TEACHER'S DIGITAL COMPETENCE IN PRIMARY EDUCATION: A SYSTEMATIC REVIEW OF LITERATURE
COMPETENCIA DIGITAL DOCENTE EN EDUCACIÓN PRIMARIA: UNA REVISIÓN SISTEMÁTICA DE LA LITERATURA

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	ABSTRACT
Keywords: teacher's digital competence, primary education, educommunication, digcompedu, systematic review	The development of teachers' media literacy and digital competence emerges as a 21st century challenge in Primary Education. This study aims to analyze teachers' digital competence through a systematic review of the literature since the publication of the European Framework DigCompEdu in 2017. The methodology used is qualitative of a descriptive nature and a review of 25 articles from two of the most prestigious databases (WoS and Scopus) has been carried out. The results show an increase in publications during the health crisis by COVID-19 and highlight the use of the TPACK model, as well as the influence of gender and age on the level of teaching digital competence. It is concluded that it is essential to continue developing training strategies to improve the digital competence of educators, considering demographic and contextual factors.
	RESUMEN
Palabras clave: competencia digital docente, educación primaria, educomunicación, digcompedu, revisión sistemática.	El desarrollo de la alfabetización mediática y de la competencia digital de los maestros surge como un reto del siglo XXI en la Educación Primaria. Este estudio tiene como objetivo analizar la competencia digital docente mediante una revisión sistemática de la literatura desde la publicación del Marco Europeo DigCompEdu en 2017. La metodología empleada es cualitativa de carácter descriptivo y se ha llevado a cabo la revisión de 25 artículos de dos de las bases de datos más prestigiosas (WoS y Scopus). Los resultados muestran un incremento en publicaciones durante la crisis sanitaria por COVID-19 y destacan el uso del modelo TPACK, así como la influencia del género y la edad en el nivel de competencia digital docente. Se concluye que es esencial continuar desarrollando estrategias formativas para mejorar la competencia digital de los docentes, considerando factores demográficos y contextuales.

Introduction

Media literacy is a key component of modern education, especially at the primary education stage. Specifically, the concepts of educommunication and literacy are fundamental elements in the current educational context, as they are essential pillars where the foundations are laid for the integral development of students in the digital era. According to Aparici and Osuna (2010) and García-Matilla (2010), a definition is proposed that attempts to unify both ideas. Thus, educommunication is understood as an interdisciplinary field of study that merges education and communication. Its purpose is to equip individuals with expressive skills essential for effective communication and to foster the development of creativity, empowering people to participate actively and critically in contemporary media society, reducing the risks of manipulation and promoting a responsible use of the media.

Educommunication is essential for citizens not only to consume, but also to produce content, enriching the social fabric and strengthening participatory democracy (García-Ruiz et al., 2014). There has been much discussion in the scientific literature about the branches of educommunication, such as "digital literacy", "communicative" and "information literacy". According to Buitrago-Alonso et al. (2017), the term "mediated" is preferable to refer to this field, given that it reflects a multidimensional nature where linkage and communication are more clearly presented.

This global vision of media literacy cannot be separated from the digital revolution, which implies profound changes in communication, consumption, relationships and production, as well as in access to knowledge. This technological transformation has generated new social demands, requiring the acquisition of skills to interact in diverse environments. Specifically, at the educational level, the effective integration of technology has become an essential element to enhance and enrich the teaching and learning process.

Digitalization has created a new generation of young people, commonly known as "digital natives", a term coined by Prensky (2001), who grow up immersed in technology from an early age. In contrast, "digital immigrants", as described by Cassany and Ayala (2008), must adapt and face challenges to develop digital competencies. However, this classification has been widely criticized in recent decades by authors such as McKenzie (2007), Kennedy et al. (2010) and Gallardo-Echenique et al. (2016). In fact, recent studies indicate that there is an increasingly smaller generation gap between those who were born in a digitized environment and those who were not, and that being a "digital native" does not imply the acquisition of the competencies and skills necessary for the integration and use of ICTs (Granado, 2019; Haz-Gómez et al., 2024).

Therefore, in a context where the digitization of society and, therefore, of education is increasingly evident, teaching digital competence (TDC) is essential for educational institutions to continue to meet this challenge in the current environment (Mora-Cantallops et al., 2022). Thus, the CDD emerges as a field of research to drive innovation and change the educational perspective (García-Ruiz et al., 2023).

To understand the CDD, it is first necessary to define digital competence (DC). Despite the varied denominations at the international level (Gisbert et al., 2016), DC is understood as the ability to safely, effectively and creatively use digital technologies (DT) in order to participate and develop in different society (Ferrari, 2013). It also encompasses skills that go beyond the mere technical use of digital tools, also including the ability to search, evaluate, select, synthesize and communicate information in digital environments (Valverde-Crespo et al., 2017). The importance of this competence in education is evident, since teacher training must promote student CD in the curricular and academic fields, among others. However, simply using TD does not guarantee effective

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integration; according to Krumsvik (2008), schools must assume pedagogical and didactic responsibility based on a DC model throughout the process.

Therefore, since the development of a competence is sought, it should go beyond the knowledge itself in the use of technology and should also cover skills and attitudes when implementing and integrating effectively these digital tools in teaching practices, being able to propose a series of activities aimed at developing CD in students, to create digital educational materials and to evaluate all parties involved in the teaching and learning process. In this sense, the CDD is defined as the "set of skills, abilities and attitudes that teachers must develop in order to incorporate digital technologies into their practice and professional development" (Lázaro et al., 2019, p.75). In this same line, the role of teachers acquires great importance since, through their pedagogical performance, they become the main responsible for the integral development of their students, within a cultural context characterized by the prevalence of TDs (Colás-Bravo et al. 2019). Therefore, in recent decades, different regional, state and European organizations and institutions have been responsible for formalizing and specifying these competencies by defining a series of common models or reference frameworks focused on responding to the need for citizen development in the area of DC.

Given this scenario, we propose the elaboration of a systematic review of the scientific literature related to the CDD in the educational environment of the Primary Education stage, which will allow not only to identify the most relevant trends, approaches and practices in research on training and development of digital competencies of educators at this educational level, but also to provide valuable information to guide policies, training programs and educational practices that promote the effective integration of technology in the Primary Education stage.

