Competencia *digital docente: una* revisión *sistemática de la literatura*

Teaching digital competence: a systematic review of the literature

Ensino de competência digital: uma revisão sistemática da literatura

Carlos Alberto Luis Grados
Universidad Privada César Vallejo
cluis@ucvvirtual.edu.pe
https://orcid.org/0000-0001-7665-5597

Resumen

Debido al brote del virus SARS-CoV-2, la dinámica de los entornos educativos ha experimentado una migración mayoritaria desde el ámbito presencial hacia el virtual, de ahí que haya sido necesario que los docentes se enfocaran en promover competencias digitales indispensables para enfrentar el fenómeno educativo en línea. Por ende, el presente artículo se enfoca en examinar las investigaciones relacionadas con las áreas de competencias digitales que deben desarrollar los docentes, así como en analizar las estrategias propuestas por instituciones formativas para fomentarlas. Para ello, se efectuó una revisión exhaustiva de artículos siguiendo las siguientes etapas: planificación de la búsqueda, ejecución y presentación del informe de revisión. En concreto, se consultaron bases de datos científicas reconocidas, como EBSCOHost, Scopus, Redalyc y SciELO. Los estudios revisados (veintiún artículos científicos) sostienen que las competencias digitales en los docentes adquieren una relevancia particular en sociedades altamente informatizadas. Por eso, instituciones como la Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura (Unesco), el Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado (INTEF) y la Comisión Europea para la Educación proponen directrices para validar las competencias digitales en los educadores, las cuales son consideradas como puntos de referencia por parte de las instituciones formadoras para promover la transformación digital de la sociedad.

Palabras clave: aprendizaje en línea, competencia digital docente, competencias del docente, educación virtual, formación de docentes.

Abstract

As a result of SARS-COV-2, learning spaces mostly migrated from in-person to virtual; it is in the latter space where teachers make use of a series of CDs (digital skills) inherent to the virtual educational phenomenon. This systematic review article focuses its attention on investigating research into the areas of CD that a teacher must develop and analyzing the strategies proposed by training institutions for their development. To meet this objective, a review of articles was carried out through the following phases: planning the search, carrying out and presenting the review report, using scientific databases such as EBSCOHost, Scopus, Redalyc and SciELO. As a result of the search, twenty-one scientific articles were selected for review. The articles maintain that CD in teachers receives special attention in highly computerized societies, where institutions such as the United Nations Educational, Scientific and Cultural Organization (UNESCO)), the National Institute of Educational Technologies and Teacher Training (Intef) and the European Commission for Education, propose guidelines to validate DC in teachers, which are taken as references by training institutions for the development of training strategies that seek to enhance CDs in teachers and promote the digital transformation of society.

Key words: online learning, teaching digital competence, teacher competencies, virtual education, teacher training.

Resumo

Devido ao surto do vírus SARS-CoV-2, a dinâmica dos ambientes educativos tem vivido uma migração maioritária do ambiente presencial para o virtual, pelo que tem sido necessário que os professores se concentrem na promoção de competências digitais essenciais para enfrentar a fenômeno educacional on-line. Portanto, este artigo concentra-se em examinar pesquisas relacionadas às áreas de competências digitais que os professores devem desenvolver, bem como analisar as estratégias propostas pelas instituições formadoras para promovê-las. Para tanto, foi realizada uma revisão exaustiva dos artigos seguindo as seguintes etapas: planejamento da busca, execução e apresentação do relatório de revisão. Especificamente, foram consultadas bases de dados científicas reconhecidas, como EBSCOHost, Scopus, Redalyc e SciELO. Os estudos revistos (vinte e um artigos científicos) sustentam que as competências digitais nos professores adquirem particular relevância em sociedades altamente informatizadas. Por esta razão, instituições como a Organização das Nações Unidas para a Educação, a Ciência e a Cultura (UNESCO), o Instituto Nacional de Tecnologias Educacionais e Formação de Professores (INTEF) e a Comissão Europeia para a Educação propõem orientações para validar as competências digitais dos educadores, que são considerados pontos

Introduction

Given the massification of virtuality in traditional pedagogical processes due to the impact of SARS-CoV-2, educators had to face a series of challenges, among which the difficulty in acquiring digital skills (CD) required by the demands stands out. of the 21st century (Silva *et al* ., 2022). In response to this reality, teachers have been compelled to quickly develop the essential CDs to continue their pedagogical work (Rodríguez *et al* ., 2022), either through self-taught learning in the use of such tools or through training. virtual provided by training institutions.

