European International Journal of Pedagogics (ISSN: 2751-OOOX)

Received: 26 May 2026 | Accepted: 24 June 2026 | Published: 17 July 2026

DOI: 10.55640/eijp-06-07-06

RESEARCH ARTICLE

Didactic Opportunities for Developing Digital Literacy and Information Competence of University Students in The Context of The Digital Transformation of Higher Education

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VOLUME: Vol.06 Issue07 2026

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Abstract

This article presents a systematic literature review and theoretical-analytical synthesis of the didactic opportunities available for developing digital literacy and information competence among university students under conditions of accelerating digital transformation of higher education. Rather than reporting new primary data, the study synthesizes converging evidence from ten peer-reviewed and internationally recognized sources in order to build an integrative didactic model; its contribution is analytical and synthetic rather than experimental. The relevance of the problem is determined by the growing gap between the volume of digital information students must process and the level of methodological support that universities currently provide for forming the skills required to search, evaluate, create, and ethically use digital content. The purpose of the study is to identify and systematize, through explicit thematic coding of the reviewed literature, the didactic conditions, methods, and organizational forms that most effectively contribute to the development of students' digital literacy and information competence within the educational process of a higher education institution. As a result, the article substantiates a structural-didactic model comprising four interrelated components - cognitive-informational, technological-operational, communicative-collaborative, and value-reflective - derived from a transparent coding of the source literature, and describes the pedagogical conditions, active learning methods, and assessment tools that support their formation. The synthesis indicates that the systematic, cross-curricular integration of information-literacy tasks, combined with mediated self-regulated learning activities and structured formative feedback, is associated with measurably stronger gains in students' digital competence than isolated, short-term training interventions reported in the reviewed studies. The practical significance of the research lies in the possibility of using the proposed model and its didactic toolkit for the design of university curricula, elective modules, and teacher-training programs aimed at strengthening students' readiness for professional activity in a digitalized information environment; empirical validation of the model within a specific institutional setting remains a task for future research.

KEYWORDS

Digital literacy, information competence, didactics, higher education, digital competence framework, university students, self-regulated learning, digital transformation of education.

INTRODUCTION

The rapid digitalization of social, economic, and educational processes has fundamentally changed the nature of the competencies that a modern university graduate must possess. Information is no longer scarce; rather, it is abundant, fragmented, and frequently unreliable, which places a growing burden on the individual's ability to search for, critically evaluate, structure, and ethically use digital information [9]. According to the 2023 Global Education Monitoring Report, digital inequality in education remains substantial worldwide: only 40 per cent of primary, 50 per cent of lower-secondary, and 65 per cent of upper-secondary schools are connected to the internet, which means that many students enter higher education with markedly uneven levels of prior digital preparedness [10]. Under these conditions, the university is compelled to assume a compensatory and formative didactic function, deliberately building digital literacy and information competence rather than assuming that students acquire them spontaneously through everyday technology use.

Digital literacy and information competence are closely related but not identical constructs. Digital literacy is commonly understood as the awareness, attitude, and ability of an individual to appropriately identify, access, manage, integrate, evaluate, analyse, and synthesize digital resources in order to construct new knowledge and communicate with others in specific life situations [9]. Information competence, in turn, denotes the more specific ability to determine an information need, locate and access relevant sources, critically appraise their quality, and use the information ethically and effectively for a defined academic or professional purpose [2]. The European Digital Competence Framework for Citizens (DigComp 2.1) operationalizes these constructs through five interrelated competence areas: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving [8]. This structure demonstrates that information competence functions as the foundational layer upon which the remaining digital competencies are built, which justifies treating the two constructs jointly within a single didactic model.

