

# REINTERPRETING DIGCOMPEDU IN HIGHER EDUCATION: ETHICAL CHALLENGES OF GENERATIVE ARTIFICIAL INTELLIGENCE

PATRÍCIA PEREIRA

Instituto Politécnico de Santarém, Escola Superior de Educação,  
Centro de Investigação em Qualidade de Vida (CIEQV), Portugal  
patricia.pereira@ese.ipsantarem.pt | <https://orcid.org/0000-0003-2337-7479>

ANA LOUREIRO

Instituto Politécnico de Santarém, Escola Superior de Educação,  
Centro de Investigação em Qualidade de Vida (CIEQV), Portugal  
ana.loureiro@ese.ipsantarem.pt | <https://orcid.org/0000-0003-1322-3070>

## ABSTRACT

The rapid expansion of Generative Artificial Intelligence (GenAI) is reshaping higher education and challenging established conceptions of educators' digital competence. This article examines the European Framework for the Digital Competence of Educators (DigCompEdu) and its adaptation to higher education, analysing its capacity to address the ethical, pedagogical, and professional implications of GenAI. Adopting a competence-based analytical approach, the study critically explores how generative technologies intersect with the six DigCompEdu competence areas, with particular attention to data protection, human agency, academic integrity, equity, transparency, and sustainability. Drawing on international policy frameworks and scientific literature, the analysis highlights emerging gaps between existing digital competence models and the stochastic, opaque, and transformative nature of GenAI systems. The article argues for a human-centred and ethically grounded reinterpretation of DigCompEdu, capable of supporting responsible, inclusive, and accountable AI integration in higher education teaching and professional practice.

## KEY WORDS

DigCompEdu; higher education; generative artificial intelligence; digital competence; ethics.



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# REINTERPRETAR O DIGCOMPEDU NO ENSINO SUPERIOR: DESAFIOS ÉTICOS DA INTELIGÊNCIA ARTIFICIAL GENERATIVA

PATRÍCIA PEREIRA

Instituto Politécnico de Santarém, Escola Superior de Educação,  
Centro de Investigação em Qualidade de Vida (CIEQV), Portugal  
patricia.pereira@ese.ipsantarem.pt | <https://orcid.org/0000-0003-2337-7479>

ANA LOUREIRO

Instituto Politécnico de Santarém, Escola Superior de Educação,  
Centro de Investigação em Qualidade de Vida (CIEQV), Portugal  
ana.loureiro@ese.ipsantarem.pt | <https://orcid.org/0000-0003-1322-3070>

## RESUMO

A rápida expansão da Inteligência Artificial Generativa (IAGEN) está a reconfigurar o ensino superior, colocando em causa conceções estabelecidas de competência digital docente. Este artigo analisa o Quadro Europeu de Competência Digital para Educadores (DigCompEdu) e a sua adaptação ao ensino superior, examinando a sua capacidade para responder às implicações éticas, pedagógicas e profissionais da IAGEN. Partindo de uma abordagem analítica baseada em competências, o estudo explora a forma como as tecnologias generativas intersectam as seis áreas de competência do DigCompEdu, com enfoque na proteção de dados, agência humana, integridade académica, equidade, transparência e sustentabilidade. Baseando-se em quadros normativos internacionais e literatura científica, a análise identifica lacunas emergentes entre os modelos atuais de competência digital e a natureza estocástica, opaca e transformadora dos sistemas de IAGEN. O artigo defende uma reinterpretação humanista e eticamente fundamentada do DigCompEdu, orientada para uma integração responsável, inclusiva e responsável da IA no ensino superior.

## PALAVRAS-CHAVE

DigCompEdu; ensino superior; inteligência artificial generativa; competência digital; ética.



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# REINTERPRETAR EL DIGCOMPEDU EN LA EDUCACIÓN SUPERIOR: DESAFÍOS ÉTICOS DE LA INTELIGENCIA ARTIFICIAL GENERATIVA

PATRÍCIA PEREIRA

Instituto Politécnico de Santarém, Escola Superior de Educação,  
Centro de Investigação em Qualidade de Vida (CIEQV), Portugal  
patricia.pereira@ese.ipsantarem.pt | <https://orcid.org/0000-0003-2337-7479>

ANA LOUREIRO

Instituto Politécnico de Santarém, Escola Superior de Educação,  
Centro de Investigação em Qualidade de Vida (CIEQV), Portugal  
ana.loureiro@ese.ipsantarem.pt | <https://orcid.org/0000-0003-1322-3070>

## RESUMEN

La rápida expansión de la Inteligencia Artificial Generativa (IAGEN) está reconfigurando la educación superior y cuestionando las concepciones de la competencia digital docente. Este artículo analiza el DigCompEdu y su adaptación a la educación superior, examinando su capacidad para responder a las implicaciones éticas, pedagógicas y profesionales de la IAGEN. Desde un enfoque basado en competencias, el estudio explora cómo las tecnologías generativas intersecan las seis áreas del DigCompEdu, con especial atención a la protección de datos, la agencia humana, la integridad académica, la equidad, la transparencia y la sostenibilidad. A partir de marcos normativos internacionales y literatura académica, el análisis identifica brechas entre los modelos actuales de competencia digital y la naturaleza estocástica, opaca y transformadora de los sistemas de IAGEN. El artículo defiende una reinterpretación humanista y éticamente fundamentada del DigCompEdu, orientada a una integración inclusiva de la IA en la educación superior.

## PALABRAS CLAVE

DigCompEdu; educación superior; inteligencia artificial generativa; competencia digital; ética.



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# Reinterpreting DigCompEdu in Higher Education: Ethical Challenges of Generative Artificial Intelligence

*Patrícia Pereira<sup>1</sup>, Ana Loureiro<sup>2</sup>*

## INTRODUCTION

In contemporary higher education, digital competence has evolved from a peripheral skill into a central driver of institutional and pedagogical transformation (Castañeda et al., 2023). Universities are increasingly expected to respond to complex digital ecosystems that shape teaching, learning, assessment, and academic work more broadly. Within this context, educators are required not merely to operate digital tools, but to integrate them pedagogically, critically and ethically in ways that enhance learning while safeguarding academic values. Responding to this need, the European Commission introduced the European Framework for the Digital Competence of Educators (DigCompEdu) as a scientifically grounded reference model to guide policy development and professional practice across educational sectors (Redecker, 2017). This study contributes to current debates on digital competence and artificial intelligence (AI) in higher education by offering a competence-based ethical reinterpretation of the DigCompEdu framework. By systematically mapping Generative AI (GenAI) related ethical challenges onto the six DigCompEdu competence areas, the analysis moves beyond transversal or tool-centred discussions of AI and provides a structured, framework-aligned lens for understanding institutional and pedagogical implications. In doing so, the article advances a human-mediated approach and governance-oriented reading of DigCompEdu, highlighting the need for its evolution in AI-mediated educational contexts.

This article aims to: (i) analyse the extent to which DigCompEdu addresses the ethical and pedagogical implications of Generative Artificial Intelligence in higher education; (ii) identify the main ethical tensions emerging across the six competence areas of the framework; and (iii) propose a human-centred reinterpretation of DigCompEdu capable of supporting responsible, transparent, and accountable AI integration in university teaching and assessment contexts.

