



The Need for Digital Literacy in Teaching and Learning in Higher Education: A Systematic Literature Review

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Abstract: *The digital transformation of higher education has made digital literacy an essential competence for both educators and students. This systematic literature review synthesizes current research (2022–2025) to examine how digital literacy is conceptualized, developed, and integrated within higher education contexts. Guided by the PRISMA framework, 44 high-impact studies from the Scopus database were analyzed through the proposed Teaching Digital Competences (TDC) Framework, which organizes digital literacy into four dimensions: Digital Knowledge and Access, Pedagogical Design and Innovation, Ethical and Critical Engagement, and Reflective and Adaptive Practice. Findings reveal that while digital competence levels are generally moderate, significant disparities exist across institutional, disciplinary, and socio-economic contexts. Digital knowledge serves as a foundational element, but its effective translation into pedagogy requires intentional instructional design, supportive ecosystems, and ethical considerations. The integration of immersive technologies, AI tools, and collaborative platforms shows strong potential to enhance student engagement and higher-order thinking. However, challenges related to equity, cognitive overload, and ethical use of digital tools remain pressing concerns. The review concludes that sustainable integration of digital literacy demands coherent institutional strategies, contextualized professional development, and a shift toward viewing digital competence as a dynamic, reflective practice rather than a static skill set. This paper contributes a structured framework to guide future research, policy formulation, and pedagogical innovation in digitally evolving higher education landscapes.*

Keywords: *Digital literacy, Digital competence, Higher education, Teaching and learning, Systematic review, TDC framework, Pedagogical innovation, Digital equity*

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1. Introduction

The digital transformation of higher education has fundamentally reshaped how knowledge is created, disseminated, and consumed. Universities worldwide are increasingly expected to equip both educators and students with the digital competences required to thrive in

technology-rich environments. Digital literacy understood as the ability to locate, evaluate, create, and

communicate information through digital technologies has therefore become a prerequisite for effective teaching and learning (Ferrando-Rodríguez et al., 2023; Getenet et al., 2024). However, the accelerated integration of digital tools into pedagogical practice has exposed disparities in skills,

access, and confidence among faculty and students, highlighting the urgent need to conceptualize and strengthen digital literacy within higher education institutions (Akour & Alenezi, 2022; Alam et al., 2023).

During and after the COVID-19 pandemic, the reliance on online and blended learning revealed critical gaps in digital readiness, pedagogical innovation, and institutional support (Meletiou-Mavrotheris et al., 2022; Shohel et al., 2022). Although digital platforms enabled instructional continuity, many educators struggled with adapting pedagogical practices, assessing student outcomes, and maintaining engagement (Grosseck et al., 2023; Loureiro & Gomes, 2023). Similarly, several studies have shown that insufficient digital competence can impede teaching effectiveness, hinder collaborative learning, and reduce student motivation (Getenet et al., 2024; Kwiatkowska & Wiśniewska-Nogaj, 2022). In contrast, targeted interventions such as immersive technologies, e-portfolios, and AI-assisted learning tools have demonstrated positive effects on student engagement and skill acquisition (Cabero-Almenara et al., 2023; Kazanidis & Pellas, 2024; Pospíšilová & Rohlíková, 2023).

Despite the progress in defining and assessing digital competences, inconsistencies remain regarding their dimensions, pedagogical relevance, and institutional implementation. Most higher education institutions adopt frameworks such as DigCompEdu, UNESCO ICT-CFT, or

national digital competence models, yet empirical findings show variations across disciplines, experience levels, and contexts (Guillén-Gámez et al., 2022; Inamorato dos Santos et al., 2023). For instance, while European studies emphasize structured professional development for educators (Gabarda Méndez et al., 2023; Grosseck et al., 2023), research from developing regions highlights infrastructural barriers and the persistence of the digital divide (Alam et al., 2023; Faloye & Ajayi, 2022). This heterogeneity underscores the necessity for a more integrated and context-sensitive model that links digital literacy with teaching effectiveness and learning innovation.