Method

Target

The main objective of the present study is to examine the scientific literature in terms of CDD level and in relation to the Primary Education stage, geographically framed in the Spanish territory, offering the scientific community an overview of the most recent lines of research on these areas, after analyzing the trends of the latest scientific contributions.

Specific objectives

In order to achieve this purpose, specific objectives are set out that will allow to narrow down the approach of the study:

a) To identify the volume of articles published on the CDD level related to the Primary Education stage in Spain.
b) To examine the frequency of mention of the European Framework for CDD and/or the MRCDD in the selected studies.
c) Analyze the main objectives of publications in this field.
d) Define the main methodologies carried out in the articles reviewed.
e) To determine the main findings of the studies analyzed.

Methodology

A descriptive qualitative study will be carried out to analyze the content of the selected articles and to carry out a critical review of the most relevant research in this field.

In order to achieve the proposed objectives and conduct the systematic review, the standards of the PRISMA statement (Moher et al., 2009) will be taken into account, specifically, the latest guide updated by Page et al. (2020). In the context of this study, it has been decided to adopt the PRISMA guidelines in order to structure more precisely each stage of the review process, by means of a flow chart that will make it possible to describe the different phases of the process that have been carried out.

Systematic Review

Information sources and search strategy

Before starting the first searches, the prestigious Web of Science (WoS) and Scopus databases were selected for this review, due to their high impact in the academic field, thus guaranteeing the quality of the selected articles.

The search to ensure the inclusion of relevant studies on CDD in the context of Primary Education took into account the following terms using the Boolean operators AND and OR, resulting in the following sentence: ("primary education" OR "primary school") AND ("digital compet*") AND ("teach*"). This statement was used in both databases. The search was conducted in early May 2024.

Eligibility Criteria

In order to ensure that the selected studies are relevant and of high quality in relation to the research objectives, a number of specific eligibility criteria have been established. These criteria were developed with the purpose of filtering and selecting the articles that provide the most convenient and solid evidence on CDD in the context of Primary Education in Spain. These are specified in Table 1.

Table 1
Filtering criteria used in databases

Filtering criteria	Justification
Publication period from 2017 to 2024	This time range is taken into account in order to analyze the trend of publications in relation to the first version of the DigCompEdu framework.
Language of publication in English or Spanish.	Considering that these are the predominant languages in the scientific literature on education in Spain, articles published in English and Spanish were included.
Study conducted in the Spanish educational context	By focusing the review on studies conducted in Spain, we ensure that the findings are directly applicable and relevant to the Spanish educational community.
Type of publication: article	Articles are selected from these databases to give a more specific focus to the study, as they provide detailed and up-to-date analyses, while other types of research may address these issues in a more general way.

A total of 454 articles were obtained (251 from WoS and 203 from Scopus). Subsequently, selection filters were applied to the databases in terms of year of publication, language, country and type of publication. After filtering these items, the duplicates are excluded. The RefWorks tool was used to automate this process. These data are shown in Table 2.

Table 2
Searching, filtering and duplicate elimination

		WoS	Scopus	Total
First search by applying the sequence		251	203	454
Eliminated after the application of filters in the search engines of the databases: year, language, article and country.	Year	30	13	43
	Language	8	8	16
	Type of publication: Article	36	43	79
	Country	45	47	92
Exclusion of duplicate items		45*	0	45
Total		87	92	**179**

Note. Duplicates were discarded from the WoS database

Study selection process

Once the initial search, filtering according to the established criteria and eliminating duplicate studies, a series of inclusion and exclusion criteria were established, which will be used as a reference when carrying out the in-depth review of the articles to determine whether they pass to the next selection phase (Table 3):

Table 3
Justification of inclusion and exclusion criteria

Criteria	Inclusion	Exclusion	Justification
C1	Educational level: Primary Education	Educational level: other than EP or EP plus another educational stage.	Only studies that address CDD in the context of Primary Education are included, allowing for a more accurate and contextualized assessment of CDD at this educational level.
C2	It is related to the CDD theme, including active teachers and teachers in initial training.	It is not related to CDD and not from another collective.	The selected research should specifically address issues related to CDD, providing relevant and applicable information to the study.
C3	Studies carried out in the Spanish educational context	Articles from contexts other than Spain	Given the particular interest in the Spanish context, studies from other countries would not provide the specific information necessary for the objectives of this review, and those conducted outside Spain were excluded.
C4	Free access	Not having free access to the full text.	The ability to access the full article allows more accurate and transparent verification of the data and methods used, also facilitating access to the review by other researchers and ensuring that the findings are reliable and verifiable.

Screening by title and abstract

After specifying the inclusion and exclusion criteria, a manual review of each of the articles was carried out, checking those that did not meet the aforementioned requirements, screening by title and abstract, which allowed rapid elimination of studies that clearly did not meet the criteria (Table 4).

Table 4
Verification of compliance with the criteria

		WoS	Scopus
After applying filters and eliminating duplicates		87	92
Eliminated for not meeting the criteria	C1	30	30
	C2	28	27
	C3	5	9
	C4	0	0
	Total	24	26
Total investigations after discarding according to criteria			**50**

Data extraction process

The research was read in its entirety ~~by the author~~ to assess thematic relevance, methodological quality and compliance with inclusion and exclusion criteria, without automated tools. The methodology, the purpose of the research and the relevance of the results to the objectives of the review were analyzed. Finally, justified articles were included in Table 5.

Table 5
Included after revision of the full text

		WoS	Scopus
After the first review of compliance with the criteria		24	26
Eliminated for not meeting inclusion and exclusion criteria	C1	0	2
	C2	3	4
	C3	1	1
	C4	2	1
Eliminated by duplication		11	0
		7	**18**
Total investigations for review		**25**	

PRISMA flow chart

To ensure a transparent and systematic selection process, a flow chart was developed based on the PRISMA guidelines. This diagram, shown in Figure 1, details each phase of the review process, from the initial identification of articles to the final inclusion of studies to be used for the review analysis.

