



Challenges of Social Media in Education. Review and Bibliometric Analysis of Scientific Production to Map Trends and Perspectives

*Desafíos de las redes sociales en educación.
Revisión y análisis bibliométrico de la producción científica
para mapear tendencias y perspectiva*

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ABSTRACT

This paper aims to analyse the trends in the articles included in the Journal Citation Report on the implications of social networks in the educational sphere during the period 2011-2020 and, in this way, to synthesise the knowledge base on their use in formal, non-formal and informal educational environments. Regarding methodology, various variables were analysed in the 157 selected articles, and exploratory and descriptive bibliometric research was carried out. The PRISMA protocol's indications have been followed for the whole process. The results show a considerable increase in production in the first quartiles of impact journals. Most of the papers were written by occasional authors from the USA. The most common theme was using social networks as a vehicle for creating virtual environments, with qualitative methodology standing out. It has been revealed that challenges remain to be addressed from an educational science perspective, such as non-formal learning, ethical dilemmas, and addictions. Collaboration and the establishment of peer-to-peer publication networks show areas for improvement.

KEYWORDS Social media; virtual environments; scientific literature; bibliometric analysis; research trends.

RESUMEN

El presente trabajo tiene como objetivo analizar las tendencias de los artículos recogidos en la base *Journal Citation Report* sobre las implicaciones de las redes sociales en el ámbito educativo durante el periodo 2011-2020 y, de este modo, sintetizar la base de conocimiento sobre su uso en entornos educativos formales, no formales e informales. En cuanto a la metodología, se han analizado diversas variables en los 157 artículos seleccionados y se ha realizado una investigación exploratoria y descriptiva con carácter bibliométrico. Para todo el proceso, se han seguido las indicaciones del protocolo PRISMA. Los resultados muestran un aumento considerable en la producción en los primeros cuartiles de las revistas de impacto. La mayoría de los trabajos fueron realizados por autores ocasionales, procedentes de EE.UU. La temática más

habitual fue el uso de las redes sociales como elemento vehicular para la creación de entornos virtuales, destacando la metodología cualitativa. Se ha revelado que quedan desafíos por abordar desde la perspectiva de las Ciencias de la Educación, como el aprendizaje no formal, o dilemas éticos y adicciones. La colaboración y el establecimiento de redes de publicación entre pares evidencian aspectos de mejora.

PALABRAS CLAVE Redes sociales; entornos virtuales; literatura científica; análisis bibliométrico; tendencias en investigación.

1. INTRODUCTION

The emergence of social networks has changed how people communicate, relate to one another and learn (Donelan, 2016). This work considers their role in education. In the words of López *et al.* (2018), “interconnections play a fundamental role in how we adapt to changes that could lead to fragmentation and isolation, and they help us understand the world systematically” (p. 235, own translation). Earlier works also showed the need for a fuller overview of research into social networks in different disciplines (Abadal, 2017).

To focus our perspective on the subject we analyse in this work, we follow the angle of authors such as Bruguera *et al.* (2019), Li *et al.* (2017), López-Navarro *et al.* (2015) and Yu-Tang *et al.* (2019), who in their analyses focussed more specifically on three areas: social networks and human behaviour; social networks and professional development; and educational networks. These authors agree that the intensity of their use means it is necessary to identify contexts, characteristics, trends and methodologies. Educational networks and their influence on learning communities in the current digital society is something that should be analysed from a variety of angles and paradigms (Calderón-Garrido, & Gil-Fernández, 2022; Gil-Fernández, & Calderón-Garrido, 2021a). In this sector, networks have provided excellent opportunities for directing and personalising learning, both from the formal and informal perspectives (Chug, & Ruhi, 2018; Gil-Fernández, & Calderón-Garrido, 2021b; Hashim, & Carpenter, 2019; León-Gomez *et al.*, 2019; Van Den Beemt *et al.*, 2020).

Studies on social networks are multifaceted and they are considered from various disciplines. Li *et al.* (2017) set out to pursue a holistic vision of networks, analysing and systematising a wide range of focuses: motivations for use, management on social media sites, impact on markets and businesses, tourism, communication, managing emergencies, politics and networks in education. Bruguera *et al.* (2019), when analysing the professional use of networks, concluded that the academic literature on networks pays the most attention to the fields of health and educational sciences, both separately and often transversally (Aparicio-Martínez *et al.*, 2019; Rhem *et al.*, 2019).

