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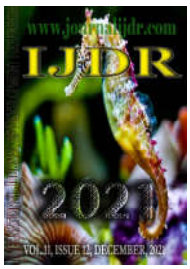

RESEARCH ARTICLE OPEN ACCESS

BIBLIOMETRIC RESEARCH AT SCOPUS DATABASEABOUT DIGITAL COMPENTENCE IN HIGHER EDUCATION

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ABSTRACT

The main goal of the article is to do a bibliometric survey of publications in the Scopus database regarding digital competence in higher education, between 2012 and 2021. Exploratory research was the methodology adopted, through a quantitative survey of bibliometric production using the main categories available at the Scopus database: means of access, publication year, areas of study, country, author and journals. The results point to a rapid growth of studies on digital competence in higher education in the last decade, mainly in the last three years, probably due to the massive use of digital technology for information and communication in the work place and in education. During Covid-19 pandemic an intensification of studies on the topic was noticeable, certainly in response to sanitary restrictions and social isolation imposed on educational institutions that were compelled to transition to distance teaching. It was observed a wide spread of scientific publications in various countries, different authors and many journals on the subject. Studies done in Spain stand out, but countries with emerging economies also made relevant contributions.

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INTRODUCTION

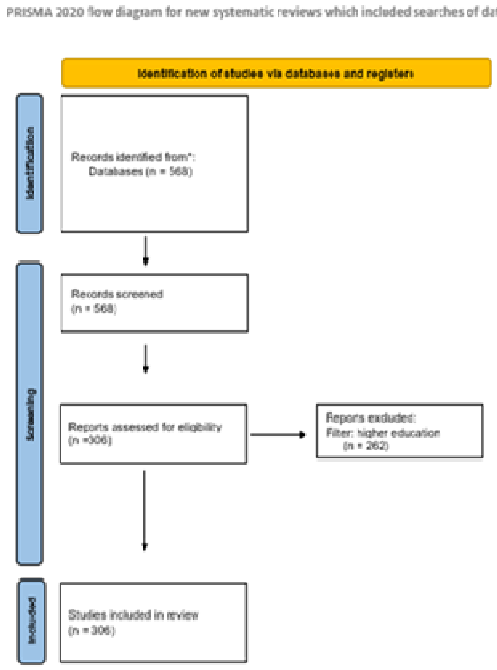
In the last two decades we witnessed more and more transformations due to the inclusion of digital technology in all aspects of our lives. These transformations occur at a faster pace and shorter and shorter cycles, bringing difficulties to the regular citizen to follow these changes, causing uncertainties e producing what Giddens (2002) called "displacements" and "detachments". The ubiquity of digital technology in the era of the "information society" (Castells, 2000) or the "knowledge-based society" gave origin to a paradoxical phenomenon: the production and circulation of information and knowledge is inversely proportional to the fruition of it by the individuals. This paradox results in the need to "requalification" and reacquisition of skills (Giddens, 2002) so one can handle the flood of information stemming from an ever greater hypermedia. However, in order for the individuals to exercise citizenship in the contemporary sociotechnichal fields, it's necessary they acquire digital competences, an integrated set of attitudes, knowledge, skills and strategies of the uses of information technologies and communication and means of digital communication so that they can convert information in to knowledge.

As educators, we defend that the construction of these competences can lead to an autonomous and critical appropriation of the means and messages in use at the global society, favoring social inclusion. From the standpoint of the institutions that deal with knowledge, bibliometric types of studies are ever more necessary, bearing in mind the importance of the creation of structures for, storage, lodging, indexation and cataloguing scientific production, the so-called databases. Currently, with the advancement of digital technology, it's possible to access in real time the main sources of scientific production in all areas of knowledge. The databases function as anchors for the researchers, so that they can, though synthetically and experimentally, have an overview of the production in their field. Since the 1970s bibliometrics has been proving itself as a reliable procedure of quantitative census and statistical measure of indexes of production and dissemination of scientific knowledge (Araújo, 2006). Following this line of reasoning, this article has as its theme the survey of bibliometrics in the Scopus Database on digital competence in higher education. In advance, we consider that the non-appropriation of digital competences is to the exclusion in the digital era just as it was for illiteracy in the industrial society.

