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ARTICLE / ARTÍCULO

Are students digitally literate? Progress, shortcomings and future challenges

¿Son los estudiantes competentes digitales? Avances, desajustes y retos de futuro

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Abstract: As part of the broader digitalisation of education and society, considerable efforts have been made in recent decades to develop the digital competencies of teachers and students, from primary education through to higher education. Based on a documentary review focused on the Ibero-American context, this article analyses the main advances, shortcomings, and challenges identified by educational research on students' digital competence over the last 25 years. Specifically, the article aims to examine the main advances and misalignments in relation to the established goals for the development of students' digital competencies. The methodology is based on the review of high-impact or highly relevant publications in academic databases, selected according to criteria of thematic relevance, citation count/relevance, open access, language, and geographical scope. The data are analysed inductively in response to the research questions. The findings reveal a predominant focus on the university context compared with school education, as well as an assessment approach that draws on European and international frameworks and relies largely on instruments based on self-perceived digital competence. Students have made progress in their digital competence; however, some areas still require specific training to ensure the exercise of citizenship with sufficient critical judgement in the consumption and dissemination of information, as well as to promote equity in education and personal well-being. The article concludes that the development of digital competence requires intentional, critical, and contextualised training models, together with further research addressing compulsory education, usage gaps, and the emerging challenges associated with artificial intelligence.

Keywords: Digital Competence; Educational Technology; Educational Research; Literature Review; Higher Education.

Resumen: Como parte del proceso de digitalización de la educación y de la sociedad, en las últimas décadas se ha hecho un esfuerzo encomiable para desarrollar las competencias digitales de docentes y estudiantes, desde la educación primaria hasta la universidad. Este artículo analiza, a partir de una revisión documental centrada en el ámbito iberoamericano, los principales avances, desajustes y retos identificados por la investigación educativa sobre la competencia digital del alumnado durante los últimos 25 años. El objetivo de este artículo es analizar los principales avances, así como los desajustes encontrados en relación a los objetivos establecidos sobre el desarrollo de las competencias digitales de los estudiantes. La metodología se basa en la revisión de publicaciones con alto impacto o relevancia en bases de datos académicas, seleccionadas mediante criterios de pertinencia temática, citación/relevancia, acceso abierto, idioma y delimitación geográfica. Los datos son analizados de forma inductiva, respondiendo a las preguntas de investigación. Los resultados ponen de manifiesto un foco mayoritario en el contexto universitario frente al ámbito escolar, una evaluación que toma como referencia marcos europeos e internacionales y pruebas de evaluación basadas en gran medida en la autopercepción de la competencia digital. Los estudiantes han avanzado en su competencia digital pero algunas áreas requieren todavía una formación específica para asegurar el ejercicio de una ciudadanía con suficiente criterio en el consumo y difusión de información, así como para asegurar la equidad en el ámbito educativo y el bienestar personal. Se concluye que el desarrollo de la competencia digital requiere modelos formativos intencionales, críticos y contextualizados, así como nuevas investigaciones que atiendan a la educación obligatoria, a las brechas de uso y a los retos emergentes asociados a la inteligencia artificial.

Palabras-clave: Competencia Digital, Tecnología Educativa, Investigación Educativa, Revisión Documental, Educación Superior.

1. Introduction

The progress of contemporary society has been characterised by an unprecedented pace of technological change that has radically transformed the structures of communication, production, and learning. Over the past 25 years, the transition from industrial society to the information society, and subsequently to the network society (Castells, 2005), has posed fundamental challenges to educational systems (García-Valcárcel, 2016). Education can no longer be confined to the transmission of static knowledge; rather, it must focus on preparing citizens who are capable of navigating a complex digital ecosystem in which information is abundant but often fragmented or unreliable.

The progression of the concept of digital competence highlights a shift in perspective from an instrumental view of digital literacy towards a cognitive and critical competence. International organisations such as the OECD (2001), through the DeSeCo project, redefined competences not merely as technical skills but as the capacity to mobilise cognitive resources in response to complex social demands. This conceptual shift implies that digital competence cannot be reduced to the instrumental use of devices or applications. Rather, digital competence is understood as a multifaceted capability that integrates knowledge, skills, attitudes, critical judgement, ethical responsibility, and civic participation within technology-mediated environments.

In the European context, the European Qualifications Framework for Lifelong Learning (European Union, 2009) consolidated digital competence as one of the eight key competences for lifelong learning, encompassing the safe and critical use of information and communication technologies (ICT) for work, leisure, and communication. In 2013, the European Digital Competence Framework (DigComp) was published (Ferrari, 2013), and its influence on the development of training programmes and assessment processes relating to digital competence has been unquestionable. In Ibero-America, meanwhile, this progression has been closely linked to the need to overcome the digital access divide; however, the focus has gradually shifted towards media literacy and digital citizenship (UNESCO, 2011).

Over the past 25 years, significant investment efforts have been made across Ibero-America. Initiatives such as Escuela 2.0 in Spain and Plan Ceibal in Uruguay represented ambitious attempts to implement the one-to-one (1:1) model, whereby each student is provided with a personal computer, in compulsory education. These initiatives, together with subsequent programmes aimed at promoting digital access in schools, have resulted in most educational institutions now having connectivity and digital devices available in classrooms. However, concerns have been raised regarding the effectiveness, quality, and long-term maintenance of these resources (Area, 2011; UNESCO, 2023).

Concerning students' cognitive capacities, one of the most persistent findings in the literature has been the challenge to the myth of the digital native. Research has shown that, although young people often demonstrate a high degree of proficiency in the use of mobile devices and social media for leisure purposes, they lack the critical competences required for academic information searches, the evaluation of information sources, and the creation of complex digital content. Studies have also highlighted that students tend to overestimate their own digital capabilities, leading to

a discrepancy between their self-perceptions and their actual levels of performance (Juca-Maldonado et al., 2025).

There is ample evidence that the everyday use of technology does not, in itself, lead to the development of digital competence. Consequently, education and training in this area are essential to promote a more conscious, critical, and purposeful use of technology. Such training is particularly effective when introduced at an early age (Fundación Cibervoluntarios, 2026). According to this report, the most significant improvements are observed in areas such as privacy, online safety, and risk management, whereas the impact on more socially oriented competences is comparatively limited. The findings further indicate that young people who combine physical and digital environments exhibit the most favourable emotional well-being indicators. These results reinforce the notion that the crucial factor lies in how technology is integrated into everyday life. Accordingly, the appropriation of technology should not be understood merely in terms of access or use, but rather as a complex process involving the interplay of experiences, knowledge, and attitudes, and one that requires educational guidance and support. In any case, the appropriation of technology constitutes the foundation for the development of Citizen Digital Sovereignty, a concept whose guiding principles include the right of all individuals to free digital education that enables them to use technology responsibly and critically, as well as the right of citizens to participate actively in decisions regarding the design, governance, and use of technology.