Figure 1
Flowchart
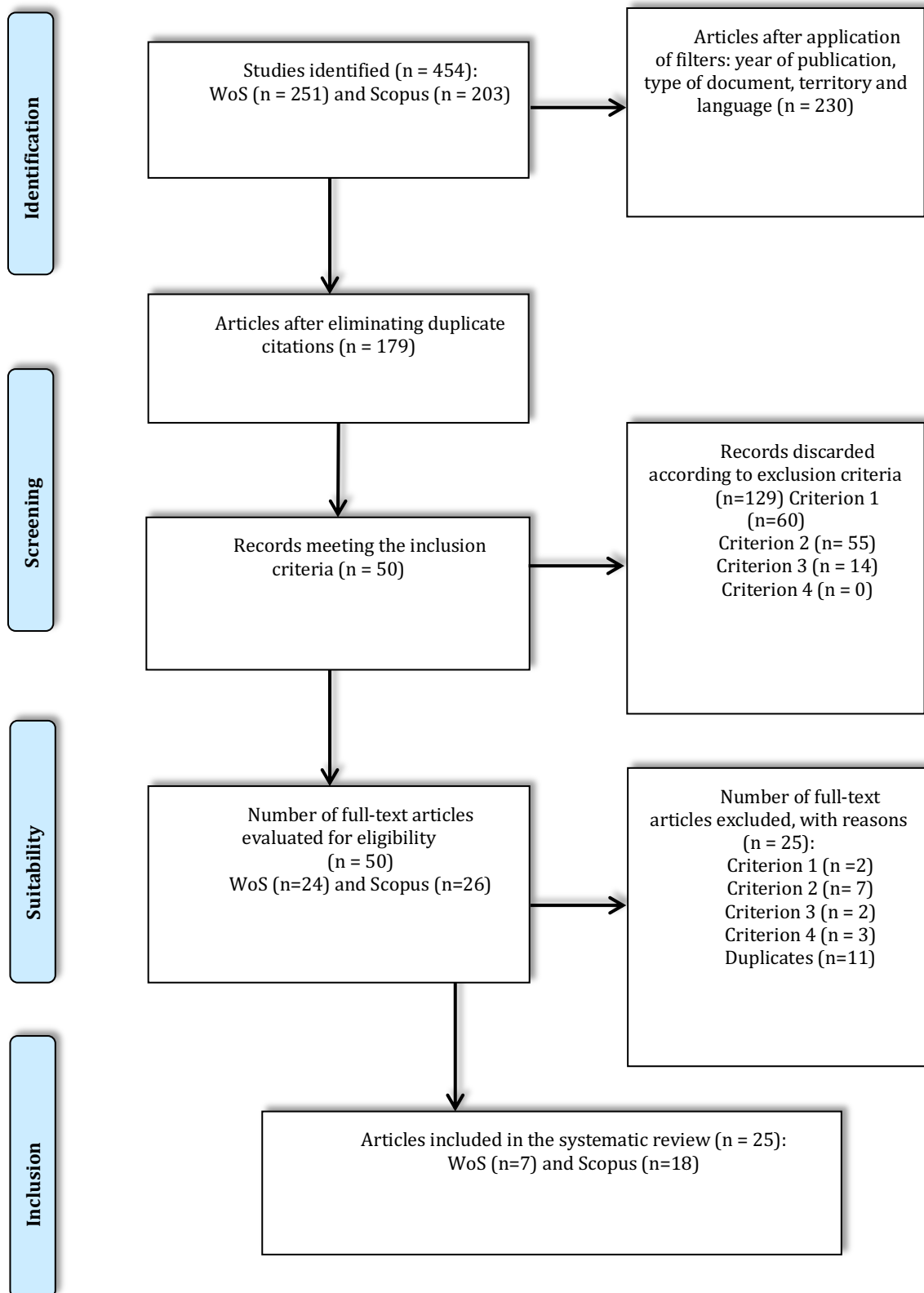
Results

After carrying out the selection process, explained in the PRISMA flow chart (Figure 1), the resulting sample consisted of 25 articles. We then proceed with the analysis of the data from the studies in line with the research questions and objectives.

Results of study selection

A sample of 25 research papers from WoS (n=7; 28%) and Scopus (n=18; 72%) was collected and numbered, including author(s), year, title and database for easy reference in other tables of the paper (Table 6).

Table 6
Articles selected for review

NO	Author(s) and year	Title	Database
1	Sánchez-Rivas, E., Ruiz-Roso Vázquez, C. & Ruiz-Palmero, J. (2024)	Teacher Digital Competence Analysis in Block Programming Applied to Educational Robotics	Scopus
2	Guillén-Gámez. F. D., Colomo-Magaña, E., Ruiz-Palmero, J. & Tomczyk, L. (2023)	The digital competence of the rural teacher of primary education in the mentoring process: a study by teaching speciality and gender	Scopus
3	Larrañaga, N., Jiménez, E. & Garmendia, M. (2023)	Oportunidades y necesidades percibidas entre los docentes de Educación Primaria para el uso educativo de las TIC	Scopus
4	Manrique, J. M. & García-Martín, J. (2022)	La competencia digital del profesorado de Educación Primaria durante la pandemia (COVID-19).	Scopus
5	Chabert, A. (2021)	Account of a Foretold Death: Analysing the Response to the Pandemic in the Schools of Castellón (Spain)	Scopus
6	Díaz-Barahona, J. D., Molina-García, J. & Monfort-Pañego, M. (2020)	El conocimiento y la intencionalidad didáctica en el uso de TIC del profesorado de educación física.	Scopus
7	Rojo-Ramos, J., Carlos-Vivas, J., Manzano-Redondo, F., Fernández-Sánchez, M. R., Rodilla-Rojo, J., García-Gordillo, M. Á & Adsuar, J. C. (2020)	Study of the digital teaching competence of physical education teachers in primary schools in one region of Spain	Scopus
8	Lores-Gómez, B., Sánchez-Thevenet, P. & García-Bellido, M. R. (2019)	La formación de la competencia digital en los docentes.	Scopus
9	Guerrero-Elecalde, R., Contreras-García., Bonilla-Martos, A. L. & Serrano-Arnáez, B. (2024)	Digital and Social-Civic Skills in Future Primary Education Teachers: A Study from the Didactics of Social Sciences for the Improvement of Teacher Training in Competences	Scopus