Lantz-Anderson *et al.* (2018), focussing on education, affirmed that the nature of professional networks has developed since the start of this century, as digital technologies have become increasingly fundamental to teachers' work. They also emphasised that teachers could access a wide variety of online opportunities for professional development, and that while many of these resources can be used individually and are self-directed, they are still essentially social technologies.

This study belongs to this field and focus, as it uses bibliometric indicators to show information about authors, networks of cooperation between authors, citations, journals, etc. from empirical studies of social networks in different areas and levels of formal and non-formal education. The research is completed with a

number of aspects typical of systematic reviews as it also seeks to analyse lines of action, policy and research methodologies. In this way, we aim to present structural aspects to enable evaluation of the current state of output relating to social networks in their generic educational use (García-García *et al.*, 2023), as well as to foster understanding of changes in trends of a topic in constant change and evolution. A literature review must summarise the state of the question of the relevant research works that contextualise work at an international level, and explain what conclusions by other authors, if there are any, are being questioned or extended. It should include a general overview of the study, its main aim and the methodological design used.

In contemporary society, with its democratic and globalised context, it is not enough to create scientific knowledge; it is also vital to disseminate it, explore the process and methodologies that guide it and consider the criteria to take into account when putting this process of dissemination into practice. It is also necessary to analyse aspects that relate to selection, self-curation and peer assessment (Hernández-González *et al.*, 2017). Systematic reviews and literature analyses using qualitative and quantitative methods, guided by objective techniques, make it possible to analyse these studies optimally (Cooper, 2017).

In recent years, there has been an increase in systematic reviews and bibliometric studies that synthesise research based on primary studies. The aim of these reviews is to examine secondary data in order to retrieve, synthesise and evaluate the existing knowledge that exists on a subject in a logical, transparent and analytical way (Martín *et al.*, 2020). For their part, bibliometric analyses provide the scientific community with valuable information: not just about where research in a given field comes from, but also identifying, focussing and channelling future trends. In the same way, they provide evidence to guarantee a solid foundation for further research. Systematic reviews and bibliometric analyses usually are —and should be— a way in and a starting point for new researchers to find their bearings in their disciplines (Maggio *et al.*, 2020) thus acting as a route map for academics. Bibliometric analysis techniques and tools provide information about the lines of research that act as guidelines for each discipline: the ones researchers follow —whether individually or in the field of collective work environments— and their impact on the scientific community (Martín-Martín *et al.*, 2016).

The aim of this work is to use bibliometric techniques to analyse and quantify the research trends present in JCR relating to the implications of social networks in the field of education, to be able to identify which practices, guiding principles and goals convey the scientific output relating to the matter in hand.

2. MATERIAL AND METHOD

2.1. Research questions and specific objectives of the study

To achieve the aim of the work, the following research questions have been set:

R.Q.1 What has been the development of scientific output on the implications of social networks in the field of education through the 2011–2020 period?

R.Q.2 What relationships can be established between authors, output, working networks, journals and impact of articles on this topic?

R.Q.3 What thematic lines of research have been developed in relation to the educational use of networks, what methodologies have been used and what trends are they following?

R.Q.4 What are the principal needs and challenges that should guide future studies on the use of social networks?

To do this, we set the following specific objectives

S.O.1 To analyse the evolution of the scientific output on JCR related to the educational use of social networks through the 2011–2020 period.

S.O.2 To establish what relationships exist between authors, output, working networks, journals and impact of articles on the chosen topic.

S.O.3 To determine what thematic lines of research have been developed in regards to the educational use of networks, what methodologies are used and what new paths are being taken.

S.O.4 To establish what the principal needs and challenges are that should guide future studies into the educational use of social networks.

2.2. Research focus, design and instruments

This research is exploratory, descriptive and bibliometric. It sets out to summarise the knowledge base regarding the use of social networks in formal, non-formal and informal educational settings, to identify the principal research trends and the variables that have shaped them. Therefore, to do so, we performed a documentary analysis of the articles published in journals indexed in the Web of Science platform, in the Core Collection database, and we selected those included in the JCR index published during the 2011-2020 period.