In this context, it is imperative to strengthen students' critical thinking skills and to ensure access to digital technologies to address the divides that have been amplified by the network society. Education must assume responsibility for preparing citizens who not only use technology but also understand it and appropriate it in ways that are informed by ethical and social considerations. Particular attention should be paid to the needs of the most vulnerable groups.

On the other hand, pedagogical resistance remains prevalent in many educational contexts. Technology has often been incorporated merely to replicate traditional practices in a digital format, without bringing about any substantial transformation in teaching methodologies. As highlighted in the UNESCO report (2023), educational technology should be learner-centred and grounded in evidence rather than driven by technological enthusiasm alone.

At present, artificial intelligence (AI) is emerging as the most disruptive technology. Its potential to personalise learning through intelligent tutoring systems, provide educational resources that support learner diversity, and facilitate self-assessment and continuous formative assessment processes that empower students in their autonomous learning is undeniable. However, these opportunities are accompanied by new ethical challenges, including data privacy, algorithmic bias, and the potential dehumanisation of the educational process (European Commission, 2022). European guidelines emphasise that the use of AI should be trustworthy and subject to human oversight, requiring educators to develop new digital competences related to understanding AI, data governance, the implications of AI for equity and human agency, the identification of algorithmic bias, and awareness of the limitations of AI in the assessment of student learning.

This article analyses the trajectory of students' digital competence development, focusing on Spain and Ibero-America. It examines both the progress achieved and the shortcomings that educational research has brought to light.

2. Methodology

The present study is based on an exploratory and analytical documentary review aimed at identifying trends, advances, and shortcomings in Ibero-American research on students' digital competence. The review of the scientific literature seeks to examine the evidence generated by previous studies while identifying knowledge gaps and future challenges in this field. The selection of documents was guided by criteria including thematic relevance, geographical scope, open-access availability, language, and position within academic databases according to citation impact or relevance. In this regard, citation counts are employed as an approximate indicator of scientific impact rather than as an exclusive measure of quality or current relevance. The aim, therefore, is to provide a synthesis of the most relevant research available in the Ibero-American context concerning the development of students' digital competence, with a particular focus on the advances achieved and the challenges that remain.

The research strategy focused on the retrieval of documentary sources, specifically journal articles, from the principal databases used in educational research. Searches were conducted in two languages, English and Spanish, across the following databases: Web of Science (WoS), Scopus, Dialnet, InDICES-CSIC, and Google Scholar.

Given the objectives of the study, the search was restricted to the Ibero-American context. According to the Ibero-American General Secretariat (SEGIB), Ibero-America comprises 19 countries in the Americas and three European countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, the Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, Venezuela, Andorra, Spain, and Portugal. Consequently, the literature search was limited to research conducted in these countries.

The following search string was employed: (Competencia digital OR Digital competence OR digital skills OR alfabetización digital OR digital literacy OR alfabetización informacional OR information literacy) AND (estudiantes OR alumnos OR students OR pupils). The search was restricted to articles in which these keywords appeared in the title. The time frame covered the period from 2000 to the present to capture relevant research developments over time (Table 1).

Table 1. Inclusion criteria and search strategies.

Category	Criteria
Databases	WOS, SCOPUS, DIALNET, InDICES-CSIC, and Google Scholar
Scope	Ibero-American
Time period	2000-2026
Type of documents	Open-access articles
Language	English and Spanish
Search string	(Competencia digital OR Digital competence OR digital skills OR alfabetización digital OR digital literacy OR alfabetización informacional OR informational literacy) AND (Estudiantes OR alumnos OR students OR pupils)
Search field	Article title
Sorting results	Number of citations/Relevance

Once the search had been conducted in each database, the results were screened using a single inclusion criterion: the study had to address students' digital competence. Consequently, documents that did not focus on the student population were excluded. The remaining records were then ranked according to citation counts in order to identify the most relevant publications, as the number of citations may serve as an objective indicator of scientific relevance or impact. In the case of Dialnet and InDICES-CSIC, where citation data are not provided, records were ranked according to the relevance criteria established by each database. Subsequently, the first 20 references from each database were selected for analysis. The findings should therefore be interpreted as a synthesis of publications with high impact or accumulated relevance, rather than as an exhaustive review of all the scientific literature available. The results relating to the number of references selected from each database are presented in Table 2.

Table 2. Results from the database search.

Databases	Number of references	Selected references
Google Scholar	162	20
WOS	140	20
SCOPUS	20	20
DIALNET	22	20
InDICES-CSIC	102	20
Total (excluding duplicates)		76

The selected references were compiled in a spreadsheet containing the essential publication data, including citation counts from each database, article title, authors, year of publication, journal, study focus, target population, country, APA reference, and abstract. The records were ranked according to the number of citations received, and duplicate references were removed, resulting in a final corpus of 76 documents. This dataset is available as an appendix to the present manuscript (Supplementary Material 1), reflecting a commitment to the principles of Open Science. Following the selection process, the references were reviewed once again to determine whether they were indexed in additional databases, and this information was also recorded in the supplementary material.

Once the documents had been selected, the references were analysed in two phases.

Phase 1. Based on the 76 selected references, an initial analysis was undertaken to address the following research questions:

- 1) In which countries were the studies conducted?
- 2) Are there any researchers who stand out within this specific field of research?
- 3) Which student populations have been the primary focus of the research?
- 4) Which research methodologies have been most frequently employed?
- 5) What are the main variables studied?
- 6) What are the main conclusions of the studies?

Phase 2. To undertake a more in-depth examination of the most influential publications, the 15 studies with the highest citation counts or levels of relevance were analysed. This second stage of the analysis sought to address the following research questions:

- 1) What reference frameworks have been used to assess students' digital competence?
- 2) Has the focus of research on digital competence evolved over time?
- 3) What have been the principal advances in research on students' digital competence?
- 4) What challenges have researchers identified regarding the development of students' digital competence?
- 5) What areas of future research do the authors suggest in relation to this topic?

For the data analysis, NotebookLM was used to generate an initial response to the research questions. This preliminary output served as a draft that the researchers subsequently analysed. The prompts employed were as follows:

Prompt Phase 1: With the aim of analysing the main advances, as well as the gaps and shortcomings identified in relation to the established objectives for the development of students' digital competence, and taking into account the information contained in the attached database, analyse its content to answer the following questions: (research questions listed).

Prompt Phase 2: With the aim of analysing the main advances, as well as the gaps and shortcomings identified in relation to the established objectives for the development of students' digital competence, and taking into account the 15 attached documentary sources, analyse their content to answer the following questions: (research questions listed).