| 10	Magaña, E. C., Méndez G., Ariza A. C. & Monzonís, N. C. (2023)	Análisis de la competencia digital de futuros profesionales de la educación en tiempos de pandemia.	Scopus
11	Torres-Hernández, N. & Gallego-Arrufat, M. (2023)	Pre-service teachers' perceptions of data protection in primary education	Scopus
12	Ciriza-Mendívil, C. D., Lacambra, A. M. & Hernández-de-la-Cruz, J. M. (2022)	Technological Pedagogical Content Knowledge: Implementation of a Didactic Proposal for Preservice History Teachers	Scopus
13	Martínez-Pérez, S., Cabero-Almenara, J., Barroso-Osuna, J. & Palacios-Rodríguez, A. (2022)	T-MOOC for Initial Teacher Training in Digital Competences: Technology and Educational Innovation	Scopus
14	Robles-Moral, F. J. & Fernández-Díaz, M. (2021)	Future primary school teachers' digital competence in teaching science through the use of social media	Scopus
15	Grande-De-Prado, M., Cañón, R., García-Martín, S. & Cantón, I. (2020)	Digital competence and gender: Teachers in training. a case study	Scopus
16	Guillén-Gámez, F. D., Lugones, A., Mayorga-Fernández, M. J. & Wang, S. (2019)	ICT use by pre-service foreign languages teachers according to gender, age and motivation	Scopus
17	Pascual, M. A., Ortega-Carrillo, J. A., Pérez-Ferra, M. & Fombona, J. (2019)	Competencias Digitales en los Estudiantes del Grado de Maestro de Educación Primaria. El caso de tres Universidades Españolas.	Scopus
18	Rodríguez-García, A. M., Fuentes-Cabrera, A. & Moreno-Guerrero, A. J. (2019)	Competencia digital docente para la búsqueda, selección, evaluación y almacenamiento de la información.	Scopus
19	Colomer-Rubio, J. C., Saiz-Serrano, J. & Bel-Martínez, J. C. (2018)	Competencia digital en futuros docentes de Ciencias Sociales en Educación Primaria: análisis desde el modelo TPACK.	WoS
20	Suárez-Guerrero, C., Lloret-Catalá, C. & Lizandra, J. (2022)	Imagen educativa de la tecnología en la COVID-19. La mirada del alumnado de Magisterio con mención TIC.	WoS
21	Fernández-Díaz, M. Robles-Moral, F. J. & Ayuso-Fernández, G. E. (2021)	Una propuesta para trabajar la competencia digital docente a través de Instagram y el Pensamiento Visual: El estudio de la sostenibilidad.	WoS
22	Fombona, J. & Pascual, M. A. (2020)	Percepción de los estudiantes de Maestro de Educación Primaria sobre su competencia digital, urgencias formativas detectadas.	WoS
23	Ortega-Carrillo, J. A., Rendón-López, L. M., Fuentes-Esparrell, J. A., & Ortega-Maldonado, Á. (2020)	Eficacia de un programa de formación en competencias digitales aplicado a estudiantes del grado de magisterio en educación primaria basado en el modelo Affective elearning+.	WoS
24	Pérez-García, Á, & Hernández-Sánchez, A. M. (2020)	Efectos del programa affective e-learning en el desarrollo de la	WoS

| **25** | Heredia-Ponce, H., Romero-Oliva, M. F., & Álvarez-Ramos, E.. (2019) | Competencia Digital en estudiantes del Grado en Educación Primaria. El blog en la formación inicial de los futuros maestros del Grado de Educación primaria. Un estudio de caso. | WoS |

Characteristics of the Included Studies

We analyzed the characteristics of 25 studies published between 2017 and 2024, considering year, methodology, language, geographic representation, and findings on CDD frameworks.

In terms of year of publication (Figure 2), studies from 2017 to 2024 were analyzed. An upward trend can be observed since 2017 with a notable concentration in the years 2019 (n=5) and 2020 (n=6), so the need arises to investigate whether there is any common correlation in the articles of these years.

Figure 2
Studies by year of publication
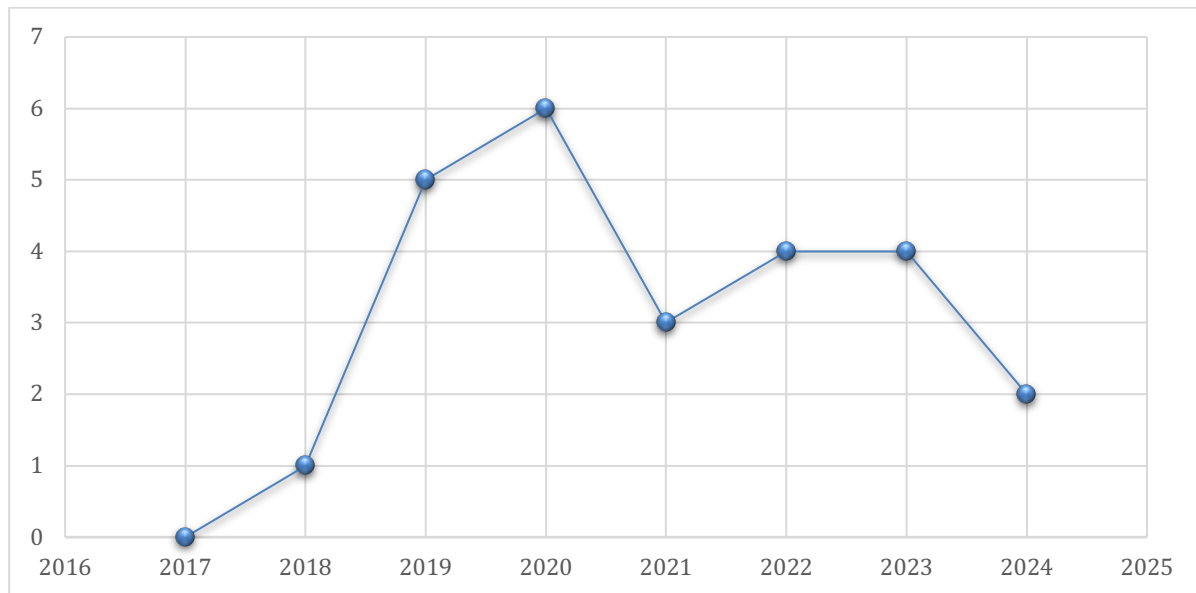
As can be seen in Figure 3, most of the research studies employ a quantitative methodology (n=13), followed by mixed methodologies (n=9) and qualitative studies (n=3). This methodological diversity offers a broad and detailed perspective on the CDD. However, qualitative studies are less frequent, as CDD tends to be measured from a quantitative approach.