And because the application of digital technology has been universalized in practically all aspects of human activity, the digital competences field of study has grown proportionately. To keep track of the studies and to identify its matrices, filters of research are necessary so one can grasp an idea, even if it's by approximation, of the scientific production in the studied field. Thus, the objective of this article is to do an exploratory and quantitative bibliometric survey in the Scopus Database, with a temporal cut of the last 10 years (2012-2021), about digital competences and education (primary field), restricting higher education to a sub-group (secondary field).

MATERIALS AND METHODS

In the information age it is necessary that researchers have agility in managing the production of the scientific production, mainly due to the great influx of production of knowledge generated in a digital culture more and more convergent (Jenkins, 2009). That is where the strategic importance of the databases with its mechanisms of organization, classification and dissemination of results from various researches, comes from. In this context, researches that are exploratory in nature gain relevance because they provide an overview of the problem of research, explaining its many approach variables (Gil, 2002). Bibliometric research fulfills this exploratory role of collecting and analyzing the scientific production in the repositories and databases in order to construct an outlook of the research according to the variables and interests of the researcher and of the overall theme. We opted for the Scopus Database, whose base has over 66 million of indexed items, with more than 22 thousand different journals available and surpassing the indexation of 140 thousand book titles. Therefore, with an archive of this stature the solution is Scopus, from Elsevier Publishing, one of the largest databases of the world (Elsevier, 2021). The research was conducted between 16th and 18th of august 2021, with the following descriptions: "digital competence and education", for the preliminary search, and later refined with the description "higher education". The temporal cut was from 2012 to 2021. With these search decisions, we adapted the PRISMA flowchart, simplifying some of the steps to adequate it to the data exploration of the platform. The figure below presents de adaptation done on the flowchart PRISMA:



Source: The authors (adapted from PRISMA, 2020)

Figure 1. Search Diagram

To get to the final selection, the starting point had 568 results, with the filter for description "digital competence and education". From these, 262 were excluded because they didn't have the description "higher education", then the search remained with 313 articles for quantitative synthesis, whose results we present in the next section.

RESULTS AND DISCUSSION

The data obtained in the preliminary search are listed in Table 1, the categorized order of the Scopus platform was not followed linearly so as to better present the results. By the above indicators, it is noticeable the great interest of the scientific community of diverse fields about the subject. As a result, it was necessary a refined search, applying filters with the description "higher education", maintaining the cut of 2012 to 2021. In Table 2, we present the results of the search with the new algorithms, commenting the most relevant trends

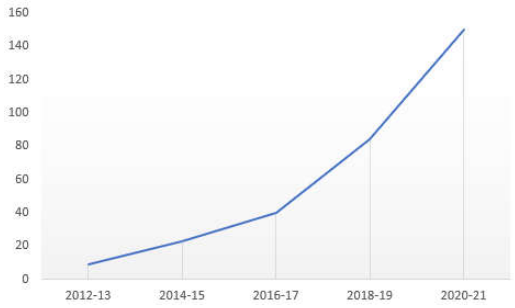
Table 1. Digital competence and education2012-2021

Descriptors: "digital competence" and "education"							Article results: 568
Access	All Open Access	Gold	Hybrid Gold	Bronze	Green		
	357	248	32	51	190		
Year (period)	2012-13	2014-15	2015-17	2018-19	2020-21		
	16	40	73	149	290		
Study area	Social Science	Computing	Psychology	Art	Engineering	Evironment	Other
	507	168	46	45	45	38	162
Countries	ESP	NOR	SWE	ITA	MEX	RUS	Other
	323	40	25	20	20	20	120
Authors	Gillén Gaméz, JD	Palacios-Rodríguez, A	Trujillo-Torrez, JM	Cabero-Almenara, J	Martín, SC	Barroso - Osuna, J	Other
	12	11	10	09	08	07	511
Journals	Sustainability (CH)	Comunicar (ES)	Nordic J D of Digital Literacy (NO)	Education and Information Technologies (CH)	Computers & Education (CH)	Education Sciences (CH)	Others
	30	16	15	14	12	12	469