## THE EUROPEAN FRAMEWORK FOR THE DIGITAL COMPETENCE OF EDUCATORS (DIGCOMPEDU)

DigCompEdu was conceived to establish a shared conceptual language and structural logic for defining, comparing, and developing educator-specific digital competences across Europe (Redecker, 2017). Its theoretical foundations rest on a critical synthesis of existing international and national competence frameworks, teacher training

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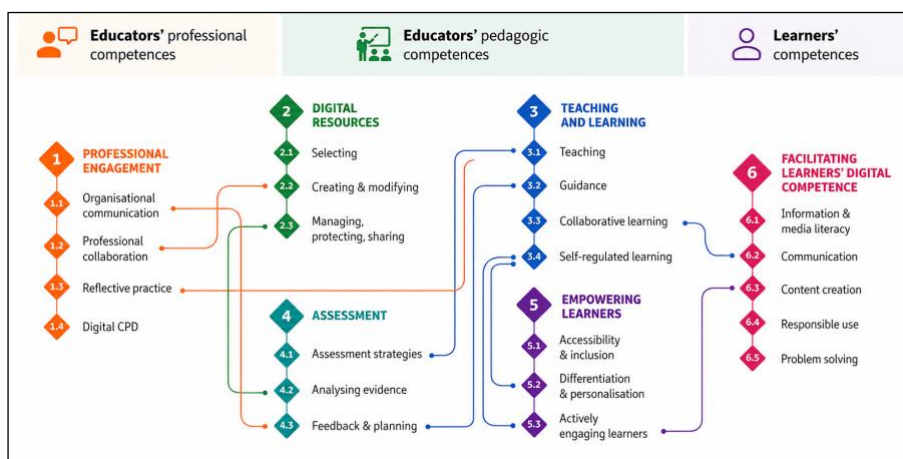
<sup>1,2</sup> Instituto Politécnico de Santarém, Escola Superior de Educação, Centro de Investigação em Qualidade de Vida, Complexo Andaluz, Apartado 131, 2001-902 Santarém, Portugal.



programmes, and self-assessment instruments, ensuring that it reflects the multifaceted nature of contemporary educational practice (Redecker, 2017). DigCompEdu shifts the focus away from instrumental or purely technical skills, emphasising the pedagogical, professional, and ethical dimensions of digital competence. Digital technologies are framed not as ends in themselves, but as means to support inclusive, innovative, and learner-centred education (European Commission, 2022; Redecker, 2017). DigCompEdu is organised into six interrelated competence areas encompassing 22 competences (Figure 1) (Redecker, 2017). Subsequently, each of the competences that structure the DigCompEdu framework is briefly presented.:

- *Area 1: Professional Engagement*, addresses educators' use of digital technologies for communication, collaboration, organisational participation, and continuous professional development.
- *Area 2: Digital Resources*, focuses on the selection, creation, modification, management, and sharing of digital learning materials.
- *Area 3: Teaching and Learning*, constitutes the pedagogical core of the framework, detailing how educators design, implement, and facilitate learning activities through digital means, including guidance, collaboration, and self-regulated learning.
- *Area 4: Assessment*, concerns the use of digital technologies to support formative and summative assessment, analyse learning evidence, and provide feedback.
- *Area 5: Empowering Learners*, emphasises accessibility, inclusion, differentiation, personalisation, and active learner engagement.
- *Area 6: Facilitating Learners' Digital Competence*, specifies how educators enable students to use digital technologies critically, creatively, safely, and responsibly (Redecker, 2017) (Figure 1).

Figure 1  
DigCompEdu competences and their connections



Note: Redecker, 2017, p. 16.

Although DigCompEdu was designed to be applicable across all levels of education, its implementation in higher education requires contextual adaptation. University teaching is characterised by greater learner autonomy, disciplinary diversity, research-informed pedagogy, and complex organisational structures, which motivated the development of higher education-oriented adaptations such as the *Marco de Competencia Digital Docente Universitario* (MCDDU) in Spain (Castañeda et al., 2023). This adaptation preserves the core structure of DigCompEdu while rephrasing descriptors to better reflect academic roles and institutional realities, and integrates elements of the European OpenEdu framework, highlighting open educational practices and resources (Castañeda et al., 2023). However, the adaptation process has revealed important tensions. The validation of the MCDDU identified a tendency towards excessive atomisation of competences, leading to micro-descriptors that may obscure a holistic view of academic professionalism. Moreover, the highly technical and pedagogical language of such frameworks can limit their accessibility and institutional adoption, especially among faculty and decision-makers (Castañeda et al., 2023). These issues underline the need for frameworks that are both rigorous and comprehensible. The rapid emergence of AI, particularly GenAI, has further exposed limitations in traditional digital competence models, which struggle to address the pedagogical, ethical, and professional challenges of AI integration in higher education. In response, the AI Pioneers project developed the Supplement to the DigCompEdu Framework, extending the original model by embedding AI-related competencies across its six areas while preserving its conceptual structure (Bekiaridis & Attwell, 2023). The supplement conceptualises AI not only as a tool but also as an object of critical analysis, emphasising AI literacy, ethical use, data awareness, and pedagogically grounded integration. It defines progressive objectives and proficiency levels, providing a coherent reference for educators' professional development in AI-mediated contexts.

Recent advances in generative systems have created what the United Nations Educational, Scientific and Cultural Organization (UNESCO) terms as “AI overhang”, where technological capabilities evolve faster than pedagogical and regulatory frameworks (UNESCO, 2023a). This has reconfigured the traditional teacher–student relationship into a teacher–AI–student dynamic, reshaping teaching practices and academic workflows (UNESCO, 2024). GenAI now directly intersects with several DigCompEdu areas, particularly Digital Resources and Teaching and Learning, enabling automated content creation and personalised support, but also raising concerns related to data protection, intellectual property, and pedagogical dependence. These developments reveal a structural gap in DigCompEdu, originally conceived for deterministic digital tools rather than stochastic and probabilistic AI systems.

The rapid institutional adoption of GenAI has been intensified by large-scale public and private investment in AI infrastructures and by growing competitive pressures affecting higher education institutions (OECD, 2023; UNESCO, 2023a). Universities are increasingly encouraged to integrate GenAI into teaching, assessment, and administrative processes before their pedagogical and ethical implications are fully understood (European Commission, 2022; UNESCO, 2023a). This context highlights the importance of adopting critical, ethically grounded, and governance-informed approaches to educators' digital competence (Castañeda et al., 2023; UNESCO, 2021).



## ETHICAL CHALLENGES AND GENERATIVE ARTIFICIAL INTELLIGENCE IN HIGHER EDUCATION

This section focuses specifically on ethical challenges associated with teaching, assessment, academic integrity, and learner agency in higher education contexts, rather than on broader societal debates surrounding artificial intelligence.

The widespread availability of generative artificial intelligence (GenAI) has exposed limitations in assessment practices centred on information recall, increasing the relevance of approaches that prioritise critical reasoning, creativity, and human judgement (UNESCO, 2023b). Simultaneously, the growing use of AI in assessment has intensified concerns regarding transparency, algorithmic bias, and accountability, reinforcing the need for educators to retain responsibility for evaluative decisions (European Commission, 2022). From a DigCompEdu perspective, GenAI amplifies ethical challenges related to human agency, equity, and professional integrity, positioning ethics as a transversal dimension rather than a competence-specific issue.

These challenges are particularly evident in DigCompEdu competence 6.4, which concerns the development of learners' digital competence. While GenAI may support learning through personalisation and accessibility, the literature highlights its potential to undermine academic values such as originality, authorship, and honesty (Bittle & El-Gayar, 2025; Bozkurt, 2024). In higher education, GenAI has normalised a dual dynamic in which pedagogical innovation coexists with increased risks of academic misconduct, including the unauthorised generation and reuse of machine-produced content (Bittle & El-Gayar, 2025). Academic integrity emerges as a central concern, as GenAI challenges established assumptions about assessment validity and authorship. In response, institutions increasingly require transparency in AI-assisted work and reaffirm academic responsibility as non-delegable (Peterson, 2025).

Ethical engagement with GenAI is thus framed as a pedagogical issue, demanding the development of digital and academic literacy that promotes critical evaluation rather than unreflective reliance on automated outputs (Bittle & El-Gayar, 2025). Issues of authorship and intellectual property further complicate this context, as AI-generated content does not align with copyright regimes based on human intentionality, making attribution to AI incompatible with academic norms (Bozkurt, 2024). Transparency regarding AI use constitutes a minimum ethical requirement.

