

Interdisciplinary AI Competencies as the Foundation of Digital Transformation

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Abstract. The accelerating pace of digital transformation across business, academia, and healthcare increasingly depends on the effective adoption of artificial intelligence (AI). While technological capabilities continue to advance rapidly, organizations face growing challenges in developing interdisciplinary AI competencies that combine technical expertise with ethical awareness and decision-making skills.

This study aims to identify key competency domains supporting responsible and effective AI use across professional contexts. It applies a qualitative multiple case study across four domains, using interviews, document analysis, and observation, while building on existing AI competency frameworks. The findings identify four core domains—strategic understanding, algorithmic risk management, data credibility assessment, and reflective decision-making—highlighting the importance of ethical and cognitive competencies in AI-supported work.

Keywords: Artificial Intelligence, Interdisciplinary Competencies, Digital Transformation

1 Introduction

Artificial intelligence (AI) has become a key enabler of digital transformation, transforming how organizations design processes, create value, and make decisions in business, higher education, and healthcare. However, AI adoption is not simply about implementing new technologies. It encompasses the reconfiguration of complex socio-technical systems in which technologies, people, organizational procedures, and institutional constraints co-evolve [1] [2]. Consequently, AI-driven transformation generates not only operational and strategic challenges but also ethical, social, and governance issues that directly impact implementation outcomes [3]. A growing body of research shows that successful AI-driven transformation depends less on technological availability and more on organizational readiness and capacity development. Empirical research indicates that artificial intelligence (AI) initiatives often fail to deliver the expected results when organizations underestimate the human, managerial, and institutional capabilities necessary to translate technological potential

into sustainable operational impact [4] [5]. Research on AI readiness emphasizes the importance of aligning AI implementation with strategic goals, organizational practices, and decision-making responsibilities, identifying competency gaps as a key barrier to value realization [6]. Within the competency challenge, the concept of AI competency has emerged as a key construct describing the competencies necessary to effectively and responsibly interact with AI systems. Prior research conceptualizes AI competencies as a multidimensional set of competencies that reaches beyond technical knowledge, encompassing practical application, critical evaluation of algorithmic outputs, and ethical awareness related to AI use [7] [8]. Subsequent work further distinguishes between technical, application, critical thinking, ethical, social, and legal dimensions, emphasizing that AI skills cannot be reduced to just technical training exclusively [9]. To address these challenges, this study aims to identify key competencies required for the effective and responsible use of AI across different professional contexts. In particular, the study focuses on how these competencies manifest across sectors and where common patterns and gaps can be observed.

Accordingly, the following research questions are formulated:

RQ1. What key competencies are required for the responsible and effective use of AI across different professional contexts?

RQ2. What common competency domains and gaps can be identified across these contexts, particularly in relation to cognitive, ethical, and epistemic dimensions?

2 Literature review

At the organizational level, the literature increasingly emphasizes the governance implications of widespread AI adoption. Studies converge on the view that responsible AI requires coordinated practices across organizational levels, encompassing structural and procedural mechanisms that enable oversight throughout the AI lifecycle [10] [11]. Importantly, AI governance extends beyond regulatory compliance by institutionalizing accountability and embedding ethical reasoning into everyday decision-making processes [12].

Despite these advances, existing competency-oriented approaches remain fragmented and often sector-specific. While interdisciplinary competence development has been advocated [13], there is still limited cross-sectoral empirical evidence on how technical understanding, ethical judgment, governance awareness, and contextual knowledge are integrated in practice [14] [15] [16].

2.1 Digital Transformation and Organizational Capabilities

Digital transformation has become a central concept in contemporary research on organizational change, reflecting the profound impact of digital technologies on how organizations operate, compete, and deliver value. As opposed to being understood as a discrete technological upgrade, digital transformation is increasingly conceptualized as a long-term, organization-wide process involving the reconfiguration of structures, processes, and capabilities [2]. This perspective emphasizes that digital technologies

do not automatically generate transformation outcomes. Instead, their effects depend on how they are embedded within organizational and institutional contexts.

A socio-technical view of digital transformation highlights the interdependence between technological artifacts and human agency. Leonardi [1] argues that technologies shape organizational action not through deterministic effects, but through affordances that are enacted by users in specific contexts. As organizations adopt advanced digital technologies, they must simultaneously adapt work practices, decision-making routines, and coordination mechanisms. Digital transformation therefore unfolds as a dynamic interaction between material properties of technology and organizational responses, as opposed to as a linear implementation process.

Within this broader transformation landscape, artificial intelligence introduces distinctive challenges and opportunities. AI systems differ from earlier digital technologies in their capacity for autonomous operation, adaptive learning, and probabilistic decision-making. These characteristics complicate traditional managerial assumptions about predictability, transparency, and control [5]. Consequently, AI-enabled digital transformation places particularly high demands on organizational capabilities extending beyond technical expertise to include strategic alignment, managerial coordination, and human judgment.

Empirical research consistently shows that organizations struggle to scale AI initiatives despite significant investments. Davenport and Ronanki [4] document that many organizations remain stuck at the pilot stage, failing to integrate AI solutions into core business processes. Their findings suggest that such failures are rarely due to technological immaturity. Instead, they stem from insufficient organizational capabilities, including unclear ownership of AI initiatives, lack of cross-functional collaboration, and limited understanding of how AI-generated insights should inform decision-making.

The concept of organizational capabilities provides a useful analytical lens for understanding these challenges. Organizational capabilities refer to the ability of an organization to deploy resources, coordinate activities, and adapt to changing environments in pursuit of strategic objectives [17]. In the context of digital transformation, dynamic capabilities—such as sensing opportunities, seizing technological potential, and transforming organizational structures—are particularly relevant. AI-enabled transformation requires organizations to continuously sense emerging technological possibilities, evaluate their relevance, and reconfigure processes and skills accordingly.

Research on AI readiness further underscores the importance of capability development. Glikson and Woolley [6] argue that organizations must develop not only technical capabilities, but also social and cognitive capabilities that enable effective human–AI collaboration. These include the ability to interpret algorithmic outputs, calibrate trust in AI systems, and integrate AI recommendations with human expertise. Without such capabilities, AI risks being either over-relied upon or underutilized, undermining its potential value.

Capability challenges are especially pronounced in complex institutional environments such as the public sector [14] show that digital transformation initiatives in public administration often falter when competency development is not

explicitly addressed. Public organizations face unique constraints, including regulatory rigidity, accountability requirements, and legacy infrastructures, which intensify the need for well-defined organizational capabilities. Their study highlights that transformation efforts must account for internal coordination mechanisms and role clarity, in lieu of assuming that digital tools exclusively can drive change.

Similarly, in healthcare organizations, AI adoption intersects with professional norms, ethical obligations, and high-stakes decision-making contexts. Studies indicate that while AI technologies offer significant potential for improving diagnostics and operational efficiency, their integration depends on organizational capabilities that support interdisciplinary collaboration and risk management [18]. Clinicians and managers must be able to interpret AI outputs, understand their limitations, and integrate them into established clinical workflows without undermining professional judgment.

Beyond sector-specific contexts, the literature increasingly emphasizes that digital transformation is as much a managerial and cultural challenge as a technological one. Organizational culture, leadership commitment, and learning orientation play a critical role in shaping transformation outcomes [19]. Leaders must articulate a clear vision for AI adoption, allocate resources for capability development, and foster an environment in which experimentation and learning are encouraged. Without such leadership, AI initiatives risk remaining isolated or generating resistance among employees.

AI-enabled systems often produce probabilistic recommendations in preference to deterministic answers, requiring organizations to reconsider how decisions are made and justified. Faraj et al. [20] argue that digital technologies reshape decision-making by redistributing expertise and authority, creating new forms of coordination between humans and machines. Organizational capabilities must therefore encompass not only the ability to use AI tools, but also the capacity to redesign decision processes in ways that balance efficiency, accountability, and human oversight.

Taken together, the literature suggests that digital transformation driven by AI is fundamentally a capability-building process. Technological adoption must be accompanied by the development of organizational capabilities that integrate strategic alignment, managerial coordination, human judgment, and institutional awareness. Organizations that fail to invest in such capabilities are unlikely to realize the promised benefits of AI, regardless of technological sophistication.

This body of research provides a critical foundation for examining AI-related competencies in practice. By framing digital transformation as a socio-technical and capability-driven process, it underscores why interdisciplinary competencies—spanning technical, organizational, and contextual domains—are central to understanding how AI reshapes contemporary organizations. This insight motivates further empirical investigation into how such capabilities are enacted across diverse professional settings.

2.2 AI Literacy and Interdisciplinary Competencies

As artificial intelligence (AI) becomes increasingly embedded in organizational processes and professional practice, attention has shifted from purely technological considerations toward the competencies required to interact with AI systems effectively and responsibly. In this context, the concept of AI literacy has emerged as a central analytical lens for understanding how individuals and organizations engage with AI. AI literacy extends beyond basic familiarity with digital tools and refers to a broad set of competencies enabling people to understand, use, evaluate, and critically reflect on AI-driven systems and outcomes.

Early scholarship on AI literacy positioned it as an extension of digital and data literacy, emphasizing foundational knowledge of algorithmic principles and machine learning concepts. However, as AI systems have become more pervasive and influential, researchers have increasingly argued that such narrow definitions are insufficient. Long and Magerko [7] conceptualize AI literacy as a multidimensional competence encompassing understanding how AI works, recognizing its limitations, interacting with AI systems, and considering their broader societal implications. This perspective marks a shift from technical proficiency toward a more holistic understanding of AI as a socio-technical phenomenon.

Subsequent research further expands this conceptualization by emphasizing that most AI users are not developers but professionals who rely on AI-generated outputs to support decision-making. Ng et al. [8] argue that AI literacy must therefore include the ability to interpret algorithmic recommendations, assess their reliability, and contextualize them within domain-specific knowledge. This interpretation-oriented view highlights the growing importance of judgment, critical thinking, and contextual awareness in AI-supported work environments, particularly in sectors such as healthcare, education, and management.

More recent syntheses provide even broader frameworks for understanding AI literacy. Annapureddy et al. [9] identify a set of defining competencies for generative AI literacy, including prompt formulation, evaluation of generated content, ethical awareness, and basic understanding of underlying mechanisms. Importantly, they distinguish between competencies required for basic AI use and those needed for more advanced interaction, such as adapting AI tools to specific tasks or integrating them into complex workflows. This work reinforces the argument that AI literacy is not a binary state but a continuum that evolves alongside technological capabilities and professional roles.

A key theme across the literature is the inherently interdisciplinary nature of AI-related competencies. AI systems operate at the intersection of computer science, domain expertise, organizational processes, and societal norms. As a result, effective AI literacy cannot be developed within a single disciplinary silo. Wolff et al. [13] explicitly argue that competencies required for digital and AI-driven transformation demand transdisciplinary educational approaches that integrate technical instruction with organizational, ethical, and social perspectives. They emphasize the importance of project-based learning environments that expose learners to real-world problems, enabling them to experience how AI systems function within complex socio-

organizational settings. Empirical evidence supports this interdisciplinary perspective. Gimpel et al. describe a cross-university initiative involving twelve professors from multiple institutions who collaboratively developed modular AI competency teaching toolkits. Their project demonstrates that interdisciplinary collaboration not only enriches the content of AI education but also enhances its relevance for diverse professional contexts. By combining perspectives from information systems, management, ethics, and domain-specific fields, such initiatives enable learners to develop transferable competencies that extend beyond technical implementation. The importance of interdisciplinary AI competencies is also evident in organizational and workforce-focused research. Salunkhe et al. [16] show that businesses operating in rapidly evolving digital environments must continuously reskill their workforce across multiple domains to remain competitive. Their findings suggest that AI literacy is increasingly required not only among technical specialists but also among managers, frontline employees, and decision-makers. This broad diffusion of AI-related competencies reflects the integration of AI into everyday organizational activities, from strategic planning to customer interaction. Beyond formal education and training, the literature highlights the role of experiential learning and informal knowledge acquisition in developing AI literacy. Professionals often acquire AI-related competencies through hands-on interaction with tools, peer learning, and iterative experimentation. However, research also cautions that experiential learning alone may be insufficient without structured reflection and ethical guidance. Studies on algorithmic decision-making show that users may develop overconfidence in AI systems or fail to recognize embedded biases if critical evaluation skills are not explicitly cultivated [21].

Ethical awareness constitutes a particularly important dimension of interdisciplinary AI competencies. AI systems can reinforce existing inequalities, produce opaque decisions, and affect fundamental rights. Consequently, several scholars argue that ethical reasoning should be treated as a core component of AI literacy in lieu of as an optional add-on. Mittelstadt et al. [22] emphasize that ethical challenges associated with AI—including fairness, accountability, and transparency—require users to understand not only technical mechanisms but also normative principles and societal values. This reinforces the need for AI literacy approaches that integrate ethical reflection into everyday AI use.

Another dimension emphasized in the literature concerns communication and collaboration across disciplinary boundaries. AI-related work often involves collaboration between data scientists, domain experts, managers, and stakeholders with varying levels of technical expertise. Effective AI literacy therefore includes the ability to translate between technical and non-technical perspectives, articulate limitations and uncertainties, and participate in collective decision-making processes [23]. Such communicative competencies are critical for preventing misunderstandings and ensuring that AI systems are used appropriately within organizations.

Taken together, the literature presents AI literacy as a complex, interdisciplinary set of competencies combining technical knowledge with critical, ethical, and contextual understanding. These competencies are shaped by education, professional practice, and organizational context, reflecting the socio-technical nature of AI. This

body of work provides the foundation for examining how AI-related competencies are enacted in practice across different professional domains. By highlighting the multifaceted and interdisciplinary nature of AI literacy, the literature underscores the need for empirical research that explores how these competencies are combined, negotiated, and applied in real-world settings. Such research is essential for understanding how individuals and organizations navigate the opportunities and risks associated with AI-enabled digital transformation.

2.3 Comparative Analysis of AI Competency Frameworks

A growing number of international organizations and academic communities have proposed frameworks to structure AI competencies and AI literacy. While these frameworks provide valuable foundations, they differ substantially in scope, assumptions, and emphasis, and remain fragmented across technical, educational, and governance perspectives.

UNESCO AI Competency Framework [24] for Teachers and Students define AI competencies across four domains: human-centered mindset, ethics and governance, AI foundations, and AI application. The framework strongly emphasizes ethical awareness, inclusion, and social responsibility, but remains primarily educational and normative, offering limited insight into organizational practice and decision-making contexts.

The OECD/EU AILit framework (AI Literacy for All) [25] conceptualizes AI literacy as understanding, using, evaluating, and creating with AI. While it captures technical and critical dimensions, governance and organizational integration are treated as external conditions as opposed to core competencies.

DigComp 2.2 [26] extends digital competence into areas relevant for AI, including data literacy, problem solving, and safety. However, AI appears mainly as an extension of general digital skills, and the framework does not explicitly address algorithmic bias, explainability, or AI governance.

Academic models of AI literacy [7] [8] [9] provide richer conceptual depth, integrating technical, ethical, and societal dimensions. Nevertheless, they are largely developed in educational settings and lack empirical grounding in organizational and cross-sectoral practice.

The World Economic Forum (WEF) Skills Framework for the Future of Jobs [27] highlights AI-related technical, human, and leadership skills, linking AI adoption to reskilling and workforce transformation. While highly practical, it does not explicitly integrate ethics and governance as core competency domains.

Governance-oriented frameworks such as AI4People, ISO/IEC 42001, and the NIST AI Risk Management Framework (AI RMF) focus on organizational structures, accountability, and lifecycle management of AI systems. These frameworks define what organizations should do to govern AI responsibly, but do not specify the human competencies required to operationalize governance in everyday professional practice.

Finally, the EU AI Act implicitly defines competence expectations by requiring organizations to ensure human oversight, risk management, and compliance

capabilities. However, it frames competencies as compliance obligations I lieu of as integrated socio-technical capabilities.

Across these frameworks, three structural limitations are evident:

1. Fragmentation – technical, ethical, educational, and governance competencies are treated separately.
2. Limited organizational perspective – most frameworks underrepresent how competencies are enacted in business, healthcare, and research practice.
3. Weak empirical grounding – existing models are largely normative, with limited qualitative evidence from real-world professional contexts.

The literature increasingly recognizes governance and ethics as integral components of artificial intelligence adoption as opposed to external compliance concerns. AI systems introduce challenges related to transparency, accountability, bias, and human oversight, which require organizations to develop governance mechanisms that combine technical, organizational, and ethical competencies [12]. Responsible AI is therefore understood as a socio-technical capability embedded in everyday organizational practice instead of a set of abstract principles.

Research highlights that ethical and governance frameworks are effective only when translated into concrete roles, routines, and decision-making processes. While many organizations adopt ethical guidelines and regulatory frameworks, these often remain disconnected from professional practice unless employees possess the competencies needed to interpret, challenge, and operationalize them [28]. Effective governance thus depends on interdisciplinary competencies, including ethical reasoning, risk awareness, communication, and trust calibration in human–AI collaboration.

3 Research Method

The aim of the study has been to develop recommendations regarding interdisciplinary competencies in the field of artificial intelligence (AI), which are or will become crucial for effective digital transformation across business, scientific, and medical sectors, as well as to formulate guidelines for training systems and programs enabling the acquisition, development, and enhancement of these competencies in professional and organizational practice. The research had a qualitative character, allowing for an in-depth analysis of competencies and attitudes toward AI in the context of real professional processes. The applied research method has been the case study, which - according to classical methodological frameworks [29] [30] - enables the analysis of complex phenomena within their natural organizational context and allows for analytical generalization. The choice of this method has been justified by the interdisciplinary nature of the research problem and the need to understand how professionals from various fields perceive and develop AI-related competencies in their practice. As Repko and Szostak [31] argue, interdisciplinary research requires tools that integrate diverse cognitive and organizational perspectives, making the case

study particularly suitable for analyses at the intersection of technology, education, and ethics.

In this research, the case study method enabled the identification of both common patterns and specific differences in technological, cognitive, and ethical competencies among representatives of four professions: a translator, a medical researcher, an HR director, and an owner of a small or medium-sized enterprise (SME). This selection reflected the assumption that each profession represents a different dimension of AI utilization—cognitive, scientific, organizational, and strategic. The translator symbolizes a knowledge profession where AI supports interpretation and language processing, the medical researcher represents scientific and medical applications, the HR director embodies human management and process automation, and the SME owner reflects innovation and decision-making. As shown by Schleiss et al. [32] and Padovano and Cardamone [33], the case study method makes it possible to understand adaptive processes and the development of AI competencies in real organizational contexts, combining empirical analysis with theoretical reflection on the development of interdisciplinary skills.

The study has been based on the analysis of reports, expert interviews, and observations of AI applications in professional practice, which allowed the identification of competency gaps, attitudes toward technology, and adaptation barriers. According to Krause-Jüttler et al. [34], the case study approach is particularly effective in studying the dynamics of interdisciplinary collaboration, where context and interaction between participants play a key role. Despite its limited generalizability, this method has provided significant insights into the relationships between technology, competencies, and cognitive reflexivity in the context of artificial intelligence. Therefore, it constituted an adequate and theoretically grounded research tool for analyzing digital transformation from the perspective of interdisciplinary competencies.

RQ1. What key competencies are required for the responsible and effective use of AI across different professional contexts?

RQ2. What common competency domains and gaps can be identified across these contexts, particularly in relation to cognitive, ethical, and epistemic dimensions?

4 Research Findings and Interpretation

The main goal of the study is to develop recommendations for interdisciplinary competencies in the field of artificial intelligence (AI) which are or will be essential for effective digital transformation across various sectors (business, science and medicine), along with the formulation of suggestions for training systems and programs that enable the effective acquisition, development, and enhancement of the abovementioned competencies in organizational and professional practice. The recommendations to be presented may support the adaptation of international AI competency frameworks that define the knowledge and skills required in the age of artificial intelligence, such as the UNESCO AI Competency Framework and the OECD & EU AI Literacy (AILit) Framework.

The table below presents the prioritized AI-related competencies identified in the study.

Table 1. Overview of AI – related competencies

Research Areas	Translator	Medical Researcher	HR Director	SME Owner
Core AI Competencies	Knowledge of AI technologies; integration of IT and AI tools; rapid adaptation to new AI technologies.	Data and AI technology fundamentals; understanding the limitations of AI; acceleration of diagnostic and therapeutic processes	Data and AI technology fundamentals; managing AI-driven change.	Data and AI technology fundamentals; strategic understanding of AI in business; productivity enhancement through AI.
AI Tool Proficiency	Ability to use AI-based translation technologies; automation and acceleration of translation processes.	Application of AI in diagnostics and clinical decision-making; AI-based interpretation of test results.	Application of AI in recruitment and selection; automation of HR processes through AI agents; AI-driven employee development personalization.	Automation of business processes through AI agents; AI-supported decision-making, sales, and marketing.
Ethical and Regulatory Competencies	Compliance with AI regulations (GDPR, IP, EU AI Act); ensuring translation data confidentiality; awareness of legal responsibility.	Compliance with AI-related medical ethics and human rights conventions; managing ethical risks; legal responsibility in AI-assisted medicine.	Compliance with AI-related labor laws and GDPR; ensuring algorithmic non-discrimination; transparency in AI-supported HR decisions.	Compliance with EU AI Act and GDPR; managing ethical and reputational risks; minimizing AI hallucinations.
Soft Skills in AI	Team management in translation projects;	Leadership in AI-assisted transformation; fostering	Leadership in AI-driven transformation; facilitating	Leadership in digital transformation; building

	understanding cultural and contextual nuances; specialization in niche domains, critical thinking especially about translation of polysemous elements and culture-specific items	openness to innovation in medicine; critical thinking.	learning and adaptation; motivating employees to creatively use AI.	human–AI collaboration culture; openness to innovation and experimentation with AI.
Required Level of AI Proficiency	Essential: AI ethics and proficiency in using AI-based translation technologies. Not required: advanced technical design or modeling skills.	Essential: medical ethics, responsible AI use, human oversight in AI-assisted decisions. Recommended: AI adoption in clinical practice. Not required: advanced technical modeling.	Essential: ethical and responsible AI use in HR, compliance with GDPR and labor law, human-in-the-loop supervision. Recommended: AI-based skill management and culture change facilitation.	Essential: strategic understanding of AI in business models; ethical and regulatory awareness; human-in-the-loop decision supervision. Recommended : identification of AI use cases and competency management in the AI era.
Emerging AI Competencies	Developing domain-specific glossaries by translators, providing linguistic data for AI applications.	AI-driven transformation shift competencies from manual analysis to time- and cost-optimized diagnostic processes.	AI-driven transformation shift HR from process management to AI implementation, risk management, and change leadership.	AI-driven transformation shift managerial focus from process management to decision-making, risk, and strategic adaptation.

Digital transformation, as defined by Westerman, Bonnet, and McAfee [35] in *Leading Digital: Turning Technology into Business Transformation*, represents a process of comprehensive change in organizational models through digital technology, in which technology acts merely as a catalyst, while success depends on people—their competencies, adaptability, and capacity to learn. The results of this study confirm that cognitive, ethical, and digital competencies are critical in the process mentioned, particularly those related to the understanding and responsible use of AI. The study shows that the role of AI in professional work is increasingly closely connected to understanding its mechanisms, interpreting its outputs, and critically reflecting on their reliability. Both knowledge-based professions and management roles demonstrate that trust in AI systems correlates with cognitive and ethical competencies instead of with technical expertise.

Among translators and physician-researchers, basic AI competencies include familiarity with digital tools and their integration into daily workflows, while the most valued skill is the ability to interpret AI-generated results. Translators reported that AI tools enhance productivity but require contextual and semantic reasoning, while physicians highlighted that AI assists in diagnostics but does not replace expert judgment. These findings affirm that critical thinking remains the most vital skill in professions where AI supports interpretation and analysis.

All respondents emphasized ethical responsibility in AI use, including maintaining human oversight, ensuring data privacy, and preventing algorithmic bias. These findings align with reports from UNESCO [24] and OECD [25], which identify reflective, ethical, and communication competencies as crucial for expert professions.

In management and business roles (HR directors and SME owners), AI is increasingly used for decision support, data analysis, and automation. HR directors identified AI ethics, legal compliance, and transparency as the most indispensable competencies. It has been reported that AI improved analytical processes but stressed the importance of algorithmic fairness. SME owners emphasized strategic understanding of AI and the need for motivation in adopting AI-driven solutions. The study also found that the greatest barrier to AI adoption lies not in technological limitations but in managerial and epistemic skill deficits - specifically, the ability to interpret and supervise AI-assisted decisions.

A major finding of this study is the growing importance of cognitive engineering, encompassing prompt engineering, context engineering, knowledge engineering, and wisdom engineering. Translators and physicians noted that prompt formulation and contextual awareness determine the quality of AI outputs, while managers highlighted the need for knowledge structuring and strategic reasoning. The development of epistemic competency - the ability to distinguish between genuine and statistical knowledge - emerged as a key predictor of responsible AI use.

Overall, four core competency domains have been identified:

1. Strategic understanding of AI;
2. Algorithmic risk management;

3. Data credibility assessment;
4. Reflective decision-making integrating critical thinking.

Across all professions, respondents ranked critical thinking as the most valuable practical competency. This confirms that successful AI use depends less on technological sophistication and more on human ability to interpret, question, and validate AI outputs.

The development of AI competencies contributes to the rise of a new interdisciplinary educational model—the neohumanities of artificial intelligence—which integrates digital humanities, data engineering, and ethical reflection. The model mentioned emphasizes cognitive responsibility, human–technology collaboration, and awareness of AI’s societal implications. It should be developed within technical universities to foster ethical and sustainable design thinking among engineers, and within humanities universities to promote understanding of cognitive, cultural, and social impacts of AI. Both should collaborate on interdisciplinary modules such as AI and Society Labs, Human–AI Communication, and Ethical Design Workshops. Education in the spirit of neohumanistic AI should facilitate shaping reflective professionals—mediators between technology and humanity—capable of co-creating an ethical, sustainable, and knowledge-driven digital future.

5 Conclusions

The study confirmed that AI-driven digital transformation shifts the emphasis from technical to cognitive, critical, and ethical competencies determining the quality of professional decision-making. Across all professional groups - translators, medical researchers, HR directors, and SME owners - critical thinking and interpretative skills emerged as key. AI enhances work efficiency but requires the ability to assess data reliability and to understand technological limitations. Cognitive and reflective competencies dominate in expert professions, while strategic thinking and ethical leadership prevail in business and management. Respondents identified epistemic and managerial competency gaps—not technological barriers - as the main obstacle to effective AI adoption. The study introduced the concept of cognitive engineering (prompt, context, knowledge, and wisdom engineering) as foundational for human–AI collaboration. It also identified the emergence of AI neohumanities - a new interdisciplinary educational paradigm combining digital humanities, data engineering, and ethics.

The “AI neohumanities” paradigm integrates technical skills with humanistic reflection to enable the critical and responsible use of artificial intelligence in complex socio-technical contexts. It is grounded in data engineering and digital humanities, with ethics ensuring that AI systems align with broader societal values such as accountability, transparency, and fairness. It should be emphasized that the success of digital transformation depends not on technological advancement but on the ability to merge technical expertise with humanistic reflection and epistemic responsibility. The identified competency domains can be further contextualized by comparing them with existing Computational Science competency frameworks, which

typically emphasize programming skills, mathematical modeling, data analysis, and high-performance computing. While these frameworks focus primarily on technical and methodological capabilities, the findings of this study highlight a broader competency spectrum that includes cognitive, ethical, and epistemic dimensions of AI use. The overlap is particularly visible in areas such as data literacy and analytical reasoning, which are central to both approaches. However, the present study extends beyond traditional computational science frameworks by emphasizing reflective decision-making, interpretation of AI outputs, and algorithmic accountability. This highlights a shift from purely technical skills toward integrative competencies enabling responsible AI use in complex contexts. The study is limited by its qualitative design, small sample, and lack of generalizability; future research should expand samples, apply quantitative and longitudinal methods, and further develop the concept of AI neohumanities.

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