In this context, an implicit demand from society towards teachers emerges in terms of digital competence (Reyes *et al* ., 2021), understood as the ability to design learning environments mediated by digital resources and media (Silva and Miranda, 2020) in a hybrid teaching scenario, that is, one that combines both virtual and in-person strategies.

Facing the development of CD in teachers, however, requires the adaptation of a set of elements that have a marked technological, informational and communicative component (Rossi and Barajas, 2018). This is because the strategies aimed at promoting digital competence are not limited only to the mastery of technological tools, since they also include comprehensive teacher training (Romero-García *et al* ., 2020) with a view to promoting a true digital transformation. .

For this reason, the underlying purpose of this systematic review is to explore research concerning the areas of digital competence that teachers must develop, as well as examine the strategies proposed by training institutions for this purpose. This task will be carried out following a set of rigorously structured steps, which have been designed to build an updated corpus of knowledge on this topic that will be based on previous knowledge (Khan *et al* ., 2022).

Method

The systematic literature review stands as an instrument that facilitates the consolidation and substantiation of an exhaustive summary of the publications made in a certain field of study (Crisol-Moya *et al* ., 2020). Its purpose is to collect relevant information on the topic under review (Reyes, 2020), which involves following three defined phases: planning, execution and

reporting of the review (Kitchenham , 2004). These stages allow for the collection of systematized and specific data about the digital competencies (CD) in teachers, as well as the strategies intended for their development.

At the beginning of the planning phase of the review, the following guiding questions have been devised: what areas of digital competence should a teacher prioritize to be considered digitally competent? And what training strategies are proposed to promote the development of digital competence in teachers?

Next, keywords were selected, such as "teacher digital competence" and " teacher digital competence ", which were applied to the titles, summaries and keywords of the articles indexed in databases such as Scopus , EBSCOhost , Redalyc. and SciELO. The inclusion and exclusion criteria are detailed below:

Table 1 . Inclusion and exclusion criteria for article selection

Inclusion criteria	Exclusion criteria
Works published in the last three years (2020 to 2022)	Jobs prior to 2020
Articles published in scientific research journals indexed in databases specialized in educational topics.	Articles that are not related to the research questions.
Articles in Spanish, English or Portuguese	

Source: self made

During the review phase, the search for articles began, according to the aforementioned criteria, which facilitated the purification and discarding of those that did not align with the purpose of this research. Table 2 offers an overview of the results obtained:

Table 2. Search results according to database consulted

Database	Search result	Search string
EBSCOHost	63	"digital teaching competence"
Scopus	30	TITLE-ABS-KEY (competition AND digital AND teaching) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (OA , "all")) AND (LIMIT-TO (PUBYEAR , 2022) OR LIMIT -TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020)) AND (LIMIT-TO (DOCTYPE , " ar ")) AND (LIMIT-TO (LANGUAGE , "Spanish") OR LIMIT-TO (LANGUAGE , " English") OR LIMIT-TO (LANGUAGE , "Portuguese"))
Redalyc	59	"digital teaching competence"
SciELO	27	"digital teaching competence"

Source: self-made

Once the articles were located, an initial review was carried out to rule out duplication in the titles of the documents downloaded from the database, as well as to determine if their content was related to the objective of this review and, finally, to relate them to the questions asked. During this process, most articles were excluded. Figure 1 illustrates the flowchart of the article search and selection procedure.