The process we used to select the works was based on the specifications of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol (Hutton *et al.*, 2016). For García-Peñalvo (2022), use of this protocol is highly recommended as it is one of the most widely used and referenced ones for systematic reviews and meta-analyses, it is applicable to all of the branches of knowledge and it represents an important help for authors to undertake critical evaluation of works and presentation of data.

This study uses as its framework the database of academic literature that is most highly rated by researchers and academic institutions: Journal Citation Report (JCR). This database comprises two indexes: the Science Citation Index (SCI) and the Social Sciences Citation Index (SSCI). It is part of the Core Collection of Web of Science (WoS). It is internationally recognised as a source that provides high-quality information in science and technology, as the rigorous evaluation of the journals indexed in it involves a high level of scientific demand. The type of data it supplies in relation to the publications in many cases guides scientific policies (Pereira, 2018).

We used the keywords “Social networks” AND “Teacher” OR “Social media” AND “Teacher” in the “Topic” section. In this way, we searched in both in the title and the abstract for the keywords in each article

indexed in JCR. For the choice of keywords, we performed a preliminary search of the most common ones in the academic articles from the discipline studied to determine the results.

Firstly, we consulted various combinations of keywords with different synonyms and related words in the relevant publications from 2020. This search was done by two researchers who subsequently specified the chosen keywords. All of the access was done using the web portal of the Fundación Española para la Ciencia y la Tecnología (FECYT–Spanish Foundation for Science and Technology). The whole of the process followed was based on the indications of the protocol set out in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Hutton *et al.*, 2016).

To analyse the data, we first carried out data cleansing through the platform itself by including the keywords “Social networks” AND “Teacher” OR “Social media” AND “Teacher” in the subject. The following inclusion and exclusion criteria were applied:

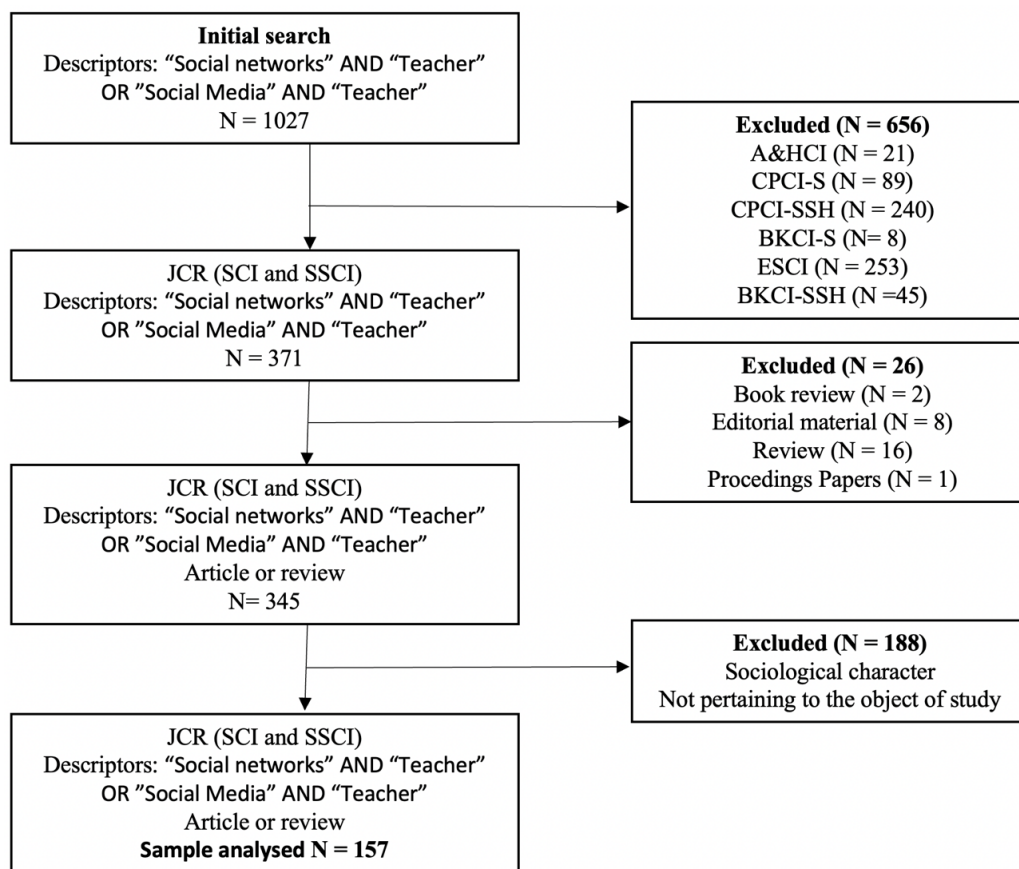
TABLE 1. Inclusion and exclusion criteria.