Additional concerns include data privacy, algorithmic bias, and equity. Research identifies persistent risks related to the reproduction of social and cultural biases and the dissemination of inaccurate outputs presented with apparent authority (García-López & Trujillo-Liñán, 2025). UNESCO also warns that uncritical reliance on GenAI may erode cognitive capacities and privilege dominant epistemological perspectives (UNESCO, 2021, 2023a). Overall, these issues indicate that promoting learners' digital competence cannot be treated as a purely technical task. While DigCompEdu remains a robust framework, the stochastic and opaque nature of GenAI requires careful reinterpretation, which the following section addresses through a competence-based analysis of its implications for higher education teaching and assessment (UNESCO, 2024).

## METHODOLOGICAL APPROACH

This study adopts a competence-based thematic analysis to examine the relevance and limitations of DigCompEdu in higher education, with a particular focus on the ethical implications of GenAI. The analysis is supported by NotebookLM<sup>2</sup> as an assistive tool for organising and interrogating documentary sources, in line with recent research on the responsible use of GenAI in qualitative analysis (Jenkins et al., 2025; Shor et al., 2025). Rather than a systematic literature review, the study follows a deductive thematic approach, in which each DigCompEdu competence operates as a pre-defined analytical theme, consistent with theoretically driven thematic analysis (Braun & Clarke, 2022).

This design reflects the assumption that the rapid consolidation of GenAI in higher education generates pedagogical, professional, and ethical challenges that must be examined within concrete domains of educators' digital practice, rather than treated as abstract issues (Bekiaridis & Attwell, 2023; European Commission, 2022). DigCompEdu is used as an organising framework that enables ethical concerns to be analysed in direct relation to specific professional competences.

The corpus consists of a purposively selected set of normative and policy-oriented documents, including DigCompEdu (Redecker, 2017), its higher education adaptation (MCDDU) (Castañeda et al., 2023), the DigCompEdu AI Supplement (Bekiaridis & Attwell, 2023), and international guidance on AI and ethics in education from UNESCO, the European Commission, and the OECD (European Commission, 2022; OECD, 2023; UNESCO, 2021). These sources were chosen for their normative authority and direct relevance to educator competence and AI governance.

NotebookLM was used as a structured analytical support tool to map these documents against DigCompEdu's six competence areas and 22 competences, enabling systematic identification and synthesis of ethical considerations related to GenAI within each domain, while maintaining human interpretive control over coding and meaning-making (Bennis & Mouwafaq, 2025; Cevik & Abu-Zidan, 2025). By positioning DigCompEdu as the main analytical framework, the study conceptualises GenAI not as an external disruption, but as a situated ethical and pedagogical challenge embedded in educators' professional practices. Ethical issues such as data governance, transparency, algorithmic bias, academic integrity, assessment, and learner empowerment are thus examined in direct relation to educators' digital competences, aligning with competence-oriented and ethically grounded approaches to AI integration in higher education (OECD, 2023; UNESCO, 2021).

## SELECTION OF DOCUMENTS FOR ANALYSIS

The analysis draws on global and supranational institutions, as the integration of GenAI in higher education is a cross-border phenomenon requiring normative frameworks with international validity. UNESCO, the Organisation for Economic Co-operation and Development (OECD), and the European Commission were adopted as institutional anchors, given their sustained production of pedagogical, ethical, and governance-

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<sup>2</sup> NotebookLM was used exclusively as an assistive tool for organising and systematising documentary sources during the analytical phase. All interpretations, analyses, and conclusions remain the sole responsibility of the authors.



oriented frameworks. These dimensions are increasingly critical as assessment, academic integrity, and equity are exposed to non-transparent uses of generative systems.

Document selection was guided by their relevance to higher education and by three analytical priorities: (a) the reconfiguration of assessment practices beyond information recall, privileging human judgment, creativity, and critical reasoning; (b) the centrality of transparency, bias mitigation, and accountability, while preserving educators' responsibility for evaluative decisions; and (c) the protection of core academic values, including academic freedom, epistemic diversity, and inclusive participation. Together, the corpus enables an integrated analysis of ethical principles, operational guidance, and competence-based approaches, providing a coherent basis for reinterpreting and, where necessary, extending DigCompEdu in response to the stochastic and ethically complex nature of GenAI. This extension is not conceived as a replacement of DigCompEdu, but as a refinement of its human-centred orientation, addressing challenges related to assessment, authorship, accountability, and professional judgment. This analytical move is supported by the MCDDU, a validated higher education adaptation of DigCompEdu (Castañeda et al., 2023), which situates educators' digital competence within university-specific responsibilities and explicitly incorporates ethical use, data protection, academic integrity, and the pedagogical integration of generative tools. The MCDDU thus operates as an intermediary framework, bridging abstract competence descriptors and the concrete demands faced by university educators in AI-rich environments.

The analysis followed a thematic approach (Naeem et al., 2025), using predefined themes to structure engagement with the selected documents. GenAI tools were used as analytical supports for organising and synthesising content, while interpretative authority and theoretical decision-making remained under researcher control. The documents analysed were as follows:

- UNESCO (2021): *Recommendation on the Ethics of Artificial Intelligence*. Establishes a global ethical reference framework for AI, grounded in human rights, justice, non-discrimination, privacy, and human oversight. In higher education, it provides a normative basis for institutional responsibility, governance, bias mitigation, and the protection of academic values.
- European Commission (2022): *Ethical guidelines on the use of artificial intelligence and data in education*. Offers guidance for the responsible use of AI in educational contexts, emphasising transparency, explainability, data protection, equity, and accountability. It is especially relevant to assessment and pedagogical decision-making, reaffirming that educators and institutions must retain control over evaluative processes.
- OECD (2023): *Artificial intelligence in science: Challenges, opportunities, and the future of research*. Provides a policy-oriented analysis of AI across the research cycle, highlighting both productivity gains and risks related to academic integrity, authorship, reproducibility, bias, and dependence on data-intensive infrastructures. It underscores the impact of large language models on research practices, evaluation cultures, and researcher training, and complements competence-based frameworks by situating digital and AI competences within broader institutional and ethical challenges.
- UNESCO (2023a): *Guidance on generative artificial intelligence in education and research*. Focuses specifically on GenAI, translating ethical principles into practical recommendations for institutional policies, academic integrity, and risk management. It addresses limits and safeguards for adoption, with

implications for teacher autonomy, authorship, plagiarism, bias, and knowledge quality.

- UNESCO (2023b): *Generative artificial intelligence and assessment: Challenges and alternatives*. Examines how GenAI undermines recall-based assessment and advocates approaches centred on critical thinking, creativity, problem solving, and human judgement, supporting the reconfiguration of assessment practices in higher education.
- UNESCO (2024): *Competency framework for the artificial intelligence era*. Presents a competence-oriented vision for education in AI-rich contexts, integrating technical, pedagogical, and ethical dimensions. It supports a human-centred operationalisation of educators' digital competence, emphasising agency, critical AI literacy, professional integrity, and inclusion, and serves as a reference for updating DigCompEdu.

## ANALYSIS

To support the systematic organisation, cross-referencing, and comparison of evidence across the 22 DigCompEdu competences, NotebookLM was employed as an auxiliary research support tool during the analytical phase. Its use was deliberately restricted to non-generative, evidence-management functions, namely the organisation, categorisation, retrieval, and comparative inspection of information from the selected documentary corpus. This decision aligns with empirical studies indicating that NotebookLM is reliable for source-bound analytical support, but unsuitable for autonomous interpretation, theory-building, or authorship (Shor et al., 2025).

Unlike open-ended generative models, NotebookLM operates within a closed corpus defined by researcher-uploaded materials, which mitigates risks such as hallucination, unverifiable inference, and epistemic opacity, while enhancing traceability and auditability (Shor et al., 2025). Comparative research further confirms that such tools are best positioned as supports for reading, systematisation, and exploratory synthesis, rather than as agents of conceptual reasoning or scholarly authorship (Cevik & Abu-Zidan, 2025).