Figure 1. Process for searching for articles
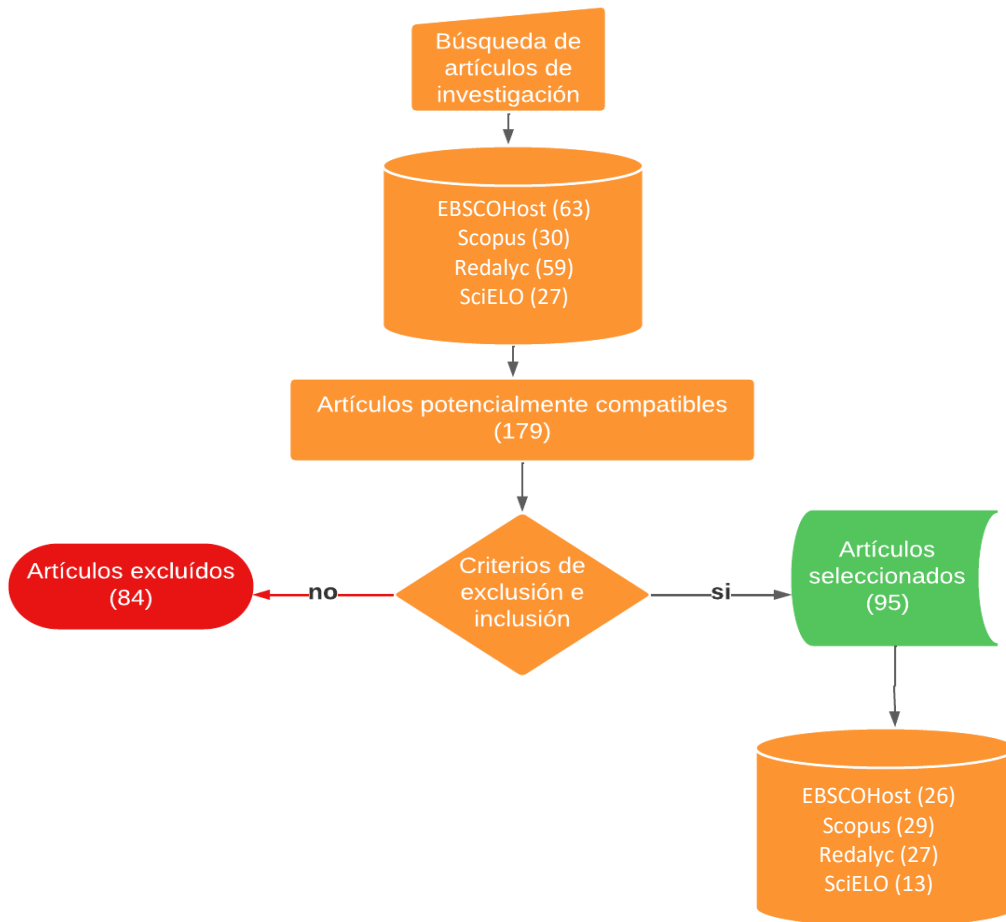
Source: self-made

In the report phase, the search results are presented, where a total of 179 articles were identified. Of these, 95 were selected, which met the established inclusion and exclusion criteria (Table 3).

Table 3. Research articles selected according to the database

Database	Potentially eligible studies	Selected studies (research articles)
EBSCOHost	63	26
Scopus	30	29
Redalyc.	59	27
SciELO	27	13
Total	179	95

Source: self-made

The selected studies were analyzed using a taxonomy that consists of two main categories: areas of digital competence in teachers and training strategies for digital competence

in teachers. Each of these categories is related to the previously proposed guiding questions. Below, table 4 shows the number of studies for each category of the taxonomy:

Table 4. Classification of selected articles by taxonomy according to the number of authors.

Category	Author(s)	Amount
Areas of digital competence in teachers	Cabero *et al* . (2020); Carriel *et al* . (2022); Cateriano -Chávez *et al* . (2021) ; Chávez and De los Ríos (2022); Chávez-Melo *et al* . (2022); Esteve *et al* . (2021); Fernández-Márquez *et al* . (2020); Loureiro *et al* . (2022); Mosquera (2021a); Mosquera (2021b); Palacios-Hidalgo *et al* . (2022); Silva *et al* . (2022).	12
Training strategies for digital competence in teachers	Basantes-Andrade *et al* . (2022); Bond *et al* . (2021); Burgos (2020); Cañete *et al* . (2022); Esteve *et al* . (2021); García *et al* . (2022); Mercader and Gairín (2020); Romero *et al* . (2020); Urbina *et al* . (2022).	9