Figure 3
No. of publications by methodology
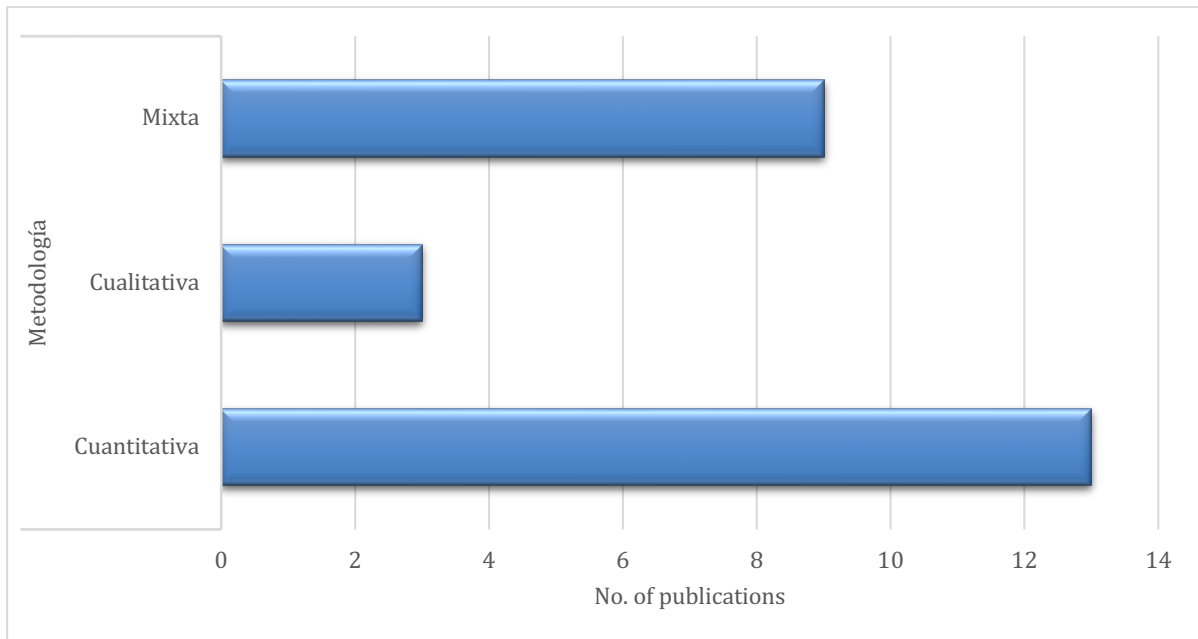
According to the type of study, there was a predominance of descriptive studies (Figure 4). However, case, experimental, longitudinal and exploratory studies are also included, case, experimental, longitudinal and exploratory studies are also included. This methodological diversity provides greater depth and a more global and diverse perspective on the CDD.

Figure 4
Type of studies according to their methodological nature

With regard to the language of the studies (Figure 5), there is a greater number of publications written in Spanish (n=14) compared to those published in English (n=11).

This may be due to the fact that only studies conducted in Spain were analyzed, so this criterion also influences the language of publication.

Figure 5
No. of publications by language
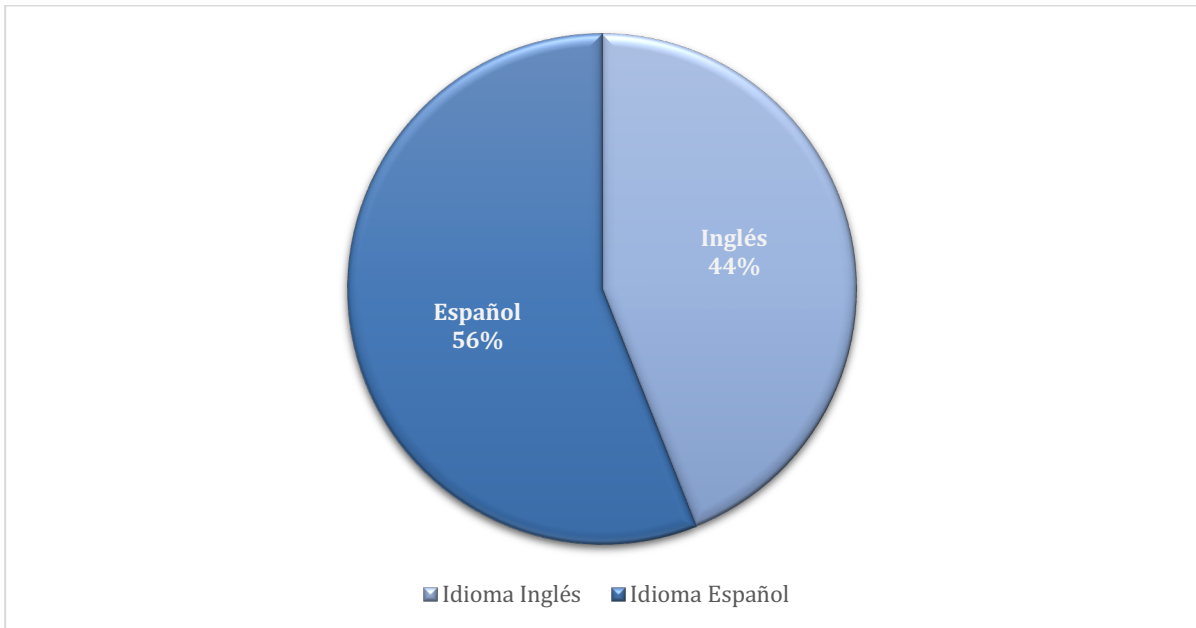
In order to count the studies in relation to the location in which they have been carried out, it should be taken into account that there are studies that collect their sample in different provinces, so that the same article may be represented in more than one of them. The data presented in the map in Figure 6 show that most of the scientific contributions analyzed are centered in the southeastern part of the Iberian Peninsula.