The pedagogical significance of the problem is confirmed by numerous empirical studies. A systematic literature review of studies conducted between 2010 and 2021 found that university-based digital-literacy interventions for future teachers most frequently target digital writing and reading, database use, digital content design, and the editing, publishing, and sharing of materials, and that virtually all reviewed interventions also measured students' perceived and developed self-efficacy as an inseparable companion construct of digital literacy [1]. Likewise, a systematic review covering 38 studies published between 2014 and 2024 shows a steady increase in scholarly attention to pre-service teachers' digital competence, with the Technological Pedagogical Content Knowledge (TPACK) framework emerging as the most widely used theoretical lens, and highlights those studies increasingly integrate this framework with complementary models to enrich both conceptual grounding and practical applicability [4]. These findings indicate that digital literacy and information competence in higher education are studied predominantly in relation to teacher training, leaving a comparative gap in didactic models addressed at the general university-student population regardless of specialization, which the present article seeks to help close.

Despite the wide recognition of the problem, three unresolved didactic contradictions can be identified in the current state of research and practice. First, there is a contradiction between the declarative inclusion of digital competencies in educational standards and curricula, and the fragmented, short-term, extracurricular character of the actual training interventions through which these competencies are supposed to be formed [1, 4]. Second, a contradiction exists between the multidimensional nature of digital literacy - encompassing technical, cognitive, communicative, and ethical dimensions - and the still-dominant, narrowly technical approach to teaching it as a set of software skills [3]. Third, there is a contradiction between the proven mediating role of psychological variables such as self-efficacy and self-regulation in translating digital literacy into academic and professional outcomes, and the limited attention that didactic design pays to cultivating these variables deliberately [5, 7]. Resolving these contradictions requires a structural-didactic model that integrates content, method, and assessment into a coherent, cross-curricular system.

Accordingly, the purpose of this article is to substantiate the didactic conditions, methods, and organizational forms that support the systematic development of digital literacy and information competence among university students, and to propose an integrated structural-didactic model suitable for implementation across different fields of study. The objectives

of the research were: (1) to analyse and systematize contemporary theoretical approaches to the concepts of digital literacy and information competence in higher education; (2) to identify the didactic conditions and active learning methods empirically associated with stronger gains in students' digital and information competence; (3) to design a structural-didactic model reflecting the interrelated components of digital literacy formation; and (4) to formulate practice-oriented recommendations for its implementation in the educational process of a higher education institution.

The theoretical significance of the study consists in clarifying the relationship between digital literacy and information competence as partially overlapping but analytically distinguishable constructs, and in demonstrating how internationally recognized reference frameworks - in particular the five-area DigComp structure and the UNESCO Digital Literacy Global Framework - can be operationalized within a unified didactic model rather than treated as parallel, competing classification systems [8, 9]. Whereas digital literacy is typically defined broadly, as the combination of awareness, attitude, and ability required to work with digital resources across the full spectrum of communicative, creative, and problem-solving tasks, information competence is more narrowly focused on the specific skills of identifying an information need and locating, evaluating, and ethically using relevant sources [2, 9]. Understanding information competence as the foundational, entry-level layer of the broader digital-literacy construct allows didactic designers to sequence instruction logically, beginning with information-search and evaluation skills before progressing toward more complex tasks of digital content creation, collaborative knowledge-building, and reflective digital citizenship.

The practical relevance of the problem is amplified by the specific conditions of contemporary university learning environments, in which lecture attendance is increasingly supplemented, and in some contexts substituted, by learning management systems, open educational resources, and artificial-intelligence-assisted search and writing tools. In such environments, a student's capacity to distinguish reliable from unreliable digital information, to attribute sources correctly, and to use digital tools purposefully rather than passively is no longer a peripheral "soft skill" but a core determinant of academic success and, ultimately, of professional employability [5, 6]. This reinforces the need for a didactic model that is not confined to a single introductory course but is embedded as a continuous, developmental thread throughout the entire period of university study.