The analysis conducted by the researchers involved a critical review of the draft generated by NotebookLM. This process included verifying that the information presented was the most relevant to the research questions, accurately reflected the findings reported in the original studies, and was free from potential biases. In addition, supplementary information considered pertinent to addressing the research questions was included.

3. Results

The results are presented according to the two phases of analysis that structured the study.

3.1. Phase 1. Analysis of all the selected documentary sources.

In which countries were the studies conducted?

Spain is the country with the highest level of scientific output on students' digital competence (Gutiérrez & Tyner, 2012; Gisbert & Esteve, 2011; Area & Guarro, 2012). In Latin America, notable contributions have been made in Mexico (García-Ávila, 2017; Islas & Franco, 2018), Chile (Jara et al., 2015; Cabero-Almenara et al., 2023), Colombia (Arrieta & Montes, 2011; López-Gil & Sevillano, 2020), Venezuela (Esteve & Gisbert, 2013; Godoy, 2009), Cuba (George & Avello-Martínez, 2021; Hernández-Campillo, Veranes, & Arias, 2023), Peru (Rumiche & Chunga, 2019), and Ecuador (Henríquez-Coronel et al., 2018; Jaén & Mena, 2021). A geographical overview of the publications analysed is presented in Figure 1.

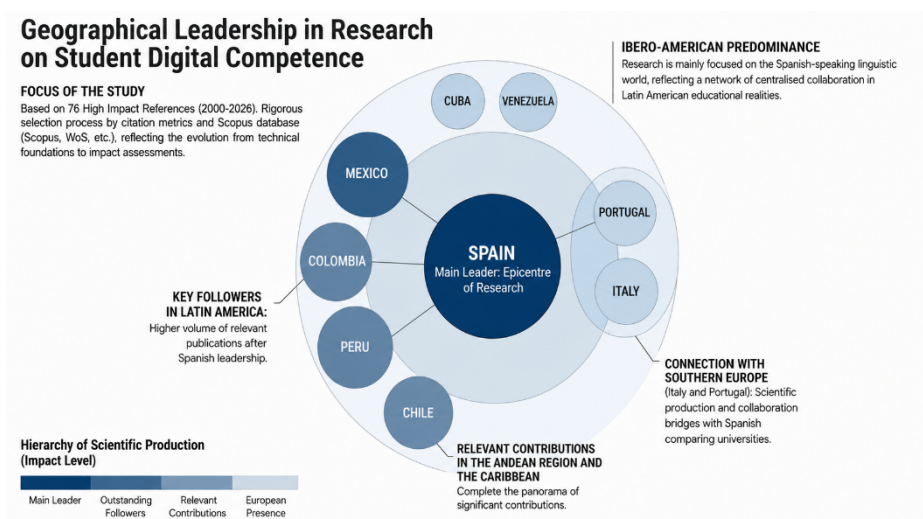


Figure 1. Geographical distribution of leading research on students' digital competence. Source: Authors' own elaboration based on data systematised by the research team, with support from generative artificial intelligence tools. All data presented were subsequently reviewed and manually verified by the authors.

Are there any researchers who stand out within this specific field of research?

Several authors have established a sustained and influential research trajectory in the field of students' digital competence. The most prominent contributors identified in the literature include the following (Figure 2):

- Mercedes Gisbert Cervera, a leading scholar in competency assessment profile benchmarks (Gisbert & Esteve, 2011; Gisbert et al., 2016; Sánchez-Caballé et al., 2020).

- Julio Cabero Almenara. Specialist in digital literacy and its relationship with academic achievement (Cabero-Almenara & Llorente-Cejudo, 2008; Cabero-Almenara et al., 2009; Cabero-Almenara et al., 2023).
- Francesc Esteve Mon. Researcher whose work has centred on assessing digital competence and computational thinking (Esteve & Gisbert, 2013; Esteve-Mon et al., 2020).
- Manuel Area Moreira. Researcher who has made significant contributions to the theoretical foundations of citizen digital literacy (Area & Guarro, 2012; Area-Moreira, 2014).
- Ignacio Aguaded. Recognised for his influential work in the field of media literacy (Bonilla-del-Río & Aguaded, 2018; Pérez-Escoda et al., 2019).

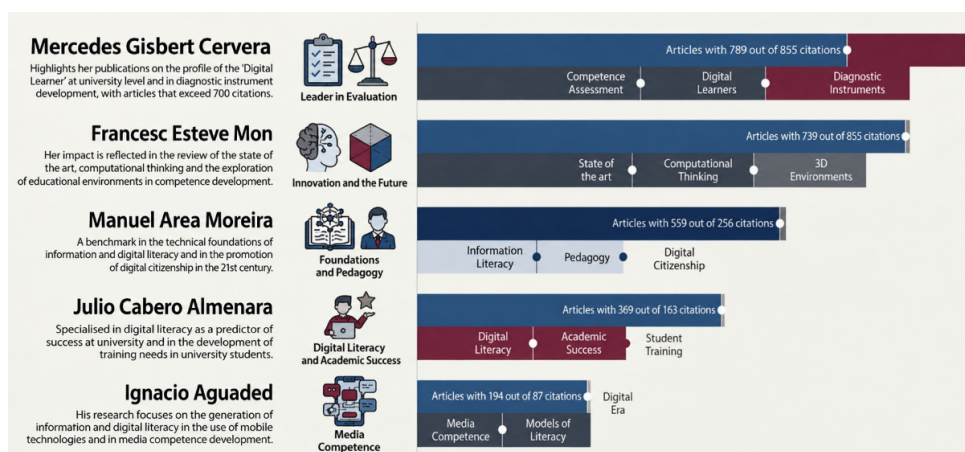


Figure 2. Leading researchers in the field of students' digital competence. Source: Authors' own elaboration based on data systematised by the research team, with support from generative artificial intelligence tools. All data presented were subsequently reviewed and manually verified by the authors.

Which student populations have been the primary focus of the research?

The majority of the studies reviewed are situated within the context of higher education. A notable emphasis is placed on students' training to become future teachers (Cabezas et al., 2014; Esteve-Mon et al., 2020; Moreno et al., 2018). By contrast, only 8% of the studies analysed focus on compulsory education, including both primary education (Bonilla-del-Río & Aguaded, 2018; Fernández et al., 2017; García-Ruiz et al., 2014) and secondary education (Jara et al., 2015; Tarango, 2014; Valverde-Crespo et al., 2018). Studies addressing other specific populations, such as adult learners (Padilla-Carmona et al., 2016) or students with disabilities, are comparatively scarce (Millán, 2011).

