



## XIII International Conference on Virtual Campus

### Aceptación de la Comunicación:

### Proposals for the Development of the Digital Competence of University Teachers: A Systematic Literature Review

### Presentada por los autores:

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# Proposals for the Development of the Digital Competence of University Teachers: A Systematic Literature Review

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**Abstract**—This article analyzes the implementation of various proposals for the development of the digital competence of university professors and the strengthening of their pedagogical practices by enabling the diversification of their strategies and methodologies, as they face the challenges in a media society in constant transformation. A systematic literature review based on the PRISMA model was carried out to identify the main findings reported on the concept of digital competence, innovations and their use in the pedagogical practices of university teachers. The document search was carried out in the Redalyc, Dialnet, Scopus and Web of Science databases during the period of 2017-2021. The final sample of 26 studies was selected based on quality and relevance criteria. The results indicate the importance of digital competence to promote digital empowerment, in addition to the identification of the needs to generate proposals for digital teacher trainings and their pedagogical integration in the daily practices in the classroom.

**Keywords**—*digital competence, pedagogical practices, systematic review, university*

## I. INTRODUCTION

In the last 5 years, university education has experienced transcendental changes in its pedagogical and didactic components due to the rapid development of Information and Communication Technologies (ICT). This leads to the constant need to strengthen the digital skills of educators to function in a digitized, media-based, and ubiquitous society full of uncertainties. A new industrial revolution is being witnessed due to the changes and innovations introduced by technologies [1]. For this reason, during the Covid-19 pandemic, educators were forced to move towards new trends with the implementation of digital platforms [2]. This scenario has favored the diversification of learning modalities and other aspects such as communication dynamics, content selection, methodology and other pedagogical components [3].

In this sense, the teaching-learning processes must mainstream the development of competencies to face emerging changes. The teachers become the main actors who assume the responsibility of being at the forefront for the benefit of their students [4], through inclusive, innovative and contextualized pedagogies to the social reality. Therefore, the university context should promote ubiquitous learning, the creation of virtual contexts, e-activities, and flipped classroom. In this sense, teachers support students in the design and evaluation of educational materials and more. [5]

The user's profile should be considered regarding the role that teachers and students play nowadays, since there is a

digital gap caused by a social, personal and technological order that generates ruptures and tensions [6]. Therefore, it is necessary to deepen the understanding of the development of teachers' digital competence by approaching their profiles and experiences with the use of technology. We ask ourselves, then, how prepared are teachers to promote spaces enriched by ICT? Is technology being used in a pedagogical way? Do all the tensions experienced around the use of technology by COVID-19 boost teachers' digital competencies? How is the development of digital competence assumed? these are several questions that invite permanent reflection on the teacher's action and the use of technology at the university level.

Therefore, the analysis of the digital competence among the set of professional competences constitutes a relevant axis. However, this systematic literature review does not intend to carry out an evaluation of the domains or levels of competence, training needs, or a theoretical conceptualization of digital competence; but rather, the concern is on the innovations or specific proposals that have been implemented in universities. As a result, this study intends to discover the teachers' actions for the development of digital competence to promote the pedagogical use in learning scenarios.

To this end, the following research questions are posed:

- What is the scientific production profile generated in the last five years on the digital competence of university teachers, particularly in terms of their geographical origin and the methodological designs used?
- How is the use of digital competence of university teachers assumed in their pedagogical practices?
- What innovations and proposals are generated around the use of digital competence?

## II. METHOD

This systematic review has been developed according to the principles of the PRISMA model [7] and the standardized methodological guidelines proposed for the preparation of quality systematic reviews [8]. The population of university teachers was established, due to the need to investigate the empirical studies that promote the generation of research on the various pedagogical-didactic components in higher education and the development of technology, innovation, and training in digital competence considered in this research [9].

### A. Procedure

First, the keywords in Spanish and English were established for the research: digital competence, digital literacy, digital skills and 21st century skills, being all the

variations found [10]. Likewise, it is worth mentioning that in several investigations, digital literacy and digital competence were referred to as the same concept, "although these two terms do not have the same connotation, nor the same level of abstraction" [11]. The second search term that delimited the sample of the study was university professors, as well as, the complementary words: pedagogical use and good practices with ICT.