2. Materials and Methods

The study employed a theoretical-analytical design based on a systematic review and comparative-pedagogical analysis of scientific literature and international policy documents concerning digital literacy, digital competence, and information literacy in higher education. The literature search was conducted in the Web of Science, Scopus, and Frontiers full-text databases, as well as in the repositories of UNESCO and the European Commission, using combinations of the keywords "digital literacy," "information literacy," "digital competence," "didactic model," and "higher education." The inclusion criteria were: (a) publication between 2017 and 2026; (b) explicit focus on university students or pre-service teachers as the target population; (c) availability of a described intervention, framework, or empirical measurement instrument; and (d) publication in a peer-reviewed journal or an internationally recognized policy report. Sources associated with retracted publications or unverifiable authorship were excluded from the analysis.

Ten sources meeting these criteria were selected for in-depth analysis: five empirical studies reporting quantitative or mixed-methods interventions [1, 5, 6, 7, and a related systematic review, 4]; one qualitative-conceptual analysis clarifying the relationship between digital competence and information literacy [2]; one theoretical framework paper proposing a multidimensional model of teacher digital competence [3]; and three international policy and standard-setting documents establishing reference frameworks for digital-literacy assessment [8, 9, 10].

The analytical procedure comprised four stages, adapted from established systematic-review protocols. In the first stage, each of the ten sources was independently coded against a fixed coding scheme comprising three fields: (a) the digital-literacy dimension(s) it substantively addressed, classified into the four categories used throughout this article (cognitive-informational, technological-operational, communicative-collaborative, value-reflective); (b) the study design or document type (systematic review, quantitative/mixed-methods intervention, conceptual-analytical paper, or policy framework); and (c) the principal outcome or claim reported by the source that bore on didactic practice. The resulting coding matrix, presented in Table 1, is reproduced in full so that the basis for every claim made in the Results section can

be traced back to a specific, identifiable source rather than to an unstated aggregation. In the second stage, a comparative-content analysis was performed across the coded matrix to identify converging findings and gaps in the pedagogical conditions associated with successful competence formation. In the third stage, the coded data were synthesized into the structural-didactic model presented in Section 3 (Table 2), expressing the interrelationships among the four identified components. In the fourth stage, the model was translated into concrete didactic recommendations - content, methods, forms of organization, and assessment tools - suitable for integration into the university educational process.

Table 1. Source coding matrix underlying the thematic synthesis

Source Digital-literacy dimension(s) coded Design / document type Principal outcome informing the synthesis

[1] Gutiérrez-Ángel et al. (2022) Technological-operational; value-reflective Systematic review (2010-2021) Interventions pair technical-skill training with self-efficacy development

[2] Mbandje, Loureiro & Lucas (2023) Cognitive-informational Conceptual-analytical review Information literacy is a foundational subset of digital competence

[3] Falloon (2020) All four (framework) Theoretical framework paper Digital competence is a composite of knowledge, skills, and dispositions

[4] Zhang, Yang & Zheng (2026) Technological-operational Systematic review (2014-2024) TPACK is the dominant framework; integration with other models is increasing

[5] Zakir et al. (2025) Value-reflective Quantitative (SEM), n = students, Indonesia Digital literacy affects performance via self-efficacy and informal learning

[6] Jian, Zou & Mahadi (2025) Communicative-collaborative Mixed-methods intervention, n = 44, China Short, gamified social-media tasks raise digital literacy and career competence

[7] Trixa & Kaspar (2024) Cognitive-informational Quantitative, n = 371, Germany Self-efficacy in information assessment predicts teaching-competence perception

[8] Carretero, Vuorikari & Punie (2017) All four (framework) Policy framework (DigComp 2.1) Five-area competence structure for citizens

[9] Law et al. (2018) Cognitive-informational Policy framework (UNESCO DLGF) Multidimensional definition of digital literacy

[10] UNESCO (2023) Value-reflective (context) Policy report (GEM Report) Persistent global disparities in digital-infrastructure access

Note: Table compiled by the author from the coding of the ten reviewed sources described above; it is reproduced here in full for methodological transparency and does not represent original empirical data collected by the author.

Given the theoretical-analytical nature of the study, no primary human-subject data were collected; the analysis relies exclusively on previously published, peer-reviewed, and policy-level sources. The reliability of the synthesis was ensured through cross-referencing of findings across independent studies conducted in different national contexts (Spain, Portugal, Germany, Indonesia, China, New Zealand, and multinational European samples), which allowed conclusions to be verified against converging rather than isolated evidence.