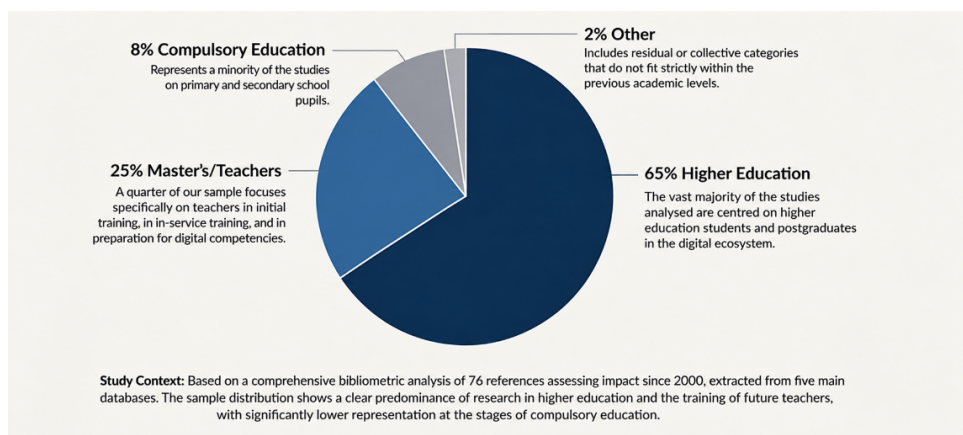


Figure 3. Student populations represented in digital competence research. Authors' own elaboration based on data systematised by the research team, with support from generative artificial intelligence tools. All data presented were subsequently reviewed and manually verified by the authors.

Which research methodologies have been most frequently employed?

Quantitative methodologies are the most frequently employed in the studies reviewed, with a predominance of survey-based approaches that rely on students' self-perceptions of their own digital competence (Centeno & Cubo, 2013; López-Meneses et al., 2020; Silva-Quiroz & Morales-Morgado, 2022). Systematic literature reviews also represent a significant proportion of the research (George Reyes & Avello-Martínez, 2021; Reis et al., 2019; Sánchez-Caballé et al., 2020), as do mixed-methods approaches that combine questionnaires with focus groups or case studies (Jara et al., 2015; López-Gil & Sevillano, 2020). To a lesser extent, quasi-experimental designs have also been employed (Fernández et al., 2017).

What are the main variables studied?

Most studies focus on the dimensions established by the DigComp Framework, including information literacy, communication, digital content creation, safety, and problem-solving (López-Meneses et al., 2020; Moreno et al., 2018). A considerable proportion of the research also examines sociodemographic factors, particularly gender and age (Esteve-Mon et al., 2020; Zhao et al., 2021), as well as socio-economic factors, such as household income, parental educational attainment, and access to technology in the home environment (Cabero-Almenara et al., 2009; Jara et al., 2015; Silva-Quiroz & Morales-Morgado, 2022). Academic performance is another frequently investigated variable, with several studies exploring the relationship between digital skills and educational achievement (Cabero-Almenara et al., 2023; Guzmán et al., 2017; Islas & Franco, 2018). Finally, some studies address attitudinal variables, including students' disposition and their levels of self-confidence towards the use of ICT (Cabellos et al., 2024; Centeno & Cubo, 2013).

What are the main conclusions in the studies?

The specialised literature has consistently challenged the widely held assumption that generations born and raised in highly digitalised environments inherently possess high

levels of digital competence. This proposition, commonly referred to as the digital native myth, has been progressively undermined by research demonstrating that everyday familiarity with digital technologies does not automatically translate into competent, reflective, or academically meaningful uses of technology. In this respect, numerous studies have shown that, although students usually develop skills associated with entertainment, communication, and the consumption of digital content, they frequently encounter significant difficulties when required to mobilise more complex competences related to the search, selection, critical evaluation, and management of information (de Vicente et al., 2022; García-Ruiz & Aguaded, 2014; Gisbert & Esteve, 2011).

On the other hand, various studies have highlighted a gap between digital learning developed in informal contexts and the demands associated with formal educational environments. Although students acquire numerous digital practices autonomously through their everyday experiences, these forms of learning do not tend to transfer either spontaneously or effectively to academic tasks requiring analysis, evidence evaluation, knowledge production, or the resolution of complex problems. This disconnect suggests that the frequent use of technology does not, in itself, guarantee the development of competences applicable to university learning or professional contexts (Guzmán et al., 2017; López-Gil & Sevillano, 2020).

Likewise, empirical evidence indicates that certain dimensions of digital competence continue to represent particular areas of vulnerability among students. These include digital safety, multimedia content creation, and, most notably, the critical evaluation of information and digital sources. Such dimensions require higher-order cognitive processes, including verification, interpretation, synthesis, and critical judgement, which typically exhibit lower levels of performance than more instrumental forms of digital competence (Moreno et al., 2018; Sales et al., 2020; Silva-Quiroz & Morales-Morgado, 2022). This situation becomes even more significant within the contemporary digital ecosystem, characterised by information overload, content automation, and the increasing integration of artificial intelligence systems, all of which demand new forms of literacy.

Finally, numerous studies highlight that family context and socio-economic conditions continue to exert a significant influence on the development of digital competence. Despite the growing availability of technological resources and institutional efforts to reduce inequalities in access, the home environment remains a determining factor in shaping opportunities for digital learning and the extent to which these opportunities translate into educational benefits. Variables such as the availability of resources, educational support within the family, and opportunities for technology use beyond the school setting account for substantial differences in levels of digital competence attained by students (Fernández-Mellizo & Manzano, 2018; Jara et al., 2015). In this regard, the contemporary digital divide can no longer be understood solely in terms of access to devices; increasingly, it manifests itself as a divide in patterns of use, educational benefit, and the development of more sophisticated digital competences. These findings reinforce the need to promote educational models that support the intentional, critical, and equitable development of students' digital competence.

3.2. Phase 2. An in-depth analysis of the most significant publications in the field of study.

What reference frameworks have been used to assess students' digital competence?

The literature reveals a clear progression from instrumental models, focused primarily on the use of tools and the performance of tasks through technological applications, towards more complex and holistic models encompassing cognitive processes, attitudes, and a broad range of skills. In particular, the following reference frameworks can be identified:

- DigComp 2.1 (European Digital Competence Framework): This is the predominant framework in contemporary research on digital competence. It conceptualises digital competence through five competence areas (information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving), which are further subdivided into 21 specific competences (Carretero et al., 2017; López-Meneses et al., 2020).
- National Educational Technology Standards for Students (NETS-S): Developed by the International Society for Technology in Education (ISTE, 2008), this framework places particular emphasis on the development of creativity, innovation, and responsible digital citizenship (Esteve & Gisbert, 2013).
- UNESCO Framework (2008): Proposed by UNESCO, this framework adopts a hierarchical progression model in which learning advances sequentially from the acquisition of basic ICT knowledge and skills to stages of knowledge deepening and, ultimately, knowledge creation (Gutiérrez & Tyner, 2012).
- Larraz's Rubric (2012): Widely recognised within the Spanish context, this framework operationalises digital competence through four complementary literacies: information literacy, technological literacy, multimedia literacy, and communicative literacy (Esteve & Gisbert, 2013; Gisbert et al., 2016).