Figure 6
No. of publications by language
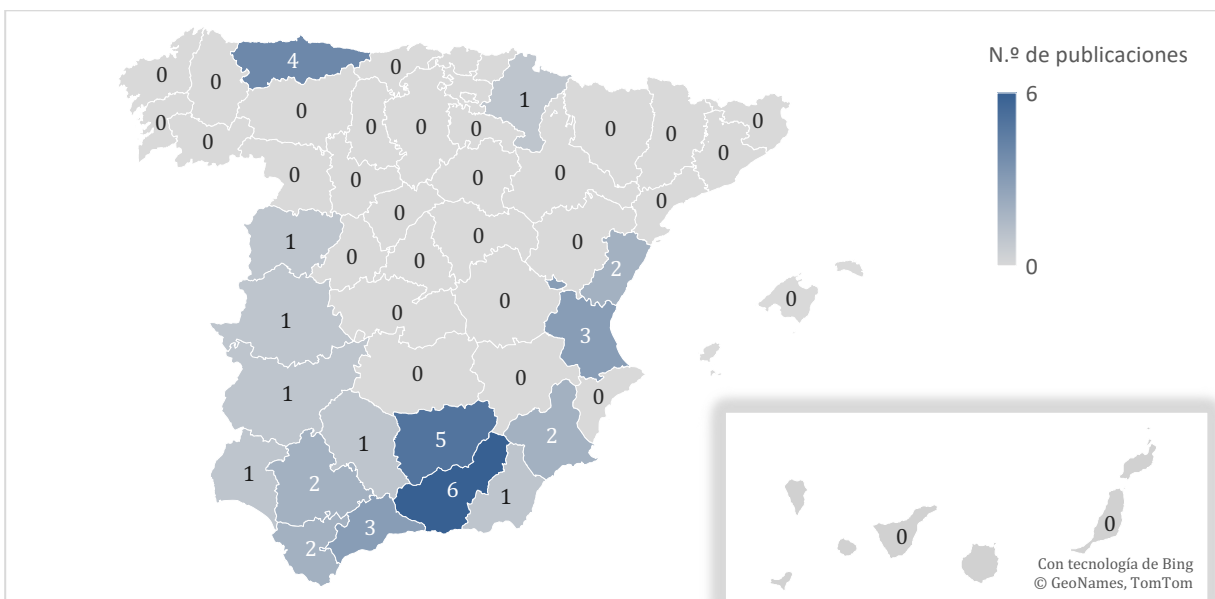
Regarding the referencing of CDD frameworks, it is noteworthy that only 12 of the 25 studies analyzed mention any of these frameworks such as DigCompEdu or Spain's MRCDD (Table 7).
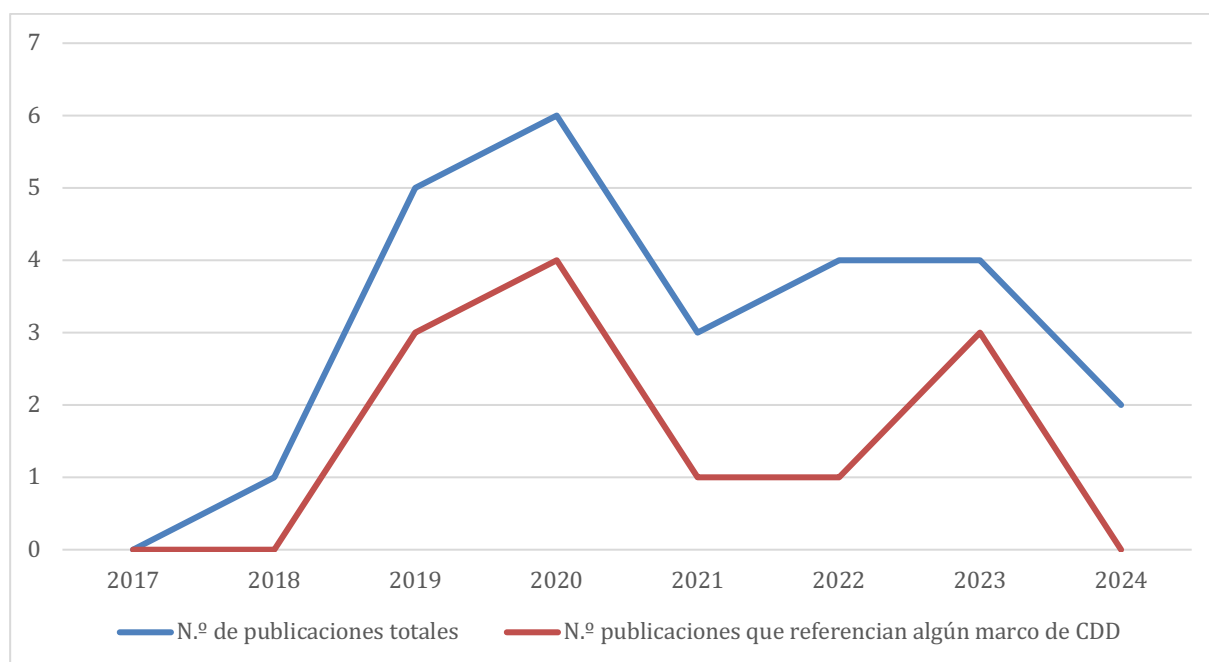
Table 7
Total publications and those mentioning a CDD framework

Year	No. of total publications	No. of publications referencing a CDD framework
2017	0	0
2018	1	0
2019	5	3
2020	6	4
2021	3	1
2022	4	1
2023	4	3
2024	2	0
Total	**25**	**12**

Figure 7 shows that in none of the years do the publications mentioning the frameworks coincide with the total number of research studies reviewed. This finding is significant, since it would be expected that most of the selected articles would make reference to these frameworks to support their research and interpret the reality in this field. However, this figure does not even reach half of the total number of publications selected for the review.

Figure 7
Comparison between total publications and those mentioning a CDD framework

Evolution in the Volume of Academic Contributions

To analyze the evolution of publications over the period of time analyzed, a table (Table 8) and a graph (Figure 7) are drawn up in which the documentary references analyzed (the number associated with each article in Table 6 is used) are represented according to the year of publication reviewed and some common parameters presented by the articles.