An additional methodological safeguard concerned the verification of source integrity. During the search process, one widely cited article on digital didactics was identified as having been formally retracted by its publishing journal following an investigation into fraudulent, paper-mill-associated authorship practices; this source was consequently excluded from the analysis despite its topical relevance, and its removal was cross-checked against the retraction notice issued by the journal's editorial board. This step illustrates the broader methodological principle applied throughout the study: preference was given to sources indexed in internationally recognized databases (Web of Science, Scopus) and to policy documents issued by recognized international organizations, since these sources undergo formal peer review or institutional vetting processes that increase the reliability of the resulting synthesis.

The comparative-pedagogical analysis itself followed the logic of thematic synthesis common in educational systematic reviews: rather than merely summarizing each source in isolation, the analysis searched for convergences and divergences across studies conducted with different

populations (in-service and pre-service teachers, general undergraduate students, doctoral students), different methodologies (systematic literature reviews, structural equation modelling, mixed-methods intervention studies, and conceptual-analytical papers), and different national education systems. This cross-population, cross-methodological triangulation was considered essential given that the ultimate purpose of the study was not merely descriptive but generative - namely, the construction of a structural-didactic model intended for practical application across a variety of institutional contexts, including university settings where digital-literacy instruction is not yet formally embedded in the curriculum.

3. Results

The comparative analysis of the selected sources allowed four interrelated structural components of university students' digital literacy and information competence to be identified.

The first component, cognitive-informational, concerns the ability to formulate an information need, search across heterogeneous digital and traditional sources, and critically evaluate the reliability of information. Empirical data show that pre-service teachers most frequently rely on general source verification and comparison of multiple sources when assessing the reliability of online information, yet a smaller share of respondents apply deeper evaluative strategies such as checking the scientific grounding or authorship credentials of a source, and perceived competence in teaching information literacy correlates significantly with self-efficacy in information assessment [7]. Passive instruction alone therefore appears insufficient for this component; what the evidence points to instead is structured, repeated practice in source evaluation embedded within disciplinary coursework.

The second component, technological-operational, covers the practical skills of searching databases, managing digital tools, and creating and editing digital content. A review of empirical interventions conducted with future teachers between 2010 and 2021 found that the competencies most frequently targeted include digital writing and reading, use of academic databases, digital design of content and materials, and the skills to edit, publish, or share such materials on the web, and that virtually every intervention paired these technical skills with the deliberate development of students' perceived and actual self-efficacy [1]. Read together with the cognitive-informational findings above, this points to a pattern rather than an isolated result: the technological-operational component functions most effectively when it is not taught on its own but is systematically linked to affective-motivational support.

The third component, communicative-collaborative, reflects the ability to interact, share, and co-create knowledge through digital channels. An intervention study involving Chinese undergraduates found that a short, gamified, one-month engagement with structured social-media tasks produced significant gains in digital literacy, professional skills, and career competence, and that digital literacy was itself a strong predictor of subsequent professional-skill development, suggesting that purposeful, collaborative digital-media engagement, rather than incidental use, drives competence gains [6]. The communicative-collaborative component, in other words, appears to respond most strongly to structured, task-based instructional design rather than to unstructured exposure to social platforms.

The fourth component, value-reflective, encompasses the ethical, critical, and self-regulatory dimensions of digital behaviour, including data safety, source attribution, and reflective self-assessment. Structural equation modelling of Indonesian university students demonstrated that digital literacy significantly predicts digital informal learning, self-efficacy for online learning, and overall digital competence, and that these variables jointly and significantly mediate the relationship between digital literacy and academic performance [5]. Read alongside the other three components, this places the value-reflective and self-regulatory dimension in a distinct role: not simply one competence among four, but the mechanism through which the other three are converted into measurable academic outcomes.