To support the application of these frameworks, researchers have validated a range of diagnostic instruments. Among the most widely used is the ICT Competences Inventory (INCOTIC), developed to assess students' self-perceived digital competence upon entry to higher education (Gisbert et al., 2011). Another prominent instrument is the University Students' Basic Digital Competences 2.0 (COBADI) questionnaire, designed specifically to measure digital competences associated with the use of Web 2.0 tools and technologies (López-Meneses et al., 2020).

Has the focus of research on digital competence evolved over time?

The documentary analysis reveals a clear evolution in the research perspective adopted towards students' digital competence. Specifically, the field has undergone a transition from a predominantly instrumental perspective, concerned primarily with the technical aspects of using hardware and software, towards a socio-cognitive approach that conceptualises digital competence as a complex form of knowing how to act, encompassing critical thinking and ethical judgement (Area-Moreira, 2014; Gutiérrez & Tyner, 2012).

Furthermore, research has increasingly demonstrated that the technological proficiency displayed by younger generations is largely recreational in nature and often superficial, revealing significant shortcomings in competences that are specifically academic in character (Gisbert & Esteve, 2011; Guzmán et al., 2017; Sánchez-Caballé et al., 2020). Consequently, more recent studies have shifted their focus towards the analysis of formal educational contexts and digital well-being.

Finally, research has increasingly challenged the notion of literacy as a unidimensional construct. The theoretical corpus has progressively converged around the concept of multiliteracies, understood as the synergistic integration of media, information, and digital literacies (Area-Moreira & Guarro, 2012).

What have been the principal advances in research on students' digital competence?

The main advances identified in the literature relate to two main dimensions: assessment methodology and the conceptual clarification of digital competence.

With regard to the methodological dimension, significant progress has been made in developing instruments that can measure levels of digital competence acquisition more objectively and systematically. In this respect, the evidence points to a transition from assessment models based on self-perception towards approaches focused on actual performance. In some cases, such assessment is implemented using three-dimensional simulation environments and virtual laboratories, tools that enable researchers to examine students' ability to solve authentic challenges in real time (Esteve y Gisbert, 2013; Gisbert et al., 2016).

At the conceptual level, distinctions have been drawn between the different dimensions of digital competence associated with students' knowledge, skills, and attitudes, which are not always aligned. The findings indicate that, despite considerable heterogeneity in levels of technical and cognitive proficiency shown by students, a highly positive disposition towards digital technologies predominates, with such technologies perceived as essential tools for both learning and everyday life (Centeno & Cubo, 2013).

What challenges have researchers identified regarding the development of students' digital competence?

The findings identify four fundamental challenges that shape the development of students' digital competence.

Firstly, there is an asymmetry between students' everyday digital skills and their academic digital competences. Whilst students demonstrate advanced levels of proficiency in environments associated with social interaction and leisure consumption, they exhibit significant deficiencies in the academic management of information, particularly concerning database searching, the critical evaluation of sources, and the production of original content. Secondly, there is a lack of diversified educational methodologies—hybrid, multimodal, and collaborative in nature (Guzmán et al., 2017)—that would enable students to develop these competences through experience and reflective practice. Thirdly, gender bias persists in the self-perception of digital competence. Significant differences have been observed in favour of male students, both in terms of perceived technical proficiency and the frequency with

which more complex technological tools are used (Centeno & Cubo, 2013). Finally, teacher digital literacy emerges as a critical factor. The training and professional development of teachers constitute an indispensable pillar, given that the effective development of students' digital competence is directly contingent upon the prior level of qualification and digital competence of their teachers (Gisbert et al., 2016).

What areas of future research do the authors suggest in relation to this topic?

The articles reviewed suggest several proposals aimed at consolidation and innovation, structured around four main strands. Firstly, a line of research has been identified that focuses on the design of strategies for the formal certification of students' digital competence, as well as on the development and validation of training models capable of guaranteeing these competence levels through longitudinal methodologies (Cabero & Llorente, 2008). Secondly, computational thinking has emerged as a key component of students' digital competence (Esteve-Mon et al., 2020). In addition, growing interest has been observed in learning analytics and the personalisation of teaching, with an emphasis on developing intelligent and adaptive tools capable of tailoring learning content to students' multiple intelligences (López-Meneses et al., 2020). Finally, the authors highlight the need for further research into the potential of 3D simulations as a means of obtaining authentic evidence of competence-based performance (Gisbert et al., 2016).

4. Discussion and Conclusions

The analysis of the most influential articles on students' digital competence confirms the presence of an intense interest within the Ibero-American scientific community to understand the extent to which the student population is developing this essential competence for active citizenship, in line with the recommendations put forward by international organisations (Comisión Europea, 2022; UNESCO, 2023).

As has been highlighted, research has focused primarily on the higher education sector, resulting in limited attention being paid to school-based contexts. Nevertheless, understanding the situation of non-university students is of considerable importance, given the need to foster responsible and active digital citizenship. Consequently, this represents a significant gap in the literature, as such knowledge should underpin evidence-based decision-making in public policy.

Concerning the assessment of students' levels of digital competence, the widespread use of self-perception questionnaires presents clear limitations, including subjectivity and social desirability bias (Paulhus, 2002). Consequently, further progress is required in the development of more objective assessment instruments.

The findings of the studies reviewed indicate that, although technological resources have become available in the majority of households and educational settings, this has not necessarily led to higher levels of information literacy. On the contrary, the evidence suggests that increased use of these technologies may be associated with a deterioration in cognitive processes such as attention, concentration, critical thinking, and creativity (Herrero-Curiel & La-Rosa, 2022). Therefore, without adequate training in the responsible use of digital technologies, their effects may be detrimental. A lack of such training can render students particularly vulnerable to

misinformation and manipulation, potentially giving rise to situations of stress and anxiety.

Furthermore, the training and assessment processes developed across the Ibero-American context have generally aligned with the European DigComp framework. Although this framework has been periodically updated to incorporate emerging technologies such as artificial intelligence, it has provided a stable reference model for the transferability of research findings from studies carried out in various countries within this geographical area. The framework has identified several imbalances in the development of digital competence (Basilotta et al., 2020), thereby facilitating the design of specific action plans in diverse educational contexts and guiding teacher training and certification pathways through the use of self-assessment and autonomous learning strategies.