Methodologically, the integration of NotebookLM is consistent with AI-assisted qualitative approaches that emphasise structured prompting, iterative refinement, and continuous human oversight (Cevik & Abu-Zidan, 2025). A structured analytical prompt was developed to map GenAI-related ethical issues onto each DigCompEdu competence and refined iteratively through interaction with the tool. Importantly, no automated coding, theme generation, or interpretative synthesis was performed. All analytical decisions remained under explicit human control, in line with reflexive thematic analysis (Braun & Clarke, 2022).

Evidence from comparative studies indicates that, while AI tools may enhance efficiency and internal consistency in early analytical stages, they lack the contextual sensitivity and epistemic accountability required for interpretative work (Bennis & Mouwafaq, 2025; Cevik & Abu-Zidan, 2025). In this study, NotebookLM functioned strictly as instrumental support, not as an analytic agent.

The subsequent sections are organised according to the DigCompEdu framework, progressing from Professional Engagement to Facilitating Learners' Digital Competence. Within each area, the analysis examines how GenAI reshapes practices



related to communication, digital resources, pedagogy, assessment, inclusion, and digital literacy, with particular attention to ethical issues intensified by GenAI, including data protection, accountability, transparency, epistemic bias, academic integrity, inclusion, and sustainability (European Commission, 2022; OECD, 2023; UNESCO, 2021, 2023a, 2023b, 2024). The analysis is not prescriptive, but offers a critical reinterpretation of DigCompEdu in light of AI-driven transformations, reinforcing a human-centred and responsibility-oriented approach to the ethical governance of AI in higher education.

## RESULTS AND DISCUSSION

This section reports the results of a competence-based thematic analysis structured according to the DigCompEdu framework. The analysis was organised around the six DigCompEdu competence areas and their 22 competences, which were used as predefined analytical categories. Ethical issues related to GenAI were identified through the systematic mapping of the selected policy and normative documents onto each DigCompEdu competence. The analytical process involved the identification, classification, and organisation of ethically relevant aspects explicitly addressed in the analysed sources, without applying quantitative weighting or comparative ranking. Results are presented by competence area, following the internal structure of DigCompEdu, from Professional Engagement to Facilitating Learners' Digital Competence. For each area, the results describe the ethical dimensions associated with the integration of GenAI in higher education teaching and professional practice, as documented in the analysed corpus. Interpretation and critical discussion of these results are addressed in the subsequent section.

### RESULTS BY COMPETENCE AREA

#### *Area 1: Professional Engagement*

##### *Organisational Communication*

The use of digital technologies for organisational communication in higher education entails significant ethical challenges when GenAI is integrated into institutional practices. The dissemination of academic resources, procedural guidance, and institutional information through automated systems intensifies concerns related to data protection, privacy, and regulatory compliance, particularly given the large-scale processing of personal and academic data. Within the European context, compliance with the General Data Protection Regulation constitutes an essential ethical requirement for the deployment of GenAI in institutional communication (Castañeda et al., 2023; European Commission, 2022). The use of GenAI to communicate academic regulations, deadlines, or administrative procedures introduces a substantive risk of factual inaccuracies, commonly described as hallucinations. In higher education, such

inaccuracies may directly affect students' academic trajectories and undermine their capacity to make informed decisions (UNESCO, 2023a). Ethical practice requires that responsibility for the accuracy and validity of institutional communication remains with human actors, irrespective of the level of automation involved (UNESCO, 2024). Transparency represents a further ethical imperative. Students and staff must be explicitly informed when institutional communication is generated or mediated by AI-driven systems, such as chatbots or automated advisory tools, to preserve trust and accountability (UNESCO, 2023b). Moreover, the use of GenAI in virtual learning environments raises concerns related to intellectual property and the reproduction of cultural and epistemic biases embedded in training data, which may conflict with higher education's commitment to equity and inclusion (European Commission, 2022; UNESCO, 2023a). Consequently, higher education institutions must ensure continuous human oversight, critical validation of AI-generated content, and clear accountability frameworks in organisational communication practices (Castañeda et al., 2023).

### *Professional collaboration*

The integration of GenAI into professional collaboration in higher education requires a careful re-examination of human accountability and institutional transparency. When academics collaborate through digital platforms on pedagogical or research-related tasks, ethical practice demands that human judgement remains central to all decision-making processes (UNESCO, 2024). The use of automated systems to support collaborative workflows introduces the risk of delegating high-stakes academic decisions to AI systems with limited transparency and explainability, thereby challenging academic autonomy, professional judgement, and institutional accountability (OECD, 2023; UNESCO, 2023b). Educators remain legally and ethically accountable for the outcomes of AI-assisted collaboration and must ensure that such practices do not infringe upon human rights or compromise professional integrity (UNESCO, 2021, 2024). In the exchange and co-creation of knowledge and resources, transparency is essential. AI-generated or AI-assisted content should be clearly identified, as undisclosed use of GenAI undermines trust and may introduce factual inaccuracies or misleading information into shared academic resources (UNESCO, 2023a, 2023b). The collaborative development of educational materials using GenAI also raises concerns related to copyright and intellectual property, given that many systems rely on training data obtained without the consent of the original creators (UNESCO, 2023b). Moreover, uncritical reliance on such tool's risks reproducing social and cultural biases embedded in training datasets, potentially reinforcing exclusion and marginalisation (UNESCO, 2023a, 2024). Finally, excessive dependence on AI-curated professional networks may contribute to the homogenisation of research agendas, limiting epistemic diversity and creative inquiry (OECD, 2023). Ethical collaboration demands continuous critical oversight and a human-centred approach that prioritises diversity, equity, and pluralistic knowledge production (UNESCO, 2023b, 2024).

### *Reflective practice*

Educators must critically evaluate the extent to which the use of tools such as large language models may compromise human agency and instructional autonomy, particularly when automated systems begin to shape pedagogical decision-making



(Castañeda et al., 2023). Excessive reliance on automated content generation poses a risk to the development and maintenance of core cognitive and instructional competencies, potentially leading to a gradual erosion of professional judgement (UNESCO, 2024). Ethical reflective practice demands that professional development initiatives extend beyond technical proficiency to include critical engagement with the ethical implications of prompt design and system use. Without such reflection, GenAI systems may reproduce social and cultural biases embedded in their training data, reinforcing inequities within academic knowledge production (UNESCO, 2023a). Identifying competence gaps also requires recognising the challenges posed by the limited explainability of AI systems, which can compromise the transparency expected in responsible academic practice (Redecker, 2017). Collaboration within higher education institutions is essential to mitigate the risks of digital poverty, as uneven access to advanced GenAI tools may exacerbate existing institutional and regional inequalities (UNESCO, 2023a). When contributing to institutional policies or supporting peers, educators have an ethical responsibility to promote a human-centred approach that prioritises student well-being and the public mission of higher education over commercial imperatives (European Commission, 2022; UNESCO, 2024). This reflective stance is particularly relevant in the context of AI-assisted assessment, where academic integrity must be redefined to emphasize higher-order cognitive skills over tasks easily automated by generative systems (OECD, 2023; UNESCO, 2023a).

#### *Digital Continuous Professional Development (CPD)*

As academic staff increasingly rely on online environments to update subject-specific competencies, they are exposed to AI-generated outputs that may contain fabricated or empirically unfounded information. Without rigorous academic validation, such inaccuracies risk contaminating scholarly discourse and undermining the integrity of scientific knowledge production (UNESCO, 2023b). The identification of appropriate professional learning opportunities also demands critical awareness of cultural and epistemic biases embedded in generative models. These systems frequently reproduce dominant perspectives associated with the Global North, contributing to regional data poverty and reinforcing global inequalities in knowledge representation (UNESCO, 2023b). Digital collaboration within CPD contexts introduces additional ethical concerns related to data privacy and informed consent, particularly when scholarly content is harvested for model training without the authorisation of original creators (UNESCO, 2023b). Educators must navigate the tension between the rapid innovation cycles of the technology sector and the safety-oriented ethical standards that underpin higher education (OECD, 2023). When supporting peers or delivering training, senior academics have a responsibility to identify and mitigate algorithmic discrimination related to gender, race, or disability present in training datasets (European Commission, 2022). Human agency must remain central to CPD frameworks, ensuring that generative technologies support rather than replace professional judgement and accountability (UNESCO, 2023b, 2024). Ethical CPD must also account for the environmental costs associated with training large-scale models, integrating sustainability into institutional strategies for digital growth (UNESCO, 2021, 2023b).