Beyond these four components, the analysis identified a set of cross-cutting didactic conditions that recur across the reviewed sources as prerequisites for effective competence formation:

1. Integration into disciplinary content rather than delivery as a stand-alone technical course, since digital and information competencies are most durably formed when practiced within authentic subject-matter tasks [2, 3]. 2. Combination of structured, scaffolded activities (activation of prior knowledge, modelling, guided practice) with autonomous, self-regulated tasks, which together support the transfer of digital skills into independent academic work [1]. 3. Use of active and gamified methods of engagement, which the reviewed intervention data associate with stronger and more sustained gains than

passive lecture-based instruction [6]. 4. Deliberate cultivation of self-efficacy and reflective self-assessment as psychological mediators, since digital competence gains are consistently linked to parallel gains in learners' confidence and self-regulation [5, 7]. 5. Application of internationally validated competence frameworks - most notably the five-area DigComp structure (information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving) - as an organizing scaffold for curriculum design and assessment [8]. 6. Systematic assessment using standardized instruments rather than ad hoc questionnaires, since studies that relied on validated scales produced more comparable and reliable evidence of competence gains than those using informally constructed measures [1].

Table 2 summarizes the four structural components, their defining characteristics, and the didactic methods most strongly associated with their formation according to the analysed sources.

The analysis further revealed that the four components are not independent of one another but form a developmental sequence in which mastery of earlier components creates the conditions necessary for progress in later ones. The cognitive-informational component, involving the identification of information needs and the critical evaluation of sources, functions as the entry point of the sequence, since without reliable evaluative skills students are unable to select trustworthy material for use in subsequent content-creation or collaborative tasks [2, 7]. The technological-operational component builds directly upon this foundation, translating validated information into digitally created or edited academic products, and empirical evidence shows that these two components are typically developed together within the same instructional interventions rather than sequentially separated in practice [1]. The communicative-collaborative component extends this process outward, requiring students to share, discuss, and co-construct knowledge using validated information and self-produced digital content within social or academic digital environments [6]. Finally, the value-reflective component operates as a regulatory layer that accompanies and, according to the reviewed structural-equation evidence, substantially amplifies the effects of the preceding three components on measurable academic outcomes such as course performance and perceived professional readiness [5].

This developmental interdependence has an important didactic implication: instructional sequences that attempt to develop communicative-collaborative or value-reflective competencies before students possess adequate cognitive-informational and technological-operational foundations are likely to produce superficial rather than durable competence gains. Conversely, instructional sequences that dwell exclusively on early-stage information-search and technical skills without ever advancing to collaborative, reflective, and creative tasks risk producing technically capable but under-motivated and insufficiently critical digital users. The structural-didactic model therefore recommends a spiral, rather than strictly linear, curricular design, in which all four components are revisited at increasing levels of complexity across successive years of study, with the relative instructional weight gradually shifting from foundational skill-building toward autonomous, reflective, and collaborative application.

Component Defining characteristic Recommended didactic methods Key sources

Cognitive-informational Formulating information needs; searching and critically evaluating sources Source-verification exercises; comparative source analysis; guided database research [2, 7]

Technological-operational Digital reading/writing, database use, content creation and editing Project-based digital content creation; database training; scaffolded skill-building modules [1, 3]

Communicative-collaborative Interaction, sharing, and co-creation of knowledge through digital channels Gamified collaborative tasks; social-media-based learning projects; peer feedback platforms [6]

Value-reflective Ethical use, safety, self-regulation, and reflective self-assessment Reflective journals/e-portfolios; self-efficacy-building feedback; formative self-assessment rubrics [5, 7]

Table 2. Structural components of digital literacy and information competence — author's synthesis derived from the thematic coding presented in Table 1

4. Discussion

The results obtained confirm and extend previous theoretical accounts of digital competence as a multidimensional rather than a purely technical construct. The Teacher Digital Competency framework proposed by Falloon conceptualizes digital competence as a composite of knowledge, skills, and

dispositions that must be integrated across professional, pedagogical, and technical domains rather than treated as a narrow set of software proficiencies [3]. The structural-didactic model developed in this article is consistent with that theoretical position: each of the four components identified - cognitive-informational, technological-operational, communicative-collaborative, and value-reflective - corresponds to a distinguishable set of knowledge, skill, and dispositional elements, and none of the reviewed empirical studies reported durable competence gains from interventions that addressed only one of these dimensions in isolation.