An interesting progression can also be observed over time in the research questions being posed, moving from a focus largely centred on the instrumental use of technology towards enquiries concerned with cognitive processes, attitudes, and digital well-being. This shift has coincided with the emergence of communication, learning, and mental health issues associated with the inappropriate use of digital technologies, including cyberbullying, addiction, excessive content consumption, overstimulation, reduced concentration, and superficial learning, among others. Consequently, scholarly interest has gradually moved from examining technological practices themselves to investigating their consequences for students' lives. The findings suggest that the field has evolved from approaches primarily concerned with access to technology and its instrumental use towards more demanding models of critical, media, and information literacy.

Advances in this field of research can be seen in the availability of a comprehensive and well-developed conceptual framework, around which a considerable degree of international consensus has been established. In addition, a range of valuable instruments for assessing digital competence have been developed and validated for different educational contexts, including compulsory education and higher education. These instruments are based on clearly defined indicators and are aligned with the competences set out in the reference framework (García-Valcárcel et al., 2020). Assessment processes have also incorporated emerging technologies, such as virtual simulations, which enable more objective forms of evaluation situated within authentic real-world contexts.

With regard to future challenges, particular emphasis should be placed on the need for participatory research in which teachers from different educational levels work collaboratively to analyse the objectives to be achieved at each stage of education and to agree upon pedagogical methodologies and collaborative processes involving families in the education of children and young people. Research must also continue to explore the dissonances between students' interest in technology in their everyday lives and its use within academic contexts. In particular, further investigation is needed into how digital competence education can be designed in ways that are meaningful across all the environments that shape students' lived experiences.

Furthermore, it is impossible to overlook the challenge that artificial intelligence poses for digital literacy. As a technology that fundamentally reconfigures the dialogical relationship between humans and machines, AI has the potential both to

enhance and to undermine the thinking skills that are essential for learning. Current research is examining the transformations brought about by this powerful tool in student learning. It is the responsibility of researchers in the field of education to gather evidence regarding these changes and to propose new learning methodologies that harness the potential of AI whilst mitigating adverse effects, such as cognitive debt (Watts, 2025) and the underdevelopment of students' intellectual capacities. Nevertheless, given that the majority of the studies included in the corpus reviewed were conducted prior to the widespread adoption of generative AI, any claims regarding its effects should be understood as prospective considerations rather than as empirical conclusions directly derived from the studies analysed.

Finally, digital divides related to gender, socioeconomic background, age, and other factors must continue to be investigated in order to inform the implementation of more inclusive policies, ensuring that all individuals can participate in society without barriers and exercise their rights as fully empowered citizens.

5. References

- Area-Moreira, M. (2011). Los efectos del modelo 1:1 en el cambio educativo en las escuelas: Evidencias y desafíos para las políticas iberoamericanas. *Revista Iberoamericana de Educación*, 56, 49–74.
- Area-Moreira, M. (2014). La alfabetización digital y la formación de la ciudadanía del siglo XXI. *Revista Integra Educativa*, 7(3), 21–33.
http://www.scielo.org.bo/pdf/rieiii/v7n3/v7n3_a02.pdf
- Area-Moreira, M., & Guarro, A. (2012). La alfabetización informacional y digital: Fundamentos pedagógicos para la enseñanza y el aprendizaje competente. *Revista Española de Documentación Científica*, 35(Monográfico), 46–74.
<https://doi.org/10.3989/redc.2012.mono.977>
- Arrieta, C. A., & Montes, V. D. (2011). Alfabetización digital: Uso de las TIC más allá de una formación instrumental y una buena infraestructura. *Revista Colombiana de Ciencia Animal - RECIA*, 3(1), 180–197.
<https://doi.org/10.24188/recia.v3.n1.2011.360>
- Basilotta V., García-Valcárcel A., Casillas S., & Cabezas M. (2020). Evaluación de competencias informacionales en escolares y estudio de algunas variables influyentes. *Revista Complutense de Educación*, 31(4), 517–528.
<https://doi.org/10.5209/rced.65835>
- Bonilla-del-Río, M., & Aguaded, I. (2018). La escuela en la era digital: Smartphones, apps y programación en educación primaria y su repercusión en la competencia mediática del alumnado. *Pixel-Bit. Revista de Medios y Educación*, 53, 151–163.
<https://doi.org/10.12795/pixelbit.2018.i53.10>
- Cabellos, B., Siddiq, F., & Scherer, R. (2024). The moderating role of school facilitating conditions and attitudes towards ICT on teachers' ICT use and emphasis on developing students' digital skills. *Computers in Human Behavior*, 150, Article 107994.
<https://doi.org/10.1016/j.chb.2023.107994>
- Cabero-Almenara, J., Gutiérrez-Castillo, J. J., Guillén-Gámez, F. D., & Gaete-Bravo, A. F. (2023). Digital competence of higher education students as a predictor of academic success. *Technology, Knowledge and Learning*, 28, 683–702.
<https://doi.org/10.1007/s10758-022-09624-8>
- Cabero-Almenara, J., & Llorente-Cejudo, M. L. (2008). La alfabetización digital de los alumnos: Competencias digitales para el siglo XXI. *Revista Portuguesa de Pedagogía*, 42(2), 7–28.
https://doi.org/10.14195/1647-8614_42-2_1
- Cabero-Almenara, J., Llorente-Cejudo, M., Leal, F., & Lucero, F. A. (2009). La alfabetización