Next, the search equations in Spanish and English were defined, using the Boolean search engines (AND-OR) to establish relationships between the terms, generating the following search equations:

1. ("digital skills" OR "digital literacy" OR "digital literacy" OR "21st century skills") AND "university teachers\*").
2. (("digital skills" OR "digital literacy" OR "digital competence" OR "21st skills") AND "university teach\*").
3. ("digital skills" OR "digital literature" OR "digital competence" OR "21st century competences") AND "university teachers\*" AND ("pedagogical use" OR "good practices in ICT").

In the same way, the search strategy was defined through an analysis of the different filters that were established in the databases. This led to eliminating the third equation as results were not obtained in the databases.

Next, the Scopus, Web of Science, Dialnet, and Redalyc databases were reviewed during the period between 2017 and 2021. The first two were selected for their prestige and international recognition. [12], constituting a benchmark for the impact of the publications. The last two were selected for being in Spanish and having a demand for publications in different contexts, mainly in Latin America. The review considered a starting point in 2017 because the official version of the INTEF in Spain on digital competences for teachers was published, which has constituted a reference for the analysis of digital competences [13] and the identification of what happened during the subsequent 4 years. Moreover, in the section regarding Level, Higher Education Institutions (HEI) were considered. The following inclusion and exclusion criteria were established (see table I):

TABLE I. INCLUSION AND EXCLUSION CRITERIA

Criteria	Inclusion criteria	Exclusion criteria
Year	2017 to 2021	Before 2017 and after 2021
Language	Spanish and English	Portuguese and others
Type of document	Articles and Thesis dissertations	Non peer reviewed documents
Access to the document	Open Access	Documents with no access to full text
Discipline	Education preferably	Psychology, Medicine, Engineering, Economy, Finance and other fields.
Population	University teachers	Elementary and Secondary teachers
Topic	Focus of experiences, innovation and practical reflections	Literature reviews and other types of documents
Level	Higher Education Institutions	Other levels of education

Source: self-made

The search in the databases was established in four moments: with the first using the defined equation, and the second applying the filters defined for the study (inclusion criteria). The third is a relevance analysis through the review of the papers; reading the titles, abstracts and keywords, to select those that are appropriate and excluding the rest, according to the exclusion criteria. Finally, the complete reading of all the studies was carried out to determine the valid and selected ones, obtaining the results indicated in Fig. 1 following the PRISMA protocol:

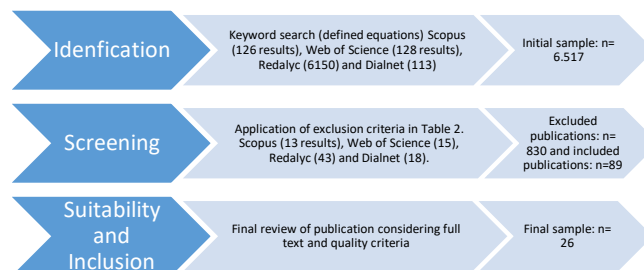


Fig. 1. Flowchart for sample selection  
Source: self-made

According to the previous flowchart in the first search, 6,517 results were identified, 126 in Scopus, 128 in Web of Science, 6150 in Redalyc, and 113 in Dialnet, making evident the extensive literature on the subject. Subsequently, the screening was carried out with the inclusion criteria, applied using the filters of each database. In Scopus and Redalyc, the type of document was the article with open access, between 2017-2021, in social sciences, published in English and Spanish. In Redalyc and Dialnet, the range was 2017-2021, in English and Spanish language within the education field. In Dialnet, only articles and thesis dissertations were filtered applying a manual review. In this screening stage, 921 were obtained (~14.13% or 921 of 6517).

Then, the suitability was carried out in two stages, the first one refers to the downloading. During this process the exclusion criteria was applied to eliminate the documents that did not comply with the range of years, subject and access to full text. Then, in the next stage, the literature review was addressed through a brief reading of the title and abstract. In Scopus there were (~0.25% or 16 of 6517) articles removed, in Web of Science (~0.11% or 7 of 6517), in Redalyc (~10.62% or 692 of 6517) and in Dialnet (~ 0.5% or 34 of 6517).