In response, this study proposes a Teaching Digital Competences (TDC) Framework that synthesizes empirical evidence from recent studies to guide digital literacy integration in higher education. The TDC Framework presented in Figure 1 comprises four interrelated dimensions: Digital Knowledge and Access encompassing awareness of tools, platforms, and information management systems necessary for instructional delivery, Pedagogical Design and Innovation focusing on the adaptation of digital tools to construct meaningful, learner-centered experiences, emphasizing responsible digital behavior, data security, and equitable participation, and Reflective and Adaptive Practice involving continuous evaluation of digital strategies, feedback mechanisms, and capacity for self-directed professional learning.

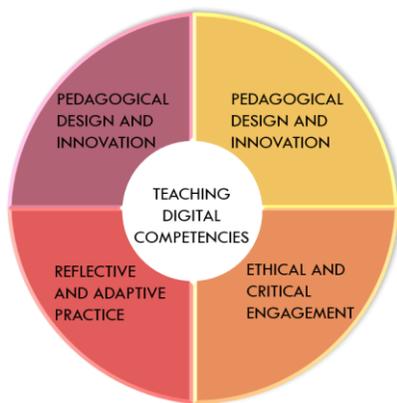


Fig 1: Teaching Digital Competencies (TDC) Framework

This framework recognizes digital literacy not merely as a technical skill but as an evolving pedagogical competence

essential for sustainable teaching and learning. It aligns with the broader agenda of promoting inclusive, flexible,

and innovation-driven higher education capable of responding to global technological shifts.

Therefore, the objective of this review is to synthesize current research on digital literacy and teaching competences in higher education, identify existing challenges and gaps, and propose future directions for research and policy. Specifically, it seeks to answer the following research questions

RQ1: How is digital literacy conceptualized and operationalized in higher education contexts?

RQ2: What are the key factors influencing the development of digital competences among educators and students?

RQ3: How does digital literacy contribute to teaching effectiveness, learning engagement, and academic performance?

RQ4: What institutional strategies and frameworks support the sustainable integration of digital literacy in higher education?

2. Literature Review

The evolution of digital literacy in higher education has gained increasing scholarly attention, especially as global shifts toward digital transformation reshape pedagogical practices, institutional strategies, and learner engagement. Existing literature consistently emphasizes that digital literacy extends beyond basic ICT skills to encompass cognitive, socio-technical, ethical, and pedagogical dimensions necessary for effective participation in technology-enhanced learning environments. Across contemporary studies, the concept of digital literacy is framed as a dynamic competence that evolves alongside technological innovations, requiring continuous adaptation by both educators and students.

2.1 Conceptualizing Digital Literacy in Higher Education

Researchers generally define digital literacy as the ability to locate, evaluate, create, and communicate information through digital tools and platforms (Getenet et al., 2024). However, recent studies highlight that this competence must be situated within specific teaching and learning contexts to be meaningful. Frameworks such as DigCompEdu, UNESCO ICT-CFT, and national digital competence models provide structured approaches for assessing digital skills, yet empirical findings reveal significant variation in how digital literacy is

conceptualized and operationalized across regions, disciplines, and experience levels (Guillén-Gámez et al., 2022; Inamorato dos Santos et al., 2023). This has led to calls for more context-sensitive models that capture the pedagogical realities of higher education.

2.2 Digital Knowledge, Skills, and Access

A substantial body of literature indicates that digital knowledge serves as the foundation upon which all other aspects of digital competence are built. Studies show that both students and teaching staff often demonstrate moderate levels of digital skills, but disparities persist due to socio-economic background, institutional support, and disciplinary differences (Silva-Quiroz & Morales-Morgado, 2022). Teacher focused studies similarly reveal gaps between self-reported digital confidence and actual competence, particularly in advanced areas such as data analytics, assessment technologies, and adaptive learning systems (Guillén-Gámez et al., 2022). These findings highlight that access to digital tools alone does not guarantee competence; effective support, training, and contextual practice remain essential.

