to expand the boundaries of information and relationships. However, to truly benefit from AI technologies, individuals must be equipped with appropriate educational support to access and interpret relevant data. Future research should therefore emphasize ethical considerations and critical thinking as key drivers in advancing AI literacy.

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