Table 8
Comparison of common parameters in the reviewed articles

	2018	2019	2020	2021	2022	2023	2024
CDD frames		8, 17, 18	7, 15, 22, 24	5	13	3, 10, 11	
Health crisis COVID-19				5	4, 12, 13, 20	3, 10, 11	
Gender variable		16	6, 7, 15				
Age variable		16	6, 7				
TPACK Model	19				12		1
Technology applied to Science in the Teacher Education Degree		25			12		
Digital tools		25		14, 21			
Communication			22, 24	21		2, 3	9

Figure 8

Representative graph with common parameters in reviewed articles
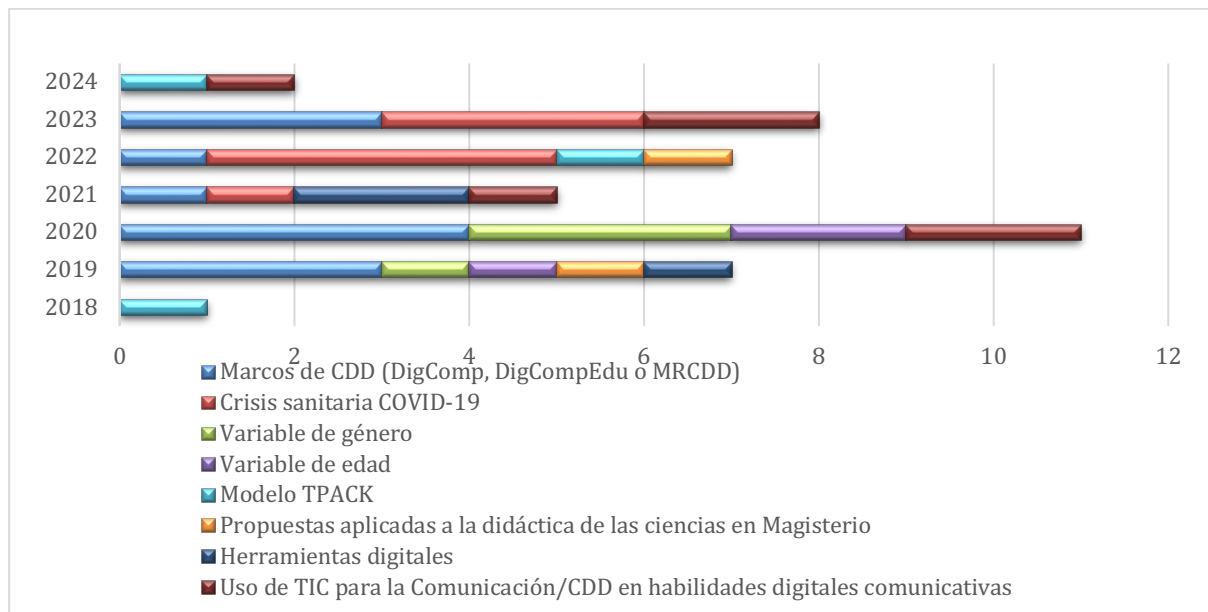
During 2019, 2020 and 2023, increases in mentions of European and/or national frameworks were observed, which coincides with peaks in publications in 2019 and 2020 (Figure 2). However, only 12 of the 25 studies analyzed since 2017 explicitly mention these frameworks (Figure 7), which could reflect an underestimation of their importance or lack of consideration of national and international standards in this field of study.

Another issue that is also very present in the academic contributions analyzed has been the health crisis produced by COVID-19; from 2021 onwards, studies appear that take this conditioning factor into account and analyze its impact on the CDD and in the educational field.

These two parameters may have an impact on the significant increase in the number of published studies that address the integration of DC in teacher education and its impact on teaching. Martínez-Pérez et al. (2022) used the DigCompEdu Check-In on prospective teachers, revealing a moderate level of digital competencies during the COVID-19 pandemic. Suarez et al. (2022) or Larrañaga et al. (2023) highlight the importance of these frameworks for structuring and evaluating digital competency training for teachers.

Mention of National and International CDD Reference Frameworks

Several studies have used the DigCompEdu and MRCDD frameworks to measure digital competencies (DC). Chabert (2021) analyzes the use of ICT during the school year where the COVID-19 pandemic took place, highlighting deficiencies in digital and English proficiency in students due to the scarcity of technological resources and access by students, in contrast to Lores-Gómez et al. (2019) and Ciriza-Mendívil et al. (2022), who point to the lack of CDD training for teachers.

Grande-De-Prado et al. (2020), Fombona and Pascual (2020), Larrañaga et al. (2023), Torres-Hernández and Gallego-Arrufat (2023), Rojo-Ramos et al. (2020) and Lores-Gómez et al. (2019) mention in their theoretical foundation CDD frameworks such as DigComp, DigCompEdu and/or MRCDD. Specifically, in Colomo-Magaña et al. (2023) evaluates the CD of teachers through a questionnaire based on the DigComp dimensions, finding areas for improvement such as the integration of ICT in teaching and continuous

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training. On the other hand, Rodríguez-García et al. (2019) also exposes insufficient teacher training in terms of the CD level linked to the competency areas stipulated by the DigCompEdu Framework.

Predominant Research Objectives, Methodologies and Results

The findings concerning the COVID-19 pandemic have had a profound impact on the research analyzed, in relation to the CDD and the implementation of ICT in the classroom. Chabert (2021) and Manrique and García-Martín (2022), who differ in methodological approach (qualitative and quantitative, respectively), but not in line of research, highlight opportunities and challenges, including the improvement of technological infrastructure and CD training.

The implementation of models such as TPACK in educational practice is investigated by Ciriza-Mendívil et al. (2022) and Colomer-Rubio et al. (2018), who point to positive results, but also deficiencies in content knowledge (CK). Ciriza-Mendívil et al. (2022) concludes that there is a need to balance the dimensions of TPACK. Sánchez-Rivas et al. (2024) also analyzes this model, highlighting a deficit in the knowledge of TPACK and strategies for computational thinking, although teachers have a better understanding of Universal Design for Learning and active methodologies. Finally, the need for updating teaching practices in educational robotics and programming, and for ongoing training in digital competence is highlighted (Colomer-Rubio et al., 2018; Suárez-Guerrero et al., 2022; Fombona & Pascual, 2020; Pascual et al., 2019).

The variables of age and gender have been studied. Regarding gender, it is indicated that men perceive themselves with a higher self-perception in CDD with respect to women in Colomo-Magaña et al. (2023), Díaz-Barahona et al. (2020). However, the studies of Rojo-Ramos et al. (2020) or Guillén-Gámez (2019) show that there is no significant difference. On the other hand, CDD was negatively influenced the older the age of the participants (Guillén-Gámez et al., 2019; Manrique & García-Martín, 2022).