2.3 Pedagogical Integration and Innovation

The literature emphasizes that digital literacy becomes pedagogically meaningful when it informs instructional design and fosters innovative teaching practices. Evidence suggests that digitally competent educators are more likely to adopt learner centered approaches, utilize collaborative platforms, integrate AI tools, and engage students in higher order thinking tasks (Gumbi et al., 2024; Josephine et al., 2023). Emerging technologies such as Virtual Reality (VR), immersive simulations, and AI-supported learning environments show strong potential to enhance engagement and motivation, though concerns around cognitive overload and uneven digital readiness persist (Antón-Sancho et al., 2022; N. Zhang & Henderson, 2015). Several researchers argue that sustainable innovation depends not only on individual teacher skills but also on supportive institutional ecosystems, including policies, infrastructure, and leadership commitment (Bucea-Manea-Țoniș et al., 2022).

2.4 Ethical and Critical Dimensions of Digital Literacy

A growing stream of research highlights the ethical and critical aspects of digital competence. The digital divide

remains a persistent challenge, with inequalities in access, affordability, and digital support disproportionately affecting marginalized learners (Faloye & Ajayi, 2022; Gan & Sun, 2021). Ethical concerns also emerge with the increasing integration of AI and digital feedback systems. Studies show that learners with limited digital literacy may rely uncritically on automated tools, raising concerns about data privacy, algorithmic bias, and academic integrity (Z. (Victor) Zhang & Hyland, 2025). Scholars call for embedding digital citizenship and ethical awareness into curricula to promote responsible, critical, and equitable use of digital resources in higher education.

2.5 Reflective and Adaptive Digital Practice

Recent literature also shows the importance of reflective and adaptive practice as a core element of digital literacy. Reflective digital competencies enable both educators and students to evaluate their digital strategies, monitor learning progress, and adjust to evolving technological demands (Kleimola & Leppisaari, 2022; Scheel et al., 2022). Learning analytics, e-portfolios, and digital self-assessment tools have been found to enhance metacognitive skills and support continuous professional growth (Cisneros-Barahona et al., 2023; Pospíšilová & Rohlíková, 2023). At the institutional level, the adoption of reflective cycles such as regular technology audits, training evaluations, and participatory feedback systems contributes to improved digital readiness and organizational adaptability (Guillén-Gámez et al., 2022).

3. Methodology

3.1 Research Design

This study employed a Systematic Literature Review (SLR) methodology, guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. The purpose of this review was to systematically identify, evaluate, and synthesize existing research related to digital literacy, digital competence, and ICT-enabled teaching and learning within higher education. This design was selected to ensure transparency, reproducibility, and comprehensive coverage of relevant literature. The Teaching Digital Competences (TDC) Framework developed in this study served as the analytical lens, linking empirical findings to conceptual dimensions of digital competence in teaching and learning.

3.2 Data Source and Search Strategy

The data for this review were obtained exclusively from the Scopus database due to its extensive coverage of high-quality, peer-reviewed literature across education, social

sciences, and computer science. The search strategy employed a Boolean combination of keywords to capture studies focused on digital literacy within higher education contexts. The exact search string used was:

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(TITLE-ABS-KEY ("digital literacy" OR "digital competence" OR "digital skills" OR "ICT literacy")) AND (TITLE-ABS-KEY("higher education" OR "university" OR "tertiary education" OR "college students" OR academia)) AND (TITLE-ABS-KEY(teaching OR learning OR pedagogy OR instruction OR curriculum))
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This query initially retrieved 4,159 results. To refine the dataset and ensure relevance, a sequence of filters was systematically applied within Scopus. The publication period was first restricted to 2022–2025, yielding 2,546 results. The subject area was then limited to Computer Science, reducing the count to 959 papers. Further narrowing by document type to articles only resulted in 419 studies, and filtering by publication stage to include only final publications produced 409 results. Subsequently, keyword refinement was applied using terms such as Higher Education, Digital Literacy, Digital Competency, E-Learning, Digital Skills, University Students, Engineering Education, and Higher Education, which reduced the dataset to 289. Restricting the source type to journals produced 288 papers, and limiting the language to English resulted in 240 studies. Finally, to ensure scholarly impact and methodological robustness, all papers with fewer than 15 citations were excluded, leaving a final corpus of 44 high-impact articles for in-depth analysis.