In the second stage, 172 documents were downloaded to be analyzed in an Excel matrix. Before this, a new review was carried out with the complete documents applying the exclusion criteria. The results of the deleted articles are in the following table II:

TABLE II. RESULTS OF THE SECOND STAGE OF SUITABILITY

Database	Exclusion criteria		
	Topics	Discipline	Population
Scopus	10		1
Web of science	10		1
Dialnet	25		15
Redalyc	14		6

Source: self-made

As a result, (~0.17% or 11 out of 6517) documents were removed from Scopus, (~0.17% or 11 out of 6517) from Web of Science, (~0.31% or 20 out of 6517) from Redalyc and (~0.61% or 40 out of 6517) from Dialnet. During the two stages of suitability, (~12.74% or 830 out of 6517) documents were excluded.

For the analysis of the 89 articles, the information was inputted into an Excel matrix and organized by: database, language, author/s, title, journal/repository, year, pages, country, type of document, candidate to be read, abstract, keywords, objective, methodology, results, conclusions, sample/participants, and context. This organization allowed synthesizing the information. The quality criteria were applied to avoid possible bias in the selection. The following questions were considered to guide the research: How is digital competence defined? How is the use of digital competence of university teachers assumed in their practices? and what are the innovations/proposal used to guarantee a rigorous, objective, complete and precise review [14].

In the phase of inclusion, the results show: one Scopus was included and (~0.18% or 12 of 6517), excluded; 7 were included and (~0.12% or 8 of 6517) excluded in Web of Science; 13 included and (~0.46% or 30 of 6517) excluded, in Redalyc and Dialnet 5 included and (~0.20% or 13 of 6517) excluded. From the total of articles in the analysis, four main categories were identified, which produced the exclusion of (~0.97% or 63 out of 6517):

1. Literature reviews, theoretical approach and documentary-theoretical analysis (~0.18% or 12 of 6517)
2. Analysis of the perceptions of use or development of digital competence or of tools, resources or virtual environments. (~0.41% or 27 of 6517)
3. Design and validation of the instrument. (~0.08% or 5 of 6517)
4. Measure or evaluate digital competence through questionnaires or surveys. (~0.29% or 19 of 6517)

It should be noted that several articles with these characteristics were eliminated in the screening stage by reading the titles and abstracts. However, the articles that reached the inclusion phase had titles and/or abstracts that matched the corresponding content and process, but when reading the entire documents, they did not respond to the quality criteria, resulting in the categories mentioned above.

### III. RESULTS

Digital competence is a widely researched topic in the literature. However, most of the studies focus on theoretical reviews and documentary analysis that were discarded from the screening stage in this study. For this reason, articles that seemed relevant proposals at first were selected, but then they were excluded in a later stage because when reading them, their performance evaluation was identified [15].

In addition, the perceptions, the development of digital competence, the use of tools and virtual environments through methods such as life stories, interviews and reflections were explored. Teaching trajectories, self-perceptions and the assessment of digital competence have also been investigated. The design and validation of measurement and evaluation instruments through questionnaires or surveys is highlighted as the most used process to identify teacher digital

competence. Despite the abundance of research in the field, there is a lack of studies that address innovation proposals for the development of teacher digital competence and allow its empowerment to be used pedagogically in the classroom. Therefore, it is necessary to promote research that analyzes the effective implementation of the teacher's digital competence not from perceptions, but from the implementation of proposals.

According to the results obtained in the 26 articles, the initially established questions can be answered as follows:

The profile of scientific production generated in terms of its geographical origin is located among the countries of Ecuador, Argentina, Mexico, Chile, Cuba, Costa Rica, and Colombia. The publications were mainly taken from data bases from Redalyc and Dialnet. The studies from Spain and Ukraine were gathered from Scopus and Web of Science, due to the fact that they evidence holistic models for the development of teachers' digital competence. The methodological designs were: the systematization of experiences, action research, educational design (Educational-Design Research, EDR), critical perspective, teaching focused on advanced training, qualitative exploratory research, quantitative approach and correlation for study cases, quantitative approach, reflective analysis, ethnographic method, qualitative and interpretative research, mixed (quali-quantitative) approach of bibliographic, descriptive and quasi-experimental comparative documentary, educational research-evaluation and exploratory reflection. These research designs are open to diverse ways of systematizing the innovation proposals in the HEI. Therefore, they enrich the possibility of innovation through their research methodologies.