Source: The authors (2021)

The scientific production about digital competences in higher education follows the rising trend of that of education in general, considering the main parameters of Table 1. With regard to the first category (Access), only Open Access (OA) enables direct access to the articles found on the platform. Other levels of access depend on permission by the database, websites and repositories of the editors, according to the license of copyrights utilized. To check that even with the trend of internationalizing accessibility proposed by the Budapest Open Access Initiative (BOAI, 2002), many productions still maintain restricted access due to copyright. As it is shown in Table 2, little over half of the articles have OA status, which may make difficult to do things like direct access, inventory agility, and mainly, quantitative analysis.

The time stream of the publication appears to obey the process of gradual insertion of digital technologies in social activities. We can observe a stable evolution of the quantity of published articles through the last decade, but abruptly in the years 2020-21, as it is shown in the graphic below.

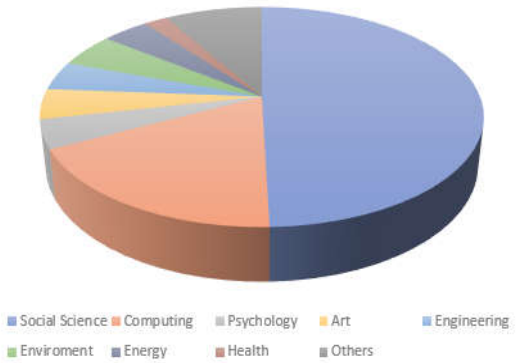


Source: The authors (2021)

Graphic 1. Evolution per year

It is likely that the increase of publications in the last couple years is linked to the Covid-19 pandemic, a phenomenon that called for the necessary promotion of discussions and researches about digital competences in the workplace, mainly in the many different areas of higher education, involving students, professors, deans and institutions. The theme's evolution was progressively stable from 2012 through 2019, suffering a radical rise that tripled the volume of publications from that year on. With the continuity of the pandemic, the flow of productions escalated in 60% in 2020, exploding in 2021, since in the first semester of the year the production had already equaled that of 2019.

The tendency is that studies on it will triple until the end of 2021, since when we returned to Scopus to refresh the data on the following week of the collection of the data, more articles were available. This acceleration on the interest of the subject may be due to the fact the pandemic surprised the education institutions in many different aspects, that go from conceptual models, planning, evaluation, preparation and distance education processes and remote work (Jusas et al., 2021). About the area of studies, the survey also follows the trend of investigation of the preliminary survey (Table 1). Although in Table 2 there is enough diversification of areas, we note that there is a greater concentration of studies in the Social Sciences. We can also notice the interest on the them by areas that go from human sciences through exact sciences and earth sciences, such as Computer Sciences, Psychology, Arts and Humanities, Engineering, Environmental Sciences, Energy, Health, Accountancy, Business Management and Medicine. Despite the scattering of the fields, the main focus is in the formation of teachers is overwhelmingly in the Social Sciences, although crossed by other areas as well. The Graphic 2 illustrates this scattering of areas with predominance of the Social Sciences.