3.3 Inclusion and Exclusion Criteria

The inclusion and exclusion criteria were designed to ensure that only relevant, high-quality studies were retained for analysis. Studies were included if they were published between 2022 and 2025, written in English, and explicitly focused on digital literacy, digital competence, or ICT skills in the context of higher education. Only peer-reviewed journal articles were considered, and the content had to address teaching, learning, or pedagogical integration of digital technologies. Conversely, studies were excluded if they focused on K–12 education, non-empirical work, conference proceedings, or editorials, or if the full text was unavailable. Duplicates identified across filtering stages were also removed. This systematic screening process ensured that the final dataset represented a balanced and credible selection of contemporary academic work in digital literacy.

3.4 Study Selection Process

The selection process followed the four stages of the PRISMA protocol: identification, screening, eligibility, and inclusion. During the identification stage, 4,159

records were retrieved through the search strategy. Titles and abstracts were screened to eliminate irrelevant records, resulting in 959 retained studies. Full-text screening of eligible papers was then conducted, with 409 studies assessed for relevance and methodological soundness. After applying the inclusion and exclusion criteria, a total

of 44 studies were selected for final synthesis. This multi-stage process provided a transparent and replicable pathway from initial retrieval to the final selection, ensuring that only studies meeting the defined criteria were analyzed.