According to the selected studies, digital competence is defined as a set of knowledge, skills, attitudes, strategies, activities [16] and reflections mediated by digital technologies that promote critical and safe empowerments through the use of various digital devices and applications. It allows the solution of complex problems, decision making, critical thinking and ethical use of the range of information and actions to be executed. In daily teaching, it constitutes a reflective practice and professional development that integrates different knowledge (knowing how to be, how to do, how to know and how to coexist) [17]. In addition, digital competence gives relevance to a comprehensive competence that encompasses elements such as: information and information literacy; communication and collaboration; digital content creation; security and problem solving [18].

Among the main proposals and innovations generated for the development of digital teaching competence, training actions, workshops, courses, techno-pedagogical accompaniment, continuous training and reflection models stand out. These proposals, their actions and strategies are mentioned below (see table III):

TABLE III. RESULTS OF THE PROPOSALS AND INNOVATIONS

Proposals and innovations	Actions and strategies taken by HEI
Workshops and seminars	<ul style="list-style-type: none"> <li>- Training resource platforms (Google Classroom)</li> <li>- Learning management systems</li> <li>- Electronic platform (Gamifying Apprentice)</li> <li>- Accompaniment workshops and spaces for reflection</li> <li>- Design of virtual learning environments</li> <li>- Visualization based training</li> </ul>

Training through courses	<ul style="list-style-type: none"> <li>- PACIE training methodologies</li> <li>- Resources Nano Open Online Course</li> <li>- Medium and average duration</li> <li>- NOOC 1 on Information and Information Literacy and NOOC 2 Communication and Collaboration</li> <li>- Google Workspace for Education (use of chat and forum)</li> <li>- Technical, pedagogical and communication approach</li> </ul>
Techno-pedagogical accompaniment	<ul style="list-style-type: none"> <li>- Virtual Learning Environment</li> <li>- Learning community</li> <li>- Tutoring program</li> </ul>
Virtual learning objects	<ul style="list-style-type: none"> <li>- Accessibility, Usage, modularity, pedagogical, communicative and classifiable.</li> <li>- Experience with mobile devices.</li> </ul>
Competition models	<ul style="list-style-type: none"> <li>- Virtual laboratories</li> <li>- Lifelong learning</li> <li>- Online teaching</li> <li>- Structural model from TPACK reflection and distance challenges</li> <li>- Technical, informative, communicative, educational, analytical and socio-ethical dimensions approaches</li> <li>- Innovation desk</li> </ul>
Use of graphic organizers, transmedia storytelling and online software	<ul style="list-style-type: none"> <li>- Assessment strategies</li> <li>- Interactive collaborative learning Kahoot, Mentimeter, Socrative, Wooclap, and Quizizz.</li> </ul>

Source: self-made

#### IV. CONCLUSIONS

The main innovations found in the literature review make evident the range of possibilities to understand and experience the use of technological resources and devices in the daily practices of university teachers. However, it will be necessary to generate actions adapted to the contextualized needs. They must become specific interventions that help to strengthen teachers' digital competences. Therefore, it is recommended to have levels of development starting from basic, intermediate, and advanced. In addition, the modalities of teacher training between face-to-face, virtual, online and blended are highlighted. Other transversal axes that become evident are collaborative learning, reflective critical thinking and competency-focused learning.

For this reason, the use of digital teaching competence is essential to promote an innovative educational approach that develops holistic learning adapted to the needs of today's society. It requires the proper use of ICT with pedagogical criteria, the integration of technologies in the teaching-learning process and a proactive attitude towards continuous learning and adaptation to technological changes.

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**Publisher:** IEEE[Cite This](#) PDF[Daysi Karina Flores](#) ; [Manuela Raposo](#) ; [Maricela Cajamarca](#) [All Authors](#)**43**Full  
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## Abstract

### Document Sections

- I. Introduction
- II. Method
- III. Results
- IV. Conclusions

[Authors](#)[Figures](#)[References](#)

## Abstract:

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**Published in:** [2023 XIII International Conference on Virtual Campus \(JICV\)](#)**Date of Conference:** 25-26 September 2023**DOI:** [10.1109/JICV59748.2023.10565677](#)

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**Publisher:** IEEE

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