This structural correspondence is not incidental. The DigComp 2.1 framework's five areas - information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving - map closely onto the four components identified in this study, with information and data literacy corresponding to the cognitive-informational component, communication and collaboration corresponding to the communicative-collaborative component, digital content creation corresponding to the technological-operational component, and safety together with elements of problem-solving corresponding to the value-reflective component [8]. This convergence between an empirically derived structural model and an independently developed, policy-level reference framework strengthens confidence that the four-component structure reflects a genuine underlying organization of digital competence rather than an artifact of the particular sample of studies analysed.

A particularly important finding concerns the mediating role of psychological variables. Structural equation modelling evidence shows that digital literacy affects academic performance not directly but through the mediating chain of digital informal learning, self-efficacy for online learning, and digital competence itself [5]. This is consistent with findings from information-literacy research showing that pre-service teachers' perceived competence in teaching information literacy is closely tied to their self-efficacy in information assessment [7]. Taken together, these findings suggest that didactic interventions focused exclusively on technical skill transmission are likely to under-perform relative to interventions that simultaneously build learners' confidence, autonomy, and reflective capacity. This has direct implications for curriculum design: information-literacy and digital-literacy modules should incorporate explicit opportunities for guided self-assessment and formative feedback, rather than relying solely on summative technical testing.

The comparative analysis also highlights an important methodological lesson. The systematic review of interventions between 2010 and 2021 found that many studies suffered from small or non-representative samples and relied on ad hoc, non-standardized instruments, which limits the comparability of their findings [1]. Studies that instead used validated scales - such as recognized digital-literacy or information-literacy assessment instruments - produced more robust and generalizable evidence, which is why university-level assessment practices are best aligned with internationally validated frameworks such as DigComp 2.1: its five clearly operationalized areas provide both a common language for curriculum design and a basis for standardized measurement [8].

The finding that short, purposefully structured, gamified interventions can produce measurable gains in digital literacy and career competence within a single month [6] is also pedagogically significant, as it challenges the assumption that meaningful competence development requires lengthy, semester-long courses. However, this result should be interpreted cautiously: the intervention in question was implemented with a relatively small sample and focused on a specific, culturally situated context, and the durability of the reported gains beyond the immediate post-intervention period was not established. A more measured reading, then, is that short, intensive interventions work best as a complement to, rather than a replacement for, sustained, cross-curricular integration of digital-literacy tasks throughout a degree program.

An additional theoretical contribution of this study lies in clarifying the relationship between digital competence and information literacy, two terms that are frequently used interchangeably in the literature despite denoting related but distinct constructs. The systematic literature review by Mbandje, Loureiro, and Lucas confirms that information literacy should be understood as a specific subset of the broader digital-competence construct, focused on the skills of accessing, evaluating, and using information effectively, while digital competence additionally encompasses communication, content creation, safety, and problem-solving [2]. This distinction has direct didactic implications: courses aiming to develop information competence should be explicitly designed as a foundational layer within a broader digital-literacy curriculum, rather than as an equivalent or substitute for it.

Finally, the analysis of policy-level sources shows that persistent global disparities in digital-infrastructure access continue to shape the starting conditions under which university-level digital-literacy instruction must operate. With well under two-thirds of upper-secondary schools worldwide connected to the internet as of the most recent monitoring data [10], universities cannot assume a uniform baseline of digital preparedness among incoming students. Consequently, any didactic model for developing digital literacy and information competence in higher education must include a diagnostic-adaptive stage capable of identifying and addressing gaps in students' prior digital experience before advancing to discipline-integrated, higher-order tasks.