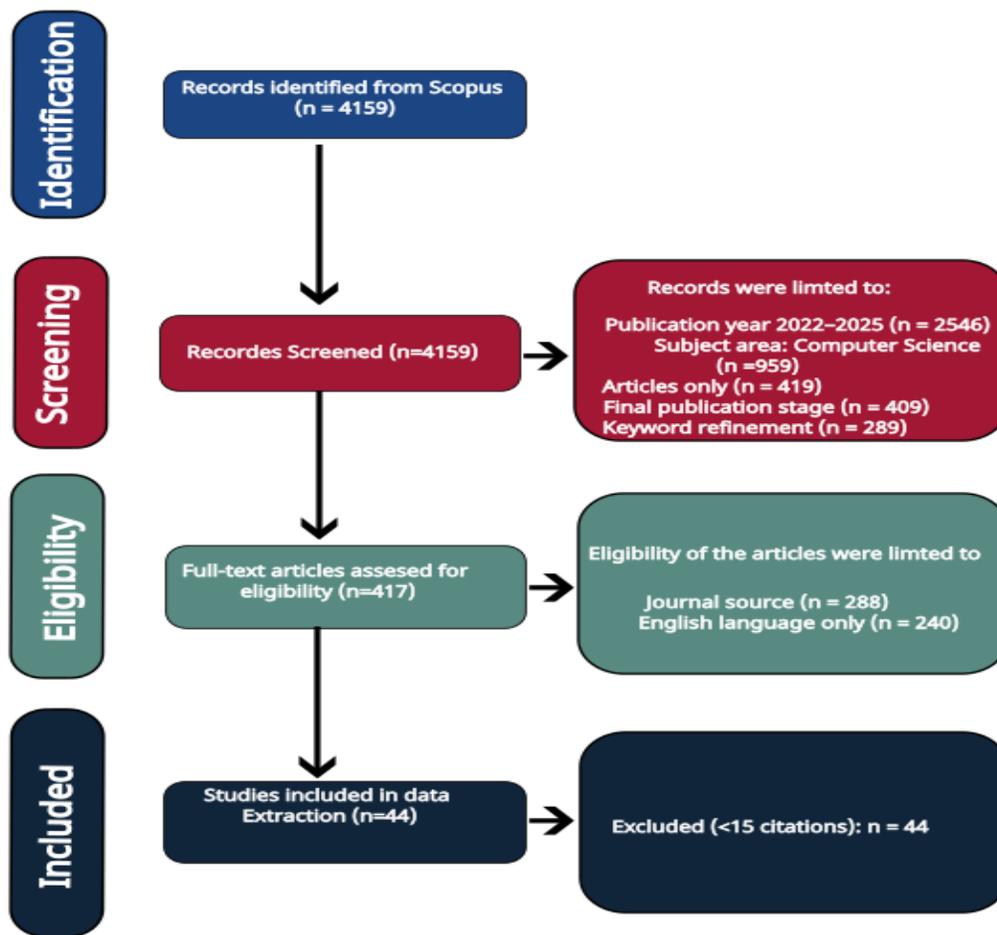


Fig 2: Teaching Digital Competencies (TDC) Framework

3.5 Data Extraction and Coding

Data extraction was carried out manually using a structured Excel matrix. For each of the 44 selected studies, essential bibliographic and methodological information was recorded, including author(s), year of publication, geographical region, research design, population group, theoretical framework, and main findings. The extracted data were subsequently coded according to the four dimensions of the TDC Framework—namely, Digital Knowledge and Access, Pedagogical Design and Innovation, Ethical and Critical Engagement, and

Reflective and Adaptive Practice. This coding process ensured that each study’s contribution could be analyzed in relation to the conceptual dimensions of teaching digital competences. The structured coding facilitated both thematic synthesis and quantitative mapping of research patterns across the selected literature.

3.6 Data Analysis and Synthesis

The analysis of the selected studies followed a qualitative thematic synthesis approach aimed at identifying patterns, similarities, and divergences across the literature. Each article was read in full and subjected to open coding to

capture significant concepts and evidence related to digital literacy and its pedagogical implications in higher education. Codes were progressively refined and grouped into higher-order categories through constant comparison and axial coding. Themes emerging from this process were then organized to reflect the main conceptual areas addressed across the reviewed studies.

To ensure analytical rigor, coding was conducted iteratively and verified through repeated cross-checking of extracted data. Relationships among themes were examined to trace how digital literacy has been defined, applied, and evaluated across different institutional and disciplinary contexts. The synthesis focused on drawing coherent interpretations from the evidence base rather than on quantifying occurrences, allowing for a nuanced understanding of how digital competences are being integrated into teaching and learning in higher education.

3.7 Quality Assessment and Reliability

To ensure methodological reliability and data validity, all included studies were sourced from peer-reviewed journals indexed in Scopus. The citation threshold of 15 citations or more served as an additional quality assurance measure to prioritize studies with demonstrated academic impact. Data extraction and coding were verified through repeated cross-checks to maintain consistency and reduce potential bias. Where necessary, disagreements in coding interpretation were resolved through discussion and re-evaluation. This rigorous quality assurance procedure enhanced the reliability and transparency of the synthesis.

4. Results and Discussion

The analysis of the forty-four selected studies directly responds to the research questions guiding this review. The four dimensions of the Teaching Digital Competences (TDC) Framework collectively address these questions, providing a coherent structure for interpreting the evidence. **RQ1** and **RQ2** are concerned with the conceptualization and development of digital literacy. These two are reflected in the findings on Digital Knowledge and Pedagogical Design. **RQ3**, which examines the influence of digital literacy on teaching effectiveness and engagement, is evident across Pedagogical Design and Reflective Practice. **RQ4**, focusing on institutional strategies and future directions, is captured in the Ethical and Adaptive dimensions. This correspondence demonstrates that the TDC Framework provides an effective analytical structure for synthesizing diverse research and for explaining how digital competence underpins contemporary higher education teaching and learning.