## *Area 2: Digital Resources*

### *Selecting digital resources*

The integration of GenAI into the selection of digital resources for higher education raises significant ethical concerns related to academic integrity, epistemic reliability, and equity. When formulating search strategies, educators must recognise that large language models frequently reflect dominant perspectives associated with the Global North, which may marginalise Indigenous knowledge systems and minority viewpoints, thereby limiting the epistemic diversity essential to university-level education (UNESCO, 2023a). The selection of digital resources is further complicated by the tendency of generative systems to produce hallucinated outputs. These responses often appear authoritative despite lacking factual accuracy. Ethical teaching practice requires rigorous evaluation of resource credibility, distinguishing between peer-reviewed, human-validated scholarship and probabilistic outputs that do not possess genuine understanding or verifiable sources (UNESCO, 2023a). Legal and ethical constraints also play a critical role, as many GenAI systems rely on copyrighted materials used without explicit consent, creating tension between technological efficiency and intellectual property rights (UNESCO, 2023a). Data protection constitutes an additional ethical dimension, particularly within regulatory frameworks such as the General Data Protection Regulation, when institutional or student data are shared with third-party providers (European Commission, 2022). Educators remain accountable for these choices, particularly because many AI systems provide limited explainability. This creates challenges for transparent and responsible pedagogical decision-making (European Commission, 2022; UNESCO, 2024). Finally, the selection of digital resources must prioritize human agency and inclusion, ensuring that AI-mediated materials do not exacerbate digital divides or undermine the development of higher-order cognitive skills through uncritical automation (UNESCO, 2023a, 2024).

### *Creating and modifying digital resources*

When educators adapt or recombine existing resources, the limited transparency of neural network-based systems can constrain the interpretability of AI-mediated modifications, thereby obscuring both the pedagogical rationale and the scientific validity of the resulting materials (European Commission, 2022; UNESCO, 2024). Within this competence area, GenAI reshapes established professional practices by introducing new forms of dependence on data-driven systems, thereby reconfiguring educators' responsibilities in relation to oversight and judgement (UNESCO, 2024). The creation of new digital resources using large language models is particularly affected by the risk of hallucinations, whereby systems generate persuasive but factually inaccurate content. This necessitates rigorous human validation to prevent the dissemination of misinformation within academic contexts (European Commission, 2022; UNESCO, 2023a). Co-creation processes involving students introduce further ethical considerations, especially regarding data protection and the requirement for informed consent before student-generated content is processed by proprietary algorithms (UNESCO, 2023a, 2023b). Adapting digital resources also requires critical attention to algorithmic bias. Training datasets often embed gendered, racial, and cultural asymmetries that may reinforce dominant worldviews and marginalise underrepresented groups if left unexamined (UNESCO, 2021, 2023b). Additionally,



interpreting licensing conditions has become increasingly complex, as existing legal frameworks struggle to define ownership and originality in machine-generated content, raising concerns for academic integrity and intellectual property protection (UNESCO, 2023a, 2023b). Beyond these issues, educators must consider the environmental impact of AI-assisted resource creation, as large-scale model training entails substantial carbon costs that challenge sustainable academic practice (OECD, 2023; UNESCO, 2023a).

### *Managing, protecting and sharing digital resources*

Generative models are often trained on large-scale datasets obtained through automated scraping, frequently without the consent of rights holders, which creates significant risks for copyright compliance and ownership protection (UNESCO, 2023a). Educators bear responsibility for ensuring that shared digital resources do not infringe legal frameworks or undermine institutional intellectual property. Ethical practice requires a strong commitment to human accountability, mandating that all AI-mediated content be systematically audited for factual accuracy and the absence of model-generated errors prior to inclusion in instructional repositories (UNESCO, 2023a). The protection of sensitive student data, including assessment and learning analytics, remains particularly challenging due to the limited transparency of many AI systems, which limits explainability and increases the risk of unauthorised profiling or privacy breaches (Castañeda et al., 2023; UNESCO, 2023a). To address these risks, higher education institutions should adopt secure data governance strategies that enable local data processing while minimising external exposure (OECD, 2023). Additionally, institutions must implement classification and evaluation mechanisms to assess the proportionality and pedagogical appropriateness of AI tools, with particular attention to identifying and mitigating algorithmic biases that may marginalise minority perspectives or reinforce social inequities (UNESCO, 2023a, 2024). The ethical sharing of digital resources must also consider environmental sustainability, as the energy demands associated with training large-scale models contribute significantly to carbon emissions, challenging higher education's commitment to sustainable development (OECD, 2023; UNESCO, 2021). A human-centred approach is essential to ensure that generative technologies support, rather than compromise, ethical knowledge production and academic integrity (UNESCO, 2024).

## *Area 3: Teaching and Learning*

### *Teaching*

The increasing reliance on GenAI within higher education teaching raises significant ethical challenges related to student privacy, data sovereignty, and pedagogical responsibility. The use of digital tools to support instruction requires scrutiny of how GenAI processes user inputs, particularly given the persistent lack of informed consent in data mining practices used for model training (UNESCO, 2024). Ethical teaching practice demands transparency regarding data use and institutional validation of AI tools before their integration into learning environments. When structuring instructional activities that balance teacher-led and student-centred approaches, educators must consider the risk that over-reliance on generative systems may displace human cognitive effort. Such



reliance threatens the development of higher-order intellectual skills and may contribute to the gradual erosion of core academic competencies (UNESCO, 2023a, 2024). Managing interaction and content within digital learning environments requires critical awareness of algorithmic bias, particularly the reproduction of dominant epistemic frameworks embedded in training data, which may privilege Western perspectives at the expense of epistemic diversity (Bender et al., 2021). The ethical use of GenAI in teaching necessitates a human-in-the-loop approach that preserves educator accountability for pedagogical decisions (Castañeda et al., 2023). This reveals a growing tension between pedagogical efficiency and the preservation of human judgement in higher education teaching practices. Pedagogical innovation, including project-based learning involving AI tools, must prioritize human agency and transparency by clearly informing students when they are engaging with machine-generated content and fostering critical evaluation of its accuracy and embedded values (UNESCO, 2023a). Reflective teaching practice should also encompass the environmental implications of AI use, given the substantial energy demands associated with training large-scale models, to ensure that instructional innovation remains socially and environmentally responsible (OECD, 2023; UNESCO, 2024).

### *Guidance*

When academic staff employ digital tools to respond to student queries, the use of large language models for rapid feedback must be balanced against the preservation of meaningful human interaction and the educator's role in fostering higher-order thinking (UNESCO, 2023a, 2024). A significant ethical risk emerges when such systems are perceived as authoritative sources, potentially misleading students who lack the expertise needed to identify inaccuracies or fabricated outputs (UNESCO, 2023a). The use of digital environments to support personalised guidance also raises concerns regarding the delegation of responsibility to algorithmic processes. Excessive reliance on automated scaffolding may weaken learners' capacity for independent reasoning and original knowledge construction, thereby undermining educational autonomy (UNESCO, 2024). In the context of monitoring student progress, the deployment of predictive analytics introduces additional ethical challenges related to privacy, proportionality, and non-discrimination (UNESCO, 2021). Educators must ensure that monitoring practices remain non-intrusive and that algorithms do not reproduce systemic biases or marginalise students from vulnerable groups (European Commission, 2022). Ethical tensions are particularly evident when AI systems identify students as being "at risk," as deterministic interpretations of such profiles may constrain learners' academic trajectories and professional development (UNESCO, 2024). Experimentation with advanced applications, such as AI-based teaching assistants or generative twins, further necessitates an ethics-by-design approach grounded in transparency, respect for intellectual property, and clear human oversight (European Commission, 2022; UNESCO, 2023a). Safeguarding guidance as a human-centred educational practice remains a non-negotiable responsibility within higher education (UNESCO, 2024).