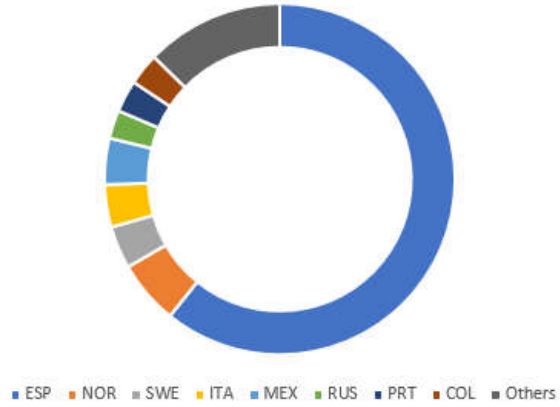


Source: The authors (2021)

Graphic 2. Distribution by area

This dispersion reveals the importance of investigating digital competences in higher education in all areas, since there is a massive insertion of digital technologies that have affected the production processes as well as the products in the most varied fields of human knowledge. In the case of education, the institutions have been compelled to implement solutions that attended the sanitary restrictions. Some researches surveyed point to some of these solutions: use of conventional social networks and simulated networks (Gordillo et al. 2021; Cabezas-González et al, 2021); use of mobile devices (Aznar-Diaz et al, 2021; Dafonte-Gómez et al, 2021), use of the environment for conventional and hybrid learning (Paylidou et al, 2021); Del Prete & Almenara, 2020), use of augmented reality (Vázquez-Cano et al, 2020a; Vázquez-Cano et al. 2020b), MOOC (Palacios-Hidalgo, 2020; Fernandez-Diaz, 2020) and others, resulting in the necessity of validation of scales of digital competence (Wang et al., 2021; Ramírez-Armenta et al, 2021). About the countries that published on the matter, Spain concentrates the greatest number of researches.

This refers to digital competence and education as well as digital competences in higher education. In Table 1, we can see that Spain is responsible for almost 1/3 of the production (27,65%), and in what refers to digital competence and higher education (Table e), the Spanish production rises to 60%. This concentration of research may be linked to the creation of the *Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado* (INTEF), they are bound to the *Ministerio de Educación y Formación Profesional*, whose efforts have been to implement, in Spanish education, of the Common Digital Competence Framework for Teachers, document published in 2017.Some authorshave dedicatedstudies of these practices, such asPérez-Calderón et. al. (2021), Calderón-Garrido et. al. (2021), Cabero-Almenara (2019), Paredes-Labra et. al. (2019), among others. The Graphic 3the distribution by countries. As we have seen, Spain (SPA) concentrates most of the studies, however it's possible to see a



Source: The authors (2021)

Graphic 3. Distribution by countries

productive enlargement on the production, with studies spreading to countries outside the Europe-USA axis and adding experiences that are ofnon-hegemonic academic culture, thus with new traditions of investigation. That is one of the advantages of the research platforms, mainly with the advent of digital technologies. In this context, it was possible to find the top 10 countries with most production, some considered of the economic periphery or in developmental stages, such as Ecuador (ECU), Colombia (COL) and Mexico (MEX), that represent 10% of the research made. This shows the importance of the subject to all countries, be them peripheral or central. The survey about the authors and the journals follows the tendency of the countries. Among the top 10 authors with the most publications, all are Spaniards. And among the top 10 journals, four are from Spanish universities and responsible for 31 articles, which are, almost 10% of the total amount of publications. That reveals the national interest on the study of digital competences in higher education. Although there is a great dispersion in the publications, it is worthy of notice that Swiss journals are the ones with most publications, with 41 articles (13,33%), in 4 journals. In this case, we must take into account, that beyond the academic tradition, Switzerland has well known journals such as *Sustainability*, *Computers and Education* e *Education and Information Technologies*. The scattering of authors and journals are far from being an obstacle, it seems to be scientifically productive, since in a globalized world there can be studies by researchers from the whole world.

CONCLUSION

We presented a bibliometric survey of the Scopus database about digital competences in higher education, with a temporal cut of the last 10 years. We conclude that there is a progressive interest in the studies on digital competences in higher education. This was particularly demonstrated in the expressive increase in the publications during the Covid-19 pandemic. Only the productions of the first semester of 2021 equaled to all of the publications of 2019, meaning in practically the triple of publications of the former year. The limitations of the present research were that the search was only done in English, requiring its repetition in other languages and with different descriptions. It is also noted the necessity of a qualitative analysis of the data in future research, since the present survey only took into account quantitative aspects

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