4.1 Digital Knowledge and Access

Digital knowledge is the cornerstone of digital competence and underpins all other forms of technological engagement in higher education. Across the reviewed literature, a consistent pattern emerges: students and teachers possess moderate levels of digital literacy but with significant contextual disparities. For instance, (Silva-Quiroz & Morales-Morgado, 2022) conducted a large-scale assessment among Chilean pre-service teachers and found that digital competence levels were intermediate, with gender and geographical location significantly influencing performance. Similarly, (Ben Youssef et al., 2022) revealed that while students' ICT knowledge positively correlated with academic performance, institutional training interventions had minimal impact due to the absence of practical alignment with students' learning needs. These studies collectively emphasize that digital knowledge acquisition is uneven and remains heavily dependent on institutional context and socio-economic background.

Teacher-focused studies similarly highlighted the centrality of digital knowledge for pedagogical efficacy. (Guillén-Gámez et al., 2024) and (Barzabal et al., 2022) demonstrated that although teachers report frequent use of ICT tools, their skills are predominantly concentrated on information access and presentation, with limited ability in data analysis, assessment, or adaptive feedback systems. (Cisneros-Barahona et al., 2023) expanded this view through a Delphi study that identified training, mentorship, and peer support as critical to developing sustainable digital competences among university educators. Likewise, (Sarva et al., 2023) found discrepancies between students' and institutional leaders' perceptions of teacher digital readiness, illustrating the gap between self-reported and objectively observed competences.

At the institutional level, (Kabakus et al., 2025) revealed that staff members' digital literacy significantly influences their intention to adopt new technologies, primarily through perceived effort expectancy and performance expectancy. Their findings align with (Antón-Sancho et al., 2022), who observed that digitalization has become more evenly distributed across teaching, tutorials, and assessment since the pandemic, though certain disciplines especially the humanities still lag behind technical fields. The convergence of these results suggests that digital knowledge functions as an ecosystemic competency encompassing students, teachers, and administrative personnel each contributing to the broader institutional digital culture.

Furthermore, (Vodá et al., 2022) and (García-Prieto et al., 2022) argued that digital literacy should not be seen merely as a technical skill but as an academic capital shaping

intellectual participation in modern higher education. Students who demonstrate digital fluency also display greater self-regulated learning and cognitive adaptability. Both of the studies reinforced this by showing that digital knowledge mediates innovation and creativity, enabling learners to connect technological resources with disciplinary expertise. Collectively, the literature affirms that digital knowledge development is a strategic necessity, and higher education institutions must transition from sporadic training to comprehensive capacity-building programs emphasizing contextual practice, infrastructure, and digital inclusivity.

4.2 Pedagogical Design and Innovation

The second dimension of the TDC framework emphasizes how digital literacy translates into pedagogical design and innovative teaching. The reviewed studies position pedagogical innovation as the transformative driver of digital education, where learning design determines the pedagogical value of technology integration. (Joseph et al., 2024) analyzed relationships between digital literacy, peer-supported collaborative learning, and AI-assisted education. Their findings established a strong positive correlation, showing that students with higher digital competence exhibit stronger collaborative behaviors and acceptance of AI tools. Similarly, (Gumbi et al., 2024) used the Technology Acceptance Model (TAM) to examine pre-service teachers' perspectives on digital game-based learning (DGBL) in STEM education. The study confirmed that perceived ease of use and usefulness significantly predicted positive attitudes towards DGBL, thereby reinforcing the potential of game-based pedagogies in developing problem-solving and critical thinking skills.

Pedagogical innovation is also closely tied to AI, VR, and digital simulation tools. (Antón-Sancho et al., 2022) compared digital natives and digital immigrants in their use of Virtual Reality (VR) for higher-education learning. The results revealed higher competence, motivation, and engagement among digital natives, yet also noted concerns about distraction and cognitive overload. In contrast, (Zhang & Hyland, 2025) and (Bucea-Manea-Țoniș et al., 2022) reported that AI integration enhances inclusivity and learning personalization but also challenges educators to redesign their pedagogical models to avoid algorithmic dependence. (Sun et al., 2022), adopting Biggs's 3P learning framework, found that information literacy and quality-oriented knowledge sharing predict innovation performance among postgraduate students, thereby demonstrating how digital competence functions as a predictor of learning creativity.