### *Collaborative learning*

The use of GenAI in collaborative learning activities within higher education requires careful ethical scrutiny, particularly regarding human agency and academic integrity. Although these tools can support collaborative knowledge exchange, they risk undermining independent thinking if students rely excessively on machine-generated



consensus rather than peer deliberation and critical dialogue (UNESCO, 2023b). Educators must ensure that collaborative learning designs do not promote the homogenisation of ideas, as generative models tend to privilege dominant perspectives, potentially marginalising minority viewpoints or Indigenous knowledge within group interactions (UNESCO, 2023b, 2024). The monitoring of group processes through AI-supported analytics introduces additional ethical challenges related to data privacy, informed consent, and proportionality. Learning analytics must not expose sensitive student data to commercial exploitation or profiling, nor should they operate beyond clearly defined pedagogical purposes (European Commission, 2022; UNESCO, 2021). The use of GenAI in peer assessment and collaborative presentations further complicates established notions of authorship and intellectual property. Institutions must provide explicit guidance to distinguish authentic student contributions from machine-generated content in order to safeguard the validity of assessment and academic standards (UNESCO, 2023b). A further concern lies in the low-transparency nature of many AI systems, which may embed hidden biases into group decision-making or peer evaluation processes without adequate explainability (Castañeda et al., 2023; UNESCO, 2024). Human oversight remains essential. Educators must be prepared to intervene when algorithmic outputs conflict with inclusive pedagogical values or exacerbate digital divides among students with unequal access to technology (European Commission, 2022; UNESCO, 2024). Ethical deployment of GenAI should ultimately reinforce the social construction of knowledge and the development of critical and reflective thinking, rather than reducing collaboration to automated task execution. (UNESCO, 2023b, 2024).

### *Self-regulated learning*

Although digital tools such as e-portfolios and planning platforms are designed to support autonomy, the incorporation of GenAI risks transferring essential cognitive processes to algorithmic systems (Castañeda et al., 2023). Educators must ensure that AI-driven research advisors or planning tools do not limit students' opportunities to develop independent reasoning and intellectual self-determination (UNESCO, 2023a). A central ethical concern relates to over-reliance on AI-generated outlines and feedback, which may foster "writing without thinking" and undermine the core academic value of original knowledge construction (UNESCO, 2023b). This suggests that self-regulated learning competences increasingly depend on students' capacity to critically mediate AI-generated support rather than merely consume automated guidance. The use of AI as a study companion or personal tutor further introduces risks associated with hallucinations and factually inaccurate outputs that may appear authoritative to learners operating autonomously (UNESCO, 2023b). Addressing these risks requires the development of critical AI literacy, enabling students to interrogate the accuracy, assumptions, and potential biases embedded in machine-generated content before integrating it into self-assessment or learning strategies (Redecker, 2017). The risk of reinforcing dominant epistemic narratives also remains salient, as GenAI tend to reproduce prevailing worldviews present in their training data, potentially marginalising alternative perspectives (UNESCO, 2023a). Moreover, the personalisation of self-regulated learning pathways through data collection raises significant concerns regarding informed consent and data protection, particularly in cross-jurisdictional digital environments (European Commission, 2022). Educators play a crucial mediating role in ensuring that self-regulated learning supported by GenAI enhances intrinsic motivation and human flourishing rather than replacing learner agency (UNESCO, 2024).

Concrete examples of cognitive offloading are increasingly visible in higher education practices. Students may rely on GenAI systems to generate literature reviews, summarise readings, propose research questions, or structure argumentative essays with limited intellectual engagement. Similarly, educators may depend excessively on automated lesson planning, feedback generation, or assessment design. While these practices may increase efficiency, they also risk weakening reflective judgement, disciplinary reasoning, and the development of epistemic autonomy (Bittle & El-Gayar, 2025; OECD, 2023; UNESCO, 2023a, 2024).

#### *Area 4: Assessment*

##### *Assessment strategies*

The increasing use of GenAI in higher education assessment practices raises significant ethical concerns related to human agency, data integrity, and fairness. Monitoring student progress through digital assessment tools requires strict adherence to data protection standards to prevent the reproduction of algorithmic biases or the marginalisation of vulnerable groups (European Commission, 2022; UNESCO, 2024). The use of AI-driven grading or proctoring systems further challenges ethical assessment practice. Such tools may diminish the social and emotional dimensions of learning while transferring accountability for high-stakes decisions to opaque technical systems (UNESCO, 2023b). The integration of GenAI into formative and summative assessment requires transparent and human-accountable practices that prevent algorithmic bias and avoid excessive dependence on automated outputs, preserving students' capacity for interpretation, argumentation, and independent reasoning (Castañeda et al., 2023; UNESCO, 2023b). This competence requires assessment models that privilege interpretation, argumentation, and reflective reasoning over tasks easily reproducible through generative systems. The use of GenAI to scaffold assignments introduces additional risks to academic integrity, requiring clear institutional policies on disclosure, authorship, and intellectual property protection (European Commission, 2022; UNESCO, 2023b). Equitable assessment further depends on the adoption of diverse formats that mitigate digital poverty, as unequal access to advanced GenAI tools may disadvantage students based on socio-economic or geographic factors (UNESCO, 2023a, 2023b). Maintaining meaningful human oversight is critical for detecting inaccuracies or fabricated outputs and for ensuring that assessment technologies are adopted in alignment with pedagogical intent and ethical principles, rather than driven by market considerations (Redecker, 2017; UNESCO, 2024).

##### *Analysing evidence*

The ethical use of evidence-based analysis in higher education requires careful scrutiny of the data-generating processes associated with GenAI. When designing learning activities that produce performance data, educators must prioritize informed consent and transparency regarding the nature, scope, and purpose of the data collected by digital systems (UNESCO, 2023b). The recording and aggregation of student progress through AI-supported tools raises significant concerns related to data protection and the potential commercial exploitation of student-generated intellectual output



(Castañeda et al., 2023). These concerns are amplified by the fact that learner interactions within digital environments generate extensive metadata that often remains invisible to students. Ethical practice demands that institutions uphold the right to an explanation for any pedagogical decisions informed by automated analysis, ensuring accountability and trust (European Commission, 2022). Interpreting educational evidence also requires a critical distinction between authentic cognitive engagement and outputs produced through automation, as conflating the two risks undermining human agency and academic integrity (OECD, 2023). Furthermore, the analysis of evidence must account for biases embedded in profiling and predictive algorithms, which may reproduce or intensify existing social inequalities and disproportionately affect marginalised groups (UNESCO, 2024). To mitigate the limitations associated with the limited transparency of many AI models, educators should combine multiple sources of evidence rather than relying exclusively on automated analytics (OECD, 2023). A human-centred approach to evidence analysis is essential, ensuring that pedagogical responsibility remains with educators and that the apparent precision of AI-generated outputs is not mistaken for genuine scientific understanding or contextual insight into student learning (Castañeda et al., 2023; UNESCO, 2023b).

### *Feedback and planning*

The use of GenAI in feedback and pedagogical planning within higher education raises substantial ethical concerns related to accuracy, bias, and human oversight. As large language models may generate persuasive but factually incorrect feedback, educators must critically verify AI-assisted responses to prevent the dissemination of hallucinated or misleading information (UNESCO, 2023b). The automation of feedback processes through assessment management systems further requires vigilance, as algorithmic outputs may reproduce social and academic inequalities if training datasets lack diversity or embed structural bias (UNESCO, 2024). Privacy and data governance constitute central ethical challenges in the use of digital technologies to monitor student progress. Institutions must ensure that learning analytics practices comply with data protection regulations and that personal data are not processed without explicit informed consent (European Commission, 2022). While AI-generated evidence may inform curriculum planning and instructional adjustments, educators must retain human accountability to ensure that pedagogical decisions are not delegated to black-box systems that lack contextual understanding (Castañeda et al., 2023). The provision of differentiated feedback through GenAI agents also raises concerns regarding the erosion of the social and emotional dimensions of learning and the potential development of student dependency (UNESCO, 2023b). Ethical practice requires that students be supported in critically interpreting AI-generated feedback, fostering reflective engagement and critical reasoning rather than passive acceptance (European Commission, 2022). Moreover, the standardisation inherent in generative models risks marginalising minority perspectives by privileging dominant worldviews. Planning decisions informed by AI must avoid pathologising learners based on biased historical data and remain grounded in inclusive, human-centred educational values (Redecker, 2017; UNESCO, 2024).