Source: self-made

Figure 2. Classification of selected articles according to year of publication
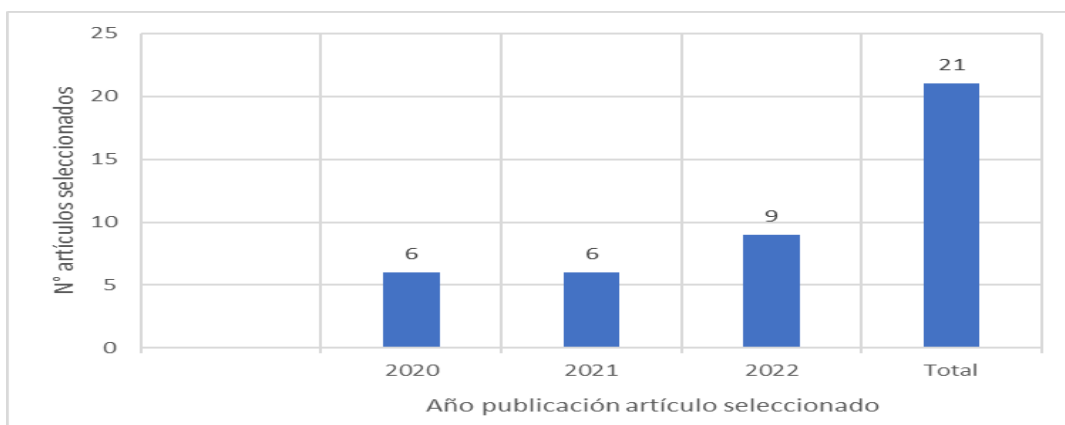
Source: self-made

Discussion

The category *areas of digital competence in teachers* are subject to analysis in various contexts. In this regard, the proposals of institutions such as the International Society for Technology in Education (ISTE), the Organization for Economic Cooperation and Development (OECD), the National Institute of Educational Technologies and Teacher Training (INTEF), the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the European Commission for Education, among other outstanding references in terms of digital competencies (CD) in teachers.

These institutions seek to guide initial and continuing teacher training policies, as well as recognize that teacher training is a key element to address the educational challenges posed by the information society (Loureiro *et al* ., 2022; Silva *et al* . , 2022). This interest is reflected in the description of viable actions for an optimal integration between technology and education, as well as in the assessment of different aspects of teacher professional development (Cateriano -Chávez *et al* ., 2021). The purpose is to promote the development of CD through reference frameworks, which describe the technical and methodological guidelines for the implementation of these competencies (Carriel *et al* ., 2022; Chávez-Melo *et al* ., 2022). This is due in part to the growing demand for virtual educational settings due to health emergencies (Chávez-Márquez and De los Ríos, 2022), as well as to address the educational crisis in the Latin American region, influenced in part by poor connectivity (Banco World Cup, 2021).

In this sense, DIGCOM (Digital Competences) proposes key competencies that every citizen and professional of the European community must develop to efficiently integrate into working life (Fernández-Márquez *et al* ., 2020). Indeed, since its first publication in 2013, going through a review in 2017, DIGCOM has become a reference for planning strategies and initiatives related to DCs. In fact, the current version (DIGCOM 2.1) maintains the five areas of competence (information and digital literacy, communication and collaboration through digital technologies, creation of digital content, security and problem solving), as well as the 21 competences and the 4 levels of competence (basic, intermediate, advanced and highly specialized).

In line with this, the International Society for Technology in Education (ISTE), supported by thousands of educators around the world, establishes CD standards for teachers, which describe the skills that a teacher must develop in order to enhance and catalyze learning (Esteve *et al.* ., 2022).

Likewise, in an effort to certify CD in teachers, the National Institute of Educational Technologies and Teacher Training (INTEF) proposes the DIGCOMEDU (European

Framework of Digital Competence for Educators), which describes the CD that every teacher must possess to promote educational innovation (Mosquera, 2021b). This framework will allow the specific use of a wide range of CDs, which are organized into six areas, twenty-two competencies and six progressive levels (Cabero-Almenara *et al* ., 2020). The essence of DIGCOMEDU lies in areas such as digital content, teaching and learning, evaluation and feedback, and student empowerment, competencies that every educator requires to develop innovative and effective strategies (Mosquera, 2021a).

In the second category, *training strategies for digital competence in teachers* , during the review process articles related to institutional proposals for the development of CD in teachers were found, directly linked to both formal and informal training and updating processes (Salazar and Lescano , 2022). These strategies respond in part to the challenges of digital transformation and the arrival of health emergencies.