Studies by (Tzafilkou et al., 2022) and (García-Prieto et al., 2022) García-Prieto et al. (2022) emphasized the need for standardized instruments for measuring pedagogical digital

competence. Tzafilkou and colleagues validated a multidimensional scale including online collaboration, digital communication, and ethical awareness, while the study (García-Prieto et al., 2022) revealed that teachers with stronger digital competence are more likely to engage in creative research and instructional innovation. These findings reinforce that pedagogical design is not just about technology adoption but intentional structuring of digital experiences that promote higher-order thinking and collaboration. (Joseph et al., 2024) further found that integrating digital tools in project-based learning leads to deeper engagement, as technology mediates both knowledge construction and self-reflection.

Moreover, (Bucea-Manea-Țoniș et al., 2022) argued that innovative pedagogies require a supportive institutional ecosystem, including leadership, digital policy, and funding for infrastructure. Without these enabling conditions, technology adoption remains superficial and fragmented. (Zhang & Hyland, 2025) also cautioned that innovation should not come at the expense of cognitive overload; pedagogical innovation must align with students' cognitive readiness and disciplinary context. Therefore, sustainable pedagogical innovation depends on coherence between technological tools, instructional design, and institutional strategy recurring conclusion across the reviewed studies.

4.3 Ethical and Critical Engagement

The third thematic area addresses the ethical, responsible, and critical dimensions of digital literacy. A significant but often underemphasized dimension of digital competence concerns the ethical, equitable, and critical use of technology. (Gan & Sun, 2022) explored digital barriers experienced by marginalized students during the COVID-19 pandemic and identified five types of inequality: technological access, affordability, digital literacy, institutional support, and social capital. Their findings demonstrate that despite rapid digitalization, educational inequities persist, leading to unequal learning opportunities. (Niu et al., 2022) extended this analysis by demonstrating that surface learning approaches increase technostress, whereas deep learning approaches enhance digital competence and emotional well-being. This suggests that ethical engagement is linked not only to digital policy but also to cognitive and emotional learning strategies.

Ethical engagement also involves the critical evaluation of digital feedback systems and AI-driven platforms. (Zhang & Hyland, 2025) investigated students' interactions with Automated Writing Evaluation (AWE) feedback systems and found that digital literacy strongly predicts students' ability to evaluate, interpret, and apply feedback effectively. Those with low literacy often relied mechanically on AWE recommendations, illustrating the

ethical risk of uncritical dependency on automation. In parallel, (Ben Youssef et al., 2022) and (Bucea-Manea-Țoniș et al., 2022) discussed the ethical implications of AI integration, highlighting issues of data privacy, algorithmic transparency, and academic integrity. They argued for institutional frameworks that embed digital ethics in both policy and curriculum to ensure responsible technology use.

Several studies also addressed digital well-being and psychological sustainability as ethical concerns. (Sarva et al., 2023) and (Antón-Sancho et al., 2022) observed that prolonged engagement with digital systems without sufficient emotional support leads to burnout and reduced creativity. Institutions must therefore adopt digital health and ethics frameworks that promote responsible screen time, cyber safety, and critical reflection on digital consumption. (Guillén-Gámez et al., 2022) further noted that while educators recognize the importance of digital ethics, few receive structured training on its implementation. This gap reveals the necessity of embedding digital citizenship education into teacher training programs.

Finally, the ethical dimension of digital transformation extends to institutional responsibility. Studies by (Cisneros-Barahona et al., 2023) and (Barzabal et al., 2022) emphasize that universities must establish guidelines and accountability mechanisms for the ethical use of digital resources, particularly in assessment, data analytics, and student monitoring. Ethical and critical engagement thus moves beyond individual behavior to institutional culture. Integrating equity, transparency, and inclusivity in digital policies will ensure that technology serves as a tool for empowerment rather than exclusion.