Regarding the use of digital tools for communication and teaching the research reviewed underlines the importance of their use not only for teaching itself, but also for effective communication between the different agents of the educational community (Torres-Hernández & Gallego-Arrufat, 2023; Guillén-Gámez et al., 2023; Robles-Moral & Fernández-Díaz, 2021; Fernández-Díaz et al., 2021; Colomo-Magaña et al., 2023). The use of digital resources for communication between these agents is highlighted, indicating that the differences in the use of these resources depend on the teaching specialty and gender (Guillén-Gámez et al., 2023). Tools such as blogs, websites or social networks such as Instagram or Pinterest, were analyzed obtaining positive results in aspects associated with communication and teaching, although the quality of learning depends largely on the teacher's ability to integrate them effectively in their classes (Robles-Moral & Fernández-Díaz, 2021; Heredia et al. 2019). In Ortega-Carrillo et al. (2020) and Pérez-García and Hernández-Sánchez (2020) analyzed a specific training program specialized in communicative-digital competencies, providing favorable results in the development of the CD of the participants.

Discussion and Conclusions

Discussion and Conclusions

Much of the research reviewed contributes to respond to the social and educational demand of identifying the training needs of teachers in the use of TD applied to the classroom reality.

In relation to the evolution in the volume of publications (associated with responding to IP1), an increase is observed since 2017. This increase may be due to several factors such as the implementation of the European DigCompEdu Framework and the MRCDD as well as the pandemic caused by COVID-19. Specifically, this situation has led to an acceleration in the improvement of digital competencies in teaching staff at all educational stages. However, the development of DC in teachers is enhanced through an adapted plan of permanent training aimed at teachers and not so much with this situation that exposed many needs and demands for emergency reasons, as exposed by Portillo-Berasaluce et al. (2022).

The frequency of mention of the European DigCompEdu Framework and/or MRCDD in the publications analyzed (related to IP2) indicates a trend towards standardization in the study of CDD. However, the omission of these frameworks in slightly more than half of the articles reviewed may indicate different realities. Therefore, an apparent relationship can be established in the creation and impact of frameworks such as DigCompEdu and MRCDD, but not enough.

As for the predominant research objectives (and linking it to the response to PI3), the studies analyzed seek to achieve certain purposes related to the CDD and other parameters or variables, the most common being: the evaluation of this competence, the impact of the COVID-19 pandemic and the integration of digital technologies in the classroom applied to the aspect of communication between the different educational agents.

Regarding the methodologies used (related to IP4), the studies reviewed employ a variety of quantitative, qualitative and mixed approaches. However, the tendency towards quantitative (and mainly descriptive) studies may limit the analysis of more qualitative and contextual aspects of the CDD.

Finally, in terms of the main findings (associated with IP5), the studies reviewed present varied results, although similar in certain key aspects, which provide a comprehensive view of the current state of the art in this field.

Many articles highlight the need for continuous and specific training in CDD for teachers (Guerrero-Elecalde et al. 2024; Suárez-Guerrero et al., 2022; Fombona & Pascual, 2020; Pascual et al., 2019), noting that, although the majority present a basic-intermediate level in their self-perception of CDD, there are specific areas such as information management, monitoring and knowledge of the digital footprint or safety in the appropriate use of technologies related to mental health problems, which require special attention, coinciding with the contributions of Cantón-Mayo et al. (2016).

The effective integration of educational technology has been a recurring theme to be considered in research by authors from 2021 (Martínez-Pérez et al., 2022; Suárez-Guerrero et al., 2022; Larrañaga et al., 2023). This situation prompted the need for training in CDD, based on the contributions of Rodríguez-Jiménez et al. (2022), which requires adaptation to emerging technological demands and the integration of:

> different pedagogical models that are currently producing favorable results and that rely, many of them, on ICT (e.g., the inverted classroom, gamification, just-in-time teaching, peer instruction), and not limiting themselves only to the

acquisition of technological equipment or the simple management of the same, since this is not enough to achieve a true integration of ICT in teaching. (p. 16)

Finally, the gender and age variable is also taken into consideration in the studies reviewed. In Colomo-Magaña et al. (2023), Grande-de-prado et al. (2020) and Barahona et al. (2020) established a relationship between male gender and a higher self-perception in their level of CDD. However, this is not supported by the studies Manrique and García-Martín (2022), Rojo-Ramos et al. (2020) and Guillén-Gámez et al. (2019), who conclude that there is no obvious relationship between self-perceived level of CDD and the gender variable.

Ultimately, taking all these variables into account, it is concluded that the digital transformation has not only redefined the way students and teachers interact with technology, but has also expanded the concept of literacy beyond basic skills. In this context, the concept of transmedia literacy arises, which according to Scolari (2018), refers to the ability of individuals to interact, interpret and create content across multiple platforms and media. This approach recognizes that young people not only passively consume information, but actively participate in the production and creation of digital content. These practices that students perform in an "informal" way are considered a learning opportunity that should be enhanced and incorporated within classrooms (Scolari et al., 2018). This perspective is particularly relevant in the context of the CDD, as teachers in Spain must be prepared not only to use digital tools, but also to guide students in the development of critical and creative skills necessary for navigating complex media environments. As the results of this systematic review show, there is still a gap in CDD training, particularly with regard to the integration of transmedia literacy school intervention programs and the teaching of competencies related to production and active participation in digital platforms. This underscores the need to update teacher training programs to incorporate these emerging competencies, ensuring that teachers can foster in their students a critical and creative use of technologies in the classroom.

Limitations

This study has several limitations: the sample of studies analyzed (n=25) is small, which limits the generalizability of the findings. Data extraction and evaluation by a single person can introduce biases, affecting reliability (Mortico, 2022).

Another limitation of the study is that the systematic review was carried out in only two databases: WoS and Scopus. These databases are widely recognized for their prestige and the quality of the articles indexed, which guarantees the inclusion of studies of high impact and scientific relevance. However, it is important to recognize that the exclusion of other databases may limit the diversity and scope of the studies considered, especially those whose publications are mainly in Spanish (as is the case of Dialnet), as they could offer relevant perspectives on the CDD in the Spanish territory.

In addition, the exclusive focus on Spain limits the international applicability of the results.

Future lines of research

The limitations identified open up opportunities for future research in CDD. Broadening the sample of studies, extending the time range and including research not indexed in major databases, would capture a greater diversity of approaches. It is crucial to deepen the application of European and state frameworks in CDD and compare international studies to enrich global understanding. In addition, investigating variables such as age, gender and professional experience could improve personalized and effective teacher training programs.

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