- digital de los alumnos universitarios mexicanos. *Enseñanza*, 27(1), 41–59.
<https://hdl.handle.net/10366/79276>
- Cabezas, M., Casillas, S., & Pinto, A. M. (2014). Percepción de los alumnos de Educación Primaria de la Universidad de Salamanca sobre su competencia digital. *EduTec. Revista Electrónica de Tecnología Educativa*, 48, Article a275.
<https://doi.org/10.21556/edutec.2014.48.156>
- Carretero, S., Vuorikari, R., & Punie, Y. (2017). *DigComp 2.1: The digital competence framework for citizens with eight proficiency levels and examples of use*. Publications Office of the European Union.
<https://doi.org/10.2760/38842>
- Castells, M. (2005). *La era de la información: Vol. 1. La sociedad red*. Alianza Editorial.
- Centeno Moreno, G., & Cubo Delgado, S. (2013). Evaluación de la competencia digital y las actitudes hacia las TIC del alumnado universitario. *Revista de Investigación Educativa*, 31(2), 517–536.
<https://www.redalyc.org/pdf/2833/283328062005.pdf>
- Comisión Europea, Dirección General de Educación, Juventud, Deporte y Cultura. (2022). *Directrices éticas sobre el uso de la inteligencia artificial (IA) y los datos en la educación y formación para los educadores*. Oficina de Publicaciones de la Unión Europea.
<https://data.europa.eu/doi/10.2766/898>
- de Vicente, A. M., Carballada, M. R., & Cestino, E. (2022). Análisis de las competencias mediáticas del alumnado que ingresa en la universidad: Un estudio de caso en estudiantes de comunicación. *Vivat Academia*, 155, 151–171.
<https://doi.org/10.15178/va.2022.155.e1375>
- Esteve, F., & Gisbert, M. (2013). Competencia digital en la educación superior: Instrumentos de evaluación y nuevos entornos. *Enlace: Revista Venezolana de Información, Tecnología y Conocimiento*, 10(3), 27–43.
- Esteve-Mon, F. M., Llopis, M. A., & Adell-Segura, J. (2020). Digital competence and computational thinking of student teachers. *International Journal of Emerging Technologies in Learning (IJET)*, 15(2), 29–41.
<https://doi.org/10.3991/ijet.v15i02.11588>
- Fernández, J., Peñalva, A., Irazabal, I., & López, J. (2017). Efectividad de un programa de alfabetización digital para estudiantes de primaria. *Cultura y Educación*, 29(1), 1–30.
<https://doi.org/10.1080/11356405.2016.1269501>
- Fernández-Mellizo, M., & Manzano, D. (2018). Análisis de las diferencias en la competencia digital de los alumnos españoles. *Papers. Revista de Sociologia*, 103(2), 175–198.
<https://doi.org/10.5565/rev/papers.2369>
- Ferrari, A. (2013). *DIGCOMP: A framework for developing and understanding digital competence in Europe*. JRC-IPTS.
<http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=6359>
- Fundación Cibervoluntarios. (2026). *Apropiación de la tecnología de niños, niñas y adolescentes en España: Impacto de la formación en competencias digitales en la percepción y el uso consciente, crítico y creativo del ecosistema digital*.
https://cibsimplewebs.blob.core.windows.net/campamentodigital/ESTUDIO_EXTENDIDO_CODI.pdf
- García-Ávila, S. (2017). Alfabetización digital. *Razón y Palabra*, 21(3_98), 66–81.
<https://revistarazonypalabra.org/index.php/ryp/article/view/1043>
- García-Ruiz, R., Ramírez-García, A., & Rodríguez-Rosell, M. M. (2014). Educación en alfabetización mediática para una nueva ciudadanía prosumidora. *Comunicar*, 22(43), 15–23.
<https://doi.org/10.3916/C43-2014-01>
- García-Valcárcel, A. (2016). *Educación en la Sociedad de la Información*. Repositorio Documental GREDOS de la Universidad de Salamanca.
<https://hdl.handle.net/10366/130219>
- García-Valcárcel, A., Casillas, S., & Basilotta, V. (2020). Validation of an indicator model (INCODIES) for assessing student digital competence in basic education. *Journal of New Approaches in Educational Research*, 9(1), 110–125.
<https://doi.org/10.7821/naer.2020.1.459>

- George Reyes, C. E., & Avello-Martínez, R. (2021). Alfabetización digital en la educación: Revisión sistemática en Scopus. *Revista de Educación a Distancia (RED)*, 21(66). <https://doi.org/10.6018/red.444751>
- Gisbert, M., Espuny, C., & González, J. (2011). INCOTIC: Una herramienta para la autoevaluación diagnóstica de la competencia digital en la universidad. *Profesorado. Revista de Currículum y Formación del Profesorado*, 15(1), 1–16. <https://doi.org/10.30827/profesorado>
- Gisbert, M., & Esteve, F. (2011). Digital learners: La competencia digital de los estudiantes universitarios. *La Cuestión Universitaria*, 7, 48–59. <https://polired.upm.es/index.php/lacuestionuniversitaria/article/view/3359>
- Gisbert, M., González, J., & Esteve, F. M. (2016). Competencia digital y competencia digital docente: Una panorámica sobre el estado de la cuestión. *Revista Interuniversitaria de Investigación en Tecnología Educativa*, 0, 74–83. <https://doi.org/10.6018/riite2016/257631>
- Godoy, C. E. (2009). Alfabetización digital, comportamientos y percepciones respecto a las TIC de los estudiantes venezolanos. *RELATEC*, 8(1), 83–104. <https://relatec.unex.es/index.php/relatec/article/view/455>
- Gutiérrez, A., & Tyner, K. (2012). Educación para los medios, alfabetización mediática y competencia digital. *Comunicar*, 38, 31–39. <https://doi.org/10.3916/C38-2012-02-03>
- Guzmán, F., García, E., & López, I. (2017). Undergraduate students' perspectives on digital competence and academic literacy in a Spanish university. *Computers in Human Behavior*, 74, 196–204. <https://doi.org/10.1016/j.chb.2017.04.040>
- Henríquez-Coronel, P., Gisbert-Cervera, M., & Fernández, I. (2018). La evaluación de la competencia digital de los estudiantes: Una revisión al caso latinoamericano. *Chasqui. Revista Latinoamericana de Comunicación*, 137, 93–112. <https://doi.org/10.16921/chasqui.v0i137.3511>
- Hernández-Campillo, T. R., Veranes Gálvez, L., & Arias Hidalgo, A. B. (2023). La alfabetización informacional en las carreras pedagógicas cubanas. *Información, Cultura y Sociedad*, 49, 9–33. <https://doi.org/10.34096/ics.i49.12665>
- Herrero-Curiel, E., & La-Rosa, L. (2022). Secondary education students and media literacy in the age of disinformation [Los estudiantes de secundaria y la alfabetización mediática en la era de la desinformación]. *Comunicar*, 73, 95–106. <https://doi.org/10.3916/C73-2022-08>
- Islas, C., & Franco, S. (2018). Detección de patrones en competencias digitales manifestadas por estudiantes universitarios. *EduTec. Revista Electrónica de Tecnología Educativa*, 64, 68–81. <https://doi.org/10.21556/edutec.2018.64.1079>
- ISTE. (2008). *National educational technology standards for students*. International Society for Technology in Education.
- Jaén, K. E., & Mena-Clerque, S. E. (2021). Alfabetización informacional para el desarrollo de competencias digitales en Educación Básica Media. *Revista Arbitrada Interdisciplinaria Koinonía*, 8(3), 128–154. <https://doi.org/10.35381/r.k.v6i3.1307>
- Jara, I., Claro, M., Enrique, J., San Martín, E., Rodríguez, P., Cabello, T., Ibieta, A., & Labbe, C. (2015). Understanding factors related to Chilean students' digital skills: A mixed methods analysis. *Computers & Education*, 88, 387–398. <https://doi.org/10.1016/j.compedu.2015.07.016>
- Juca-Maldonado, A. X., García-Vera, J. S., Juca-Maldonado, F., & Carrión-González, J. T. (2025). Competencias tecnológicas de la generación Z: Una evaluación cuantitativa de las habilidades frente a la percepción de los nativos digitales. *Revista Transdisciplinaria de Estudios Sociales y Tecnológicos*, 5(2), 16–24. <https://doi.org/10.58594/rtest.v5i2.160>
- Larraz, V. (2012). *La competència digital a la Universitat* [Tesis doctoral, Universitat d'Andorra]. TDX. <https://www.tdx.cat/handle/10803/113431>
- López-Gil, K. S., & Sevillano, M. L. (2020). Desarrollo de competencias digitales de estudiantes universitarios en contextos