INCLUSION CRITERIA	EXCLUSION CRITERIA
IC1. Included in JCR	
IC1. Years 2011-2020	
IC2. Language: English or Spanish	
IC3. Areas of knowledge, type of source, type of document, country, type of access: All	
	CE3. No access to work
CI5. Formal, non-formal and informal education. Role of actors and level of education: all	CE5. Works that do not correspond to the subject matter. Research whose sample has not been collected in educational settings or which does not have an educational purpose.

Once the protocol had been designed, we asked two external experts to validate it. To apply the exclusion criteria, the two authors of this work analysed each article. In the event of disagreements, a third opinion was obtained, although this only was only needed on six occasions. All the articles selected were reviewed individually in order to extract each of the results shown.

A total of 1027 works were published in the 2011–2020 period, that matched the keywords “Social networks” AND “Teacher” OR “Social media” and “Teacher” included in the main collection of Web of Science (SCI, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S y ESCI). Of these, 371 are in the JCR database (SCI and SSCI), and 345 of them belong to the “article” category. We reviewed all of the articles and found that the content of 188 did not correspond with the keywords used in the research because, despite appearing as part of the topic of the article, they were in all cases articles from the fields of sociology, communication or health sciences that mentioned the educational level of the subjects involved in the research, but they did not match the study object. Consequently, the final sample comprised 157 articles. Figure 1 shows the selection made.

FIGURE 1. Flowchart of the selection of items carried out.



The authorship of each article was then checked through the institutional *profiles* of each researcher or their presence in academic social networks such as Google Scholar, ResearchGate or Academia.edu. This way, we were able to verify and establish the gender and name of each author and any variance in the names they used.

Next, we classified articles into five topics using their keywords and abstracts. To do so, each article was analysed by both authors, with the involvement of a third expert in the case of disagreement. To guarantee quality in all of this review process, (Wright *et al.*, 2007), we calculated Cohen's kappa ($k = 0.92$). The choice of topics was based on previous systematic reviews centred on the use of social networks in educational settings.

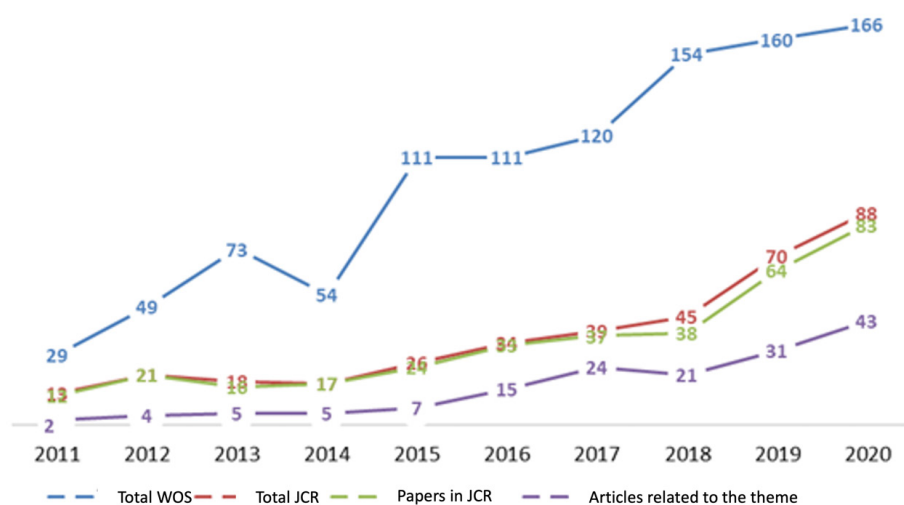
Finally, we coded all of the data and analysed them using the Statistical Package for Social Science (SPSS) version 21.0. quantitative analysis software. The variables analysed were: year of publication of