## *Area 5: Empowering Learners*

### *Accessibility and inclusion*

Ensuring accessibility and inclusion in higher education requires careful ethical scrutiny of the risks associated with GenAI. Promoting equitable access to digital learning environments demands explicit attention to digital poverty, as reliance on costly proprietary GenAI systems may intensify existing socio-economic inequalities among students (Castañeda et al., 2023; UNESCO, 2023b). Institutional decisions regarding the adoption of such tools must avoid creating barriers for learners with limited access to reliable internet connectivity or personal digital devices (UNESCO, 2023b). Ethical pedagogical practice further requires sensitivity to the many AI systems, which may conceal systemic biases that undermine inclusive education (European Commission, 2022; UNESCO, 2023b). The use of AI-powered assistive technologies introduces additional ethical complexity. While generative systems can support students with special educational needs through personalised interventions (e.g. automated transcription or simplified content), they also carry risks of producing inaccurate or inappropriate outputs that may disproportionately affect vulnerable learners (UNESCO, 2023b). These practices raise serious concerns regarding the processing of sensitive personal data and the adequacy of informed consent in highly complex algorithmic environments (European Commission, 2022; UNESCO, 2021). Inclusive design strategies must involve critical examination of the cultural and linguistic assumptions embedded in training datasets, as many GenAI models reflect dominant Western epistemologies that marginalise minority perspectives or Indigenous knowledge systems (Giannini, 2023; UNESCO, 2023b). A humanistic approach remains essential to preserve educator accountability, ensuring that AI-generated materials are continuously evaluated for bias, accuracy, and pedagogical suitability. Ongoing monitoring is also required to prevent overdependence on assistive technologies that may ultimately hinder the development of critical thinking and independent reasoning (Castañeda et al., 2023; UNESCO, 2024).

### *Differentiation and personalisation*

When digital technologies are employed to address individual learner needs, educators must confront the risk that generative models encode social and cognitive biases that may marginalise students based on socio-economic background or learning profile (UNESCO, 2023a). Personalised learning pathways rely on extensive data processing, which introduces substantial concerns regarding privacy, data protection, and the right to meaningful human intervention in pedagogical decisions (European Commission, 2022). As institutions increasingly adopt AI-driven personalisation strategies, there is a risk that automated systems prioritise efficiency and optimisation over the preservation of human agency. Such practices may narrow students' intellectual experiences and constrain opportunities for exploratory and critical learning (UNESCO, 2023a). Ethical implementation requires transparency regarding the functioning of algorithms that shape individual learning itineraries and clear mechanisms for academic oversight (Castañeda et al., 2023). If GenAI is allowed to define learning objectives or progression without human mediation, they risk undermining both the educator's pedagogical responsibility and the learner's capacity for independent critical inquiry (UNESCO, 2024). These risks are particularly acute in diverse learning contexts, where uncritical reliance



on generative outputs may reinforce stereotypes embedded in training datasets (UNESCO, 2023a). Moreover, differentiation practices must not exacerbate digital divides. Equitable access to high-quality generative tools is a prerequisite for fair personalisation (OECD, 2023). Personalisation strategies must remain grounded in human-accountable frameworks that protect digital rights and support the long-term intellectual development of all learners (Castañeda et al., 2023).

### *Actively engaging learners*

The use of GenAI to actively engage learners in higher education requires careful ethical scrutiny, particularly with regard to epistemic reliability and human agency. While digital technologies are frequently employed to enhance motivation and conceptual understanding, large language models may generate hallucinated or inaccurate content presented as factual, thereby threatening the integrity of the learning process (UNESCO, 2023a). This risk is compounded by the limited transparency of many generative systems, which restricts understanding of how and why specific outputs are produced (UNESCO, 2023a). Placing students' active use of digital technologies at the centre of pedagogy raises further ethical concerns. GenAI must remain a tool that extends human cognition rather than substituting it, as excessive reliance on automated outputs may undermine the development of foundational cognitive abilities, independent reasoning, and critical engagement (UNESCO, 2023a, 2024). Ethical teaching practice requires that engagement-oriented activities encourage questioning, reflection, and evaluation of AI-generated content, rather than passive acceptance. The selection of technologies intended to promote engagement must also consider algorithmic bias. GenAI systems often reflect dominant cultural and epistemic perspectives, which may marginalise disadvantaged groups and reproduce existing inequities (UNESCO, 2023a). Institutional oversight is essential to ensure that data collection practices respect privacy and that engagement strategies do not exacerbate digital divides (UNESCO, 2023b). Educators remain ethically accountable for all pedagogical decisions, ensuring that AI-supported engagement fosters inclusivity, protects learners' intrinsic motivation, and reinforces the social construction of knowledge rather than reinforcing stereotypes or dependency (UNESCO, 2023a, 2024).

## *Area 6: Facilitating Learners' Digital Competence*

### *Information and media literacy*

The increasing presence of GenAI in higher education requires renewed ethical attention to information and media literacy practices. When students identify information needs and navigate digital environments, there is a heightened risk of over-reliance on conversational systems that privilege fluent and persuasive outputs over factual accuracy (UNESCO, 2023a). Such reliance threatens human agency, as learners may accept automated responses uncritically, without engaging in independent reasoning or empirical verification (UNESCO, 2023a). This reveals that information and media literacy can no longer be understood solely as the ability to retrieve information, but also as the capacity to critically interrogate probabilistic and



AI-generated knowledge. Evaluating the credibility of information sources is further complicated by the limited transparency of generative models. These systems often provide insufficient insight into their training data and algorithmic processes (European Commission, 2022). This opacity undermines learners' ability to detect misinformation, disinformation, and deepfakes, which are increasingly used to manipulate public opinion (European Commission, 2022). Ethical teaching practice must emphasize critical interrogation of AI-generated content, particularly given that these systems often reproduce dominant epistemic perspectives while marginalising minority voices due to biases embedded in their training datasets (UNESCO, 2021). The organisation and processing of information through GenAI also raises significant concerns related to data protection and the risk of data poverty. Many tools collect and reuse online data without consent, potentially infringing upon rights such as the right to be forgotten and other international data protection standards (UNESCO, 2023a). Educators have an ethical responsibility to inform students about how their personal inputs may be exploited for model training and commercial purposes. Moreover, unequal access to advanced AI tools risks exacerbating existing digital inequalities, particularly in low-resource contexts (UNESCO, 2021). Information and media literacy must ensure that AI augments human intellectual judgement rather than replacing critical engagement with validated sources and empirical evidence (UNESCO, 2023a).

#### *Digital communication & collaboration*

As educators increasingly mediate interaction through AI-supported platforms, the emergence of a teacher–AI–student dynamic challenges traditional pedagogical relationships and risks weakening authentic human connections (UNESCO, 2024). This concern is heightened by the fact that large language models function as stochastic systems that reproduce linguistic patterns without real-world understanding, increasing the likelihood of disseminating plausible yet incorrect information (UNESCO, 2023b). The sharing of data and scholarly content through AI-mediated environments further introduces ethical challenges related to consent and intellectual property. Many GenAI systems are trained on datasets collected through large-scale web scraping without the explicit authorisation of rights holders, potentially contravening data protection frameworks such as the General Data Protection Regulation (UNESCO, 2023b). Within higher education, this directly affects academic integrity, as collaborative knowledge production supported by AI requires clear attribution practices to preserve originality and research credibility (UNESCO, 2023a). Addressing algorithmic bias is also essential in digital communication and collaboration. Generative models frequently reflect dominant cultural and epistemic perspectives associated with the Global North, which may marginalise minority voices and Indigenous knowledge in academic exchanges (UNESCO, 2023b). Educators must design communication strategies that recognise and mitigate these biases to prevent AI-amplified discrimination (UNESCO, 2024). Additionally, the management of digital identity demands vigilance against deepfakes and unethical manipulation of personal data, while also addressing risks of digital poverty that limit equitable participation. Ethical safeguards are thus necessary to ensure that AI-supported collaboration promotes human flourishing, social justice, and inclusive academic communities (UNESCO, 2024).