Based on this discussion, the following practice-oriented recommendations can be formulated for the design and implementation of university-level digital-literacy instruction:

1. Conduct a diagnostic assessment of students' baseline digital and information competence at the start of a degree program, using a validated instrument aligned with an internationally recognized framework such as DigComp 2.1 [8]. 2. Integrate digital-literacy and information-competence tasks into disciplinary coursework across the curriculum, rather than confining them to a single stand-alone module [2, 4]. 3. Combine scaffolded, structured practice with autonomous, self-regulated learning tasks, gradually shifting responsibility from instructor-guided to student-directed activity [1]. 4. Employ active, collaborative, and where appropriate gamified instructional methods, supported by structured formative feedback that explicitly targets learners' self-efficacy [5, 6, 7]. 5. Institutionalize reflective self-assessment tools, such as digital portfolios or reflective journals, as a means of developing the value-reflective component of digital competence [5]. 6. Provide continuous professional development for faculty, since teachers' own digital competence directly shapes their capacity to model and scaffold these skills for students [3, 4].

It is also necessary to acknowledge the limitations of the present analysis. First, because the study is theoretical-analytical rather than empirical, the structural-didactic model proposed here has not yet been tested through a controlled pedagogical experiment; its validity rests on the convergence of findings from independently conducted studies rather than on original primary data collected by the author. Second, the reviewed empirical sources originate from a limited set of national contexts - primarily Spain, Portugal, Germany, Indonesia, and China - and while the recurrence of similar patterns across these diverse settings strengthens confidence in the generalizability of the findings, cultural and institutional differences in digital infrastructure, curricular traditions, and student demographics may moderate the effectiveness of specific didactic methods in other contexts, including in Central Asian higher-education systems. Third, several of the reviewed intervention studies were based on comparatively small samples, which constrains the strength of causal claims that can be drawn regarding the precise magnitude of competence gains attributable to particular methods [1, 6]. These limitations point to a clear direction for subsequent empirical research: the pilot implementation and controlled evaluation of the proposed structural-didactic model within specific national and institutional settings.

Notwithstanding these limitations, the convergence of evidence across independent studies conducted in markedly different educational systems - from teacher-training programs in Southern Europe to gamified social-media interventions in East Asia and structural-equation analyses of academic performance in Southeast Asia - lends considerable weight to the four-component structural model proposed in this article. The consistency with which self-efficacy, reflective self-regulation, and cross-curricular integration emerge as decisive success factors, regardless of the specific technological tools or national context involved, suggests that these are not merely local pedagogical preferences but structural features of how digital and information competence are formed in adult learners more generally [1, 5, 6, 7]. This cross-contextual consistency is precisely what justifies proposing the model as a general didactic framework rather than as a context-bound recommendation applicable only to the settings in which the underlying studies were conducted.

Conclusion

The analysis conducted in this article confirms that digital literacy and information competence constitute a multidimensional, didactically formable construct rather than a set of skills students acquire automatically through everyday technology use. Four interrelated structural components were identified - cognitive-informational, technological-operational, communicative-collaborative, and value-reflective - each requiring distinct but interconnected didactic support. The comparative analysis of empirical and policy sources demonstrates that the most effective didactic conditions for developing these components include cross-curricular

integration rather than isolated instruction, a balanced combination of scaffolded and autonomous learning tasks, the use of active and collaborative methods, the deliberate cultivation of learners' self-efficacy and reflective capacity, and reliance on internationally validated competence frameworks and assessment instruments.

The proposed structural-didactic model offers universities a coherent basis for redesigning curricula, elective modules, and faculty-development programs aimed at strengthening students' readiness to operate effectively, critically, and ethically within a digitalized information environment. Future research should focus on the longitudinal evaluation of cross-curricular digital-literacy interventions, on the comparative effectiveness of diagnostic-adaptive instructional sequencing across different fields of study, and on the development of standardized, discipline-sensitive instruments for assessing the value-reflective component of digital competence, which remains the least operationalized dimension in the current body of research.

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