4.4 Reflective and Adaptive Practice

Reflective and adaptive practice represents the capacity of learners and educators to self-assess, adapt, and evolve within dynamic digital environments. (Kleimola & Leppisaari, 2022) found that reflective competence, self-awareness, and agency are among the most crucial future skills, with learning analytics serving as a catalyst for reflection and metacognition. Students using analytics dashboards developed greater self-regulation and were able to track their cognitive growth more effectively. (Scheel et al., 2022) added that digital learning acceptance is significantly influenced by students' self-organization and independence, and those who cultivate reflective habits exhibit lower resistance to digital transformation.

(García-Prieto et al., 2022) and (Guillén-Gámez et al., 2022) highlighted the connection between reflection, research productivity, and creativity. Teachers who engage in reflective digital practices report higher adaptability and

are more likely to implement innovative instructional approaches. Similarly, (Cisneros-Barahona et al., 2023) demonstrated through Delphi consensus that mentorship, feedback loops, and continuous professional support foster reflective digital competence among educators. These insights suggest that reflection is both a personal and collective mechanism that transforms digital competence into a dynamic, evolving process.

Post-pandemic studies such as (Antón-Sancho et al., 2022) and (Barzabal et al., 2022) showed that universities have increasingly embedded reflective digital practices into institutional strategies. Teachers began using e-portfolios, virtual reflections, and digital journals to assess pedagogical effectiveness and student engagement. (Zhang & Hyland, 2025) also found that digital tools supporting self-assessment and peer evaluation improve learners' metacognitive skills, thus enabling adaptive learning. Collectively, these findings underscore that reflection and adaptation form the bridge between competence and transformation, ensuring that digital learning ecosystems remain sustainable and responsive.

Moreover, reflective and adaptive practices are foundational for institutional learning. (Ben Youssef et al., 2022) and (Guillén-Gámez et al., 2022) noted that higher-education institutions that institutionalize reflective cycles—through data-informed teaching evaluations, regular technology audits, and participatory feedback—demonstrate higher adaptability and innovation capacity. Such organizations transform digital feedback into organizational learning, positioning themselves as learning institutions in the digital age. Therefore, adaptive practice represents the iterative alignment of pedagogy, technology, and institutional policy to evolving educational realities.

5. Conclusion and Recommendations

5.1 Conclusion

This systematic literature review has synthesized current research to address the critical need for digital literacy in higher education teaching and learning. In response to the identified gaps in conceptualization and implementation, the study proposed the Teaching Digital Competences (TDC) Framework, comprising four interconnected dimensions: Digital Knowledge and Access, Pedagogical Design and Innovation, Ethical and Critical Engagement, and Reflective and Adaptive Practice.

The analysis of 44 high-impact studies demonstrates that digital literacy is not merely a technical skill but a foundational pedagogical competence. Key findings indicate that while moderate levels of digital competence

exist, significant disparities persist across contexts, influenced by institutional support, socio-economic factors, and disciplinary backgrounds. Pedagogical innovation, particularly through AI, VR, and collaborative digital tools, shows strong potential to enhance engagement and higher-order thinking when intentionally designed. Furthermore, the ethical and critical dimensions of digital literacy are paramount to ensuring equitable access, protecting well-being, and fostering responsible technology use. Finally, reflective and adaptive practices at both individual and institutional levels are essential for sustaining digital transformation and aligning technological integration with evolving educational needs.

5.2 Recommendations

This review underscores that a holistic, institution-wide strategy is required to move beyond sporadic training toward embedding digital literacy as a core component of academic culture. Future research should focus on developing context-sensitive assessment tools, longitudinal studies on competency development, and scalable models for professional development that bridge the gap between digital policy and classroom practice.

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