- informales de aprendizaje. *Educatio Siglo XXI*, 38(1), 53–78.
<https://doi.org/10.6018/educatio.413141>
- López-Meneses, E., Sirignano, F. M., Vázquez-Cano, E., & Ramírez-Hurtado, J. M. (2020). University students' digital competence in three areas of the DigComp 2.1 model: A comparative study at three European universities. *Australasian Journal of Educational Technology*, 36(3), 69–88.
<https://doi.org/10.14742/ajet.5583>
- Millán, A. N. (2011). CREADIS (Centro de Recursos Electrónicos para Alumnos Universitarios con Discapacidad): Una iniciativa académica para la alfabetización informacional de los estudiantes universitarios con discapacidad. *Anales de Documentación*, 14(2), 1–14.
<http://revistas.um.es/analesdoc/article/view/115681>
- Moreno, M. D., Gabarda, V., & Rodríguez, A. M. (2018). Alfabetización informacional y competencia digital en estudiantes de magisterio. *Profesorado. Revista de Currículum y Formación del Profesorado*, 22(3), 253–270.
<https://doi.org/10.30827/profesorado.v22i3.8001>
- OCDE. (2001). *Definition and selection of competencies (DeSeCo)*.
<http://www.oecd.org/edu/skills-beyond-school/definitionandselectionofcompetenciesdeseco.htm>
- Padilla-Carmona, M. T., Suárez-Ortega, M., & Sánchez-García, M. F. (2016). Inclusión digital de los estudiantes adultos que acceden a la universidad: Análisis de sus actitudes y competencias digitales. *Revista Complutense de Educación*, 27(3), 1229–1246.
https://doi.org/10.5209/rev_RCED.2016.v27.n3.47669
- Paulhus, D. L. (2002). Socially desirable responding: The evolution of a construct. En H. I. Braun, D. N. Jackson, & D. E. Wiley (Eds.), *The role of constructs in psychological and educational measurement* (pp. 49–69). Lawrence Erlbaum Associates.
- Pérez-Escoda, A., García-Ruiz, R., & Aguaded, I. (2019). Dimensions of digital literacy based on five models of development. *Cultura y Educación*, 31(2), 232–266.
<https://doi.org/10.1080/11356405.2019.1603274>
- Reis, C., Pessoa, T., & Gallego-Arrufat, M. J. (2019). Alfabetización y competencia digital en Educación Superior: Una revisión sistemática. *REDU. Revista de Docencia Universitaria*, 17(1), 45–58.
<https://doi.org/10.4995/redu.2019.11274>
- Rumiche Chávarry, R. D. P., & Chunga Chinguel, G. R. (2019). Evaluación de competencias digitales de estudiantes de la Universidad Católica de Santo Toribio de Mogrovejo (Perú). *IJNE: International Journal of New Education*, 4, 75–89.
<https://dialnet.unirioja.es/descarga/articulo/7424943.pdf>
- Sales, D., Cuevas-Cerveró, A., & Gómez-Hernández, J. A. (2020). Perspectives on the information and digital competence of Social Sciences students and faculty before and during lockdown due to Covid-19. *Profesional de la Información*, 29(4), Article e290423.
<https://doi.org/10.3145/epi.2020.jul.23>
- Sánchez-Caballé, A., Gisbert-Cervera, M., & Esteve-Mon, F. (2020). The digital competence of university students: A systematic literature review. *Aloma: Revista de Psicologia, Ciències de l'Educació i de l'Esport*, 38(1), 63–74.
<https://doi.org/10.51698/aloma.2020.38.1.63-74>
- Silva-Quiroz, J., & Morales-Morgado, E. M. (2022). Assessing digital competence and its relationship with the socioeconomic level of Chilean university students. *International Journal of Educational Technology in Higher Education*, 19, Article 46. <https://doi.org/10.1186/s41239-022-00346-6>
- Tarango, J. (2014). Uso y acceso a las TIC en estudiantes de escuelas secundarias públicas en la ciudad de Chihuahua, México: Inclusión en la didáctica y en la alfabetización digital. *Revista Complutense de Educación*, 25(1), 133–152.
https://doi.org/10.5209/rev_RCED.2014.v25.n1.41250
- UNESCO. (2011). *Alfabetización mediática e informacional: Currículum para profesores*. <http://unesdoc.unesco.org/images/0021/002160/216099s.pdf>

- UNESCO. (2023). *Tecnología en educación: ¿Una herramienta en los términos de quién?* https://www.unesco.org/gem-report/sites/default/files/medias/fichiers/2023/07/2023reportflyer_SP.pdf
- Unión Europea. (2009). *El Marco Europeo de Cualificaciones para el aprendizaje permanente (EQF-MEC)*. https://ec.europa.eu/ploteus/sites/eac-eqf/files/broch_es.pdf
- Valverde-Crespo, D., Pro-Bueno, A. J., & González-Sánchez, J. (2018). La competencia informacional-digital en la enseñanza y aprendizaje de las ciencias en la educación secundaria obligatoria actual: Una revisión teórica. *Revista Eureka sobre Enseñanza y Divulgación de las Ciencias*, 15(2), Article 2105. https://doi.org/10.25267/Rev_Eureka_ens_en_divulg_cienc.2018.v15.i2.2105
- Watts, K. J. (2025). Paying the cognitive debt: An experiential learning framework for integrating AI in social work education. *Education Sciences*, 15(10), Article 1304. <https://doi.org/10.3390/educsci15101304>
- Zhao, Y., Sánchez, M. C., Pinto, A. M., & Zhao, L. (2021). Digital competence in higher education: Students' perception and personal factors. *Sustainability*, 13(21), Article 12184. <https://doi.org/10.3390/su132112184>