However, with the spread of covid-19, it was shown that a considerable number of educational institutions lacked plans for the effective integration of information technologies in the classroom (Mercader and Gairín , 2020). Faced with this situation, teachers were forced to quickly adapt to this new reality, without prior preparation in the use of technologies, development of digital content and application of strategies for a virtual environment (Bond *et al* ., 2021). This situation was exacerbated by the educational crisis that affects various Latin American regions, such as Peru, Bolivia, Colombia, Venezuela and the countries of Central America (Ortiz *et al* ., 2023).

Given this scenario, and with the aim of improving the quality of teaching, both basic education and higher education institutions implemented a set of training actions and strategies, based on international reference frameworks such as UNESCO, ISTE, DIGCOM. and DIGCOMEDU. These actions ranged from theoretical proposals to those that integrated digital competencies as a transversal axis. In this sense, two groups of strategies are distinguished: those that prioritize training based on a traditional expository approach and those that promote approaches based on collaborative and active strategies (Viñoles -Cosentino *et al* ., 2022).

Expository-type strategies include activities such as seminars and courses, developed both in person and virtually (Basantes-Andrade *et al* ., 2022). These proposals usually use the most popular ICTs, although with special emphasis on instrumental and technological aspects rather than on didactic and pedagogical principles (Urbina *et al* ., 2022).

On the other hand, collaborative strategies promote social interaction between peers and groups with the aim of promoting innovation and generating educational synergy between teachers (Palacios-Hidalgo *et al* ., 2022) to seek to respond to the changing needs of a society. in constant evolution (Cañete *et al* ., 2002).

Regarding the information and communication technology (ICT) resources used for the development of training strategies, they are mostly carried out through learning management platforms (LMS). open source and free (García Sánchez *et al* ., 2022). Among these, MOODLE (Modular and Object-Oriented Dynamic Learning Environment) and Classroom (Gómez, 2020) stand out , where digital learning is promoted through massive open online courses (MOOC).

Regarding the use of digital tools, the institutions, with the aim of enhancing the performance of their teachers in the digital field, opted for *online applications* that could be used both on mobile devices (phones, tablets, *laptops* , etc.) and on desktop computers. Among the most used tools are those of Google for Education (Gamarra *et al* ., 2021), a computer package that offers a series of resources developed for distance teaching processes, such as Google Meet , Forms, Documents and Chat, which in its free version offers up to 15 gigabytes of storage (Ruiz, 2022).

Regarding the evaluation of digital competencies (CD) in teachers, various documents were taken as reference, such as the guide for the evaluation of CD proposed by the International Telecommunications Union (ITU), the CD evaluation guide teacher proposed by the Community of Madrid, the self-evaluation of the CD for teachers of the Telefónica Foundation, and the evaluation of the CD of higher education teachers in Peru. All of these are based on the guidelines established in the Digital Teaching Competence Reference Framework (Learning Technologies Working Group, 2022), which seeks to describe the competencies of basic or higher education teachers throughout their professional career. regarding distance learning, regardless of the area or level of teaching in which they work.

Conclusion

The studies analyzed highlight that the development of digital competencies (CD) in teachers acquires particular relevance in highly computerized societies. For this reason, various international institutions—such as UNESCO, INTEF, ISTE and the OECD—recommend a set of competencies and levels aimed at validating the digital skills and abilities that every teacher must possess to perform effectively in virtual environments.

The authors consulted, in fact, suggest that special attention should be paid to training strategies in the development of CD in teachers. Consequently, institutions must promote a permanent teacher training system based on collaborative and active approaches, where reflection, teamwork and the practical application of the virtual tools provided by ICT are promoted. In addition, it is crucial to clearly establish training plans for teachers on topics related to digital competence, which must include programs or guides for their evaluation.

Finally, it is highlighted that digital competencies in teachers must be understood as a set of knowledge, skills and attitudes that cover different domains of knowledge. In other words, they should not be limited only to the classroom space, which suggests a more integrative and holistic vision of them, as indicated in the articles consulted.

Future lines of research

This review article on digital competencies in teachers opens new possibilities for research in the context of distance teaching and the use of technological tools appropriate for this modality, as well as for the exploration of evaluation methods suitable for these competencies.

Furthermore, it is important to pay attention to research that addresses issues related to andragogy, given that teachers are adults and, therefore, teaching methods and strategies for the development of digital competences must be adapted to the specific characteristics of individuals with experience. in their field, who feel the need to learn and who have the willingness and intrinsic motivation to acquire new knowledge.

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