### *Digital content creation*

When students are tasked with creating, editing, or modifying digital content, educators must distinguish between authentic knowledge construction and algorithmic synthesis, ensuring that learning activities foster independent reasoning and higher-order cognitive skills rather than automated reproduction (Castañeda et al., 2023; UNESCO, 2023a). Excessive reliance on generative outputs risks undermining learner autonomy and compromising the development of critical intellectual capacities (UNESCO, 2023a). Ethical concerns also arise from the tendency of generative models to reinforce epistemic perspectives while marginalising plural viewpoints or minority voices, which may lead to the homogenisation of academic knowledge (UNESCO, 2023a). Teaching students about copyright and licensing becomes particularly complex in this context, as many generative systems rely on training data used without the consent of original creators. This legal ambiguity challenges established norms of authorship and academic integrity within higher education institutions (UNESCO, 2023a, 2023b). The design of tasks involving computational instructions, such as prompt engineering, further exposes issues of transparency and accountability. The black-box nature of generative models limits learners' ability to understand why specific outputs are produced, constraining critical interpretation and verification (European Commission, 2022; UNESCO, 2023a). Ethical teaching practice must prioritise the critical evaluation of AI-generated content to prevent fabricated information or hallucinations from being accepted as validated academic knowledge. Addressing algorithmic bias is equally essential to ensure that digital content creation supports inclusive and equitable learning environments. Ultimately, generative technologies should enhance human intellectual capability rather than substitute the reflective and critical engagement central to higher education (UNESCO, 2024).

### *Responsible use*

Responsible use of GenAI in higher education requires renewed ethical attention to teacher accountability and student agency. Learning activities designed to promote responsible engagement with AI must prioritize critical evaluation of machine-generated outputs, particularly given the tendency of generative models to reproduce dominant epistemic perspectives and marginalise minority voices (UNESCO, 2023a). Educators face the ethical challenge of encouraging creative exploration of these tools while preventing over-reliance that may weaken foundational intellectual skills and independent reasoning (UNESCO, 2024). Developing students' capacity to identify hallucinations, inaccuracies, and embedded biases is essential to ensure that human determination remains central to knowledge construction (UNESCO, 2023a). This suggests that responsible AI use should be framed as an ethical and epistemic competence rather than merely a technical skill. Institutional compliance with data protection standards constitutes a further ethical requirement. Generative models are often trained on data collected without explicit consent, raising concerns related to privacy, data sovereignty, and the right to be forgotten (UNESCO, 2023a). Educators should support students in understanding the legal and ethical implications of sharing personal information within AI interfaces, including the configuration of privacy settings and responsible data practices (Castañeda et al., 2023). Responsible use also extends to environmental sustainability, as the computational demands of training and operating large-scale models generate significant carbon emissions. Ethical teaching practice should promote awareness of the environmental impact of digital

technologies and encourage sustainable patterns of use (OECD, 2023; UNESCO, 2024). Monitoring student behaviour in AI-mediated environments introduces additional challenges related to academic integrity and surveillance. While detecting AI-assisted plagiarism is necessary, reliance on automated proctoring systems risks reinforcing discriminatory practices (UNESCO, 2023a). Safeguarding learners' social well-being further requires proactive measures against AI-enabled harassment and non-consensual deepfake creation (European Commission, 2022). A human-centred approach remains essential to ensure that the responsible use of AI supports inclusive, ethical, and sustainable higher education practices (UNESCO, 2024).

## CONCLUSIONS

This study examined the implications of GenAI for higher education through a theoretical analysis structured around the six competence areas and 22 competences of the DigCompEdu framework (Redecker, 2017). The findings confirm that DigCompEdu remains a coherent reference for conceptualising educators' digital competence, while also revealing significant tensions when confronted with the ethical and epistemic challenges posed by GenAI. The competence-based structure proved effective for organising and comparing heterogeneous sources, enabling a detailed analysis of how GenAI intersects with professional engagement, pedagogy, assessment, learner empowerment, and digital competence development.

Methodologically, the study illustrates how competence frameworks can be combined with a source-grounded and explicitly human-led analytical process. NotebookLM was used only for document organisation and cross-comparison, supporting consistency and traceability without replacing human interpretation or judgement. This approach aligns with current concerns regarding the limits of AI-assisted qualitative analysis and the need to preserve reflexivity and epistemic responsibility (Braun & Clarke, 2022; Cevik & Abu-Zidan, 2025; Shor et al., 2025).

The study also has clear limitations. As a document-based and theoretical analysis, it does not capture situated practices or disciplinary variability, and competence mapping inevitably simplifies complex pedagogical realities. This points to the need for further empirical research on how educators negotiate ethical, pedagogical, and institutional constraints in concrete AI-mediated contexts.

The analysis indicates that GenAI intensifies pre-existing ethical concerns—such as data protection, intellectual property, transparency, academic integrity, and sustainability—while also raising new questions about human agency, accountability, and governance (European Commission, 2022; OECD, 2023; UNESCO, 2021, 2023a, 2023b, 2024). Although DigCompEdu promotes responsible digital practice, it does not explicitly address how such tensions should be managed in probabilistic and non-transparent AI systems. Rather than offering prescriptive solutions, the study suggests that DigCompEdu would benefit from a more explicit integration of ethical and AI-related dimensions, understood not as additional technical competences but as part of a broader reflection on responsibility, judgement, and institutional governance.

Conceptually, the findings imply that ethics should not be treated as a transversal add-on, but as a constitutive dimension of digital competence itself. DigCompEdu is not rendered obsolete by GenAI, but its continued relevance depends on a shift from a skills-oriented reading towards a governance-aware and responsibility-centred interpretation. More broadly, the study highlights the limits of competence frameworks that remain



disconnected from questions of accountability, academic values, and professional judgement, suggesting that addressing AI in higher education requires rethinking how responsibility, autonomy, and institutional oversight are articulated under conditions of epistemic uncertainty.

Overall, the findings suggest that the reinterpretation of DigCompEdu in higher education should move beyond operational uses of digital technologies and recognise educators as ethical mediators of AI integration. Competence development must include the capacity to critically evaluate AI-generated content, preserve academic integrity, ensure transparent pedagogical decision-making, protect learner autonomy, and address inequalities intensified by data-driven systems. In this sense, ethical responsibility becomes inseparable from digital competence itself, particularly in institutional contexts increasingly shaped by generative technologies.

## DISCLOSURE ON THE USE OF ARTIFICIAL INTELLIGENCE TOOLS

NotebookLM was used solely as an assistive tool to support the organisation, retrieval, and systematisation of documentary sources during the analytical phase. It was not employed for autonomous content generation, theoretical interpretation, analytical decision-making, or article writing. All methodological choices, analyses, interpretations, and conclusions remain the sole responsibility of the authors. Following completion of the final version of the article, a linguistic review was undertaken to ensure clarity, formal accuracy, and compliance with academic writing standards, without any modification to the scientific content.

## AUTHORS CONTRIBUTION

Conceptualization: P. P.; Methodology: P. P.; Validation, P. P. and A. L.; Formal Analysis: P. P.; Investigation: P. P.; Resources: P. P.; Data Curation: P. P.; Writing – Original Draft Preparation: P. P.; Writing – Review & Editing: P. P. and A. L.; Visualization: P.P.; Supervision: A. L.; Project Administration: P. P. All authors have read and agreed to the published version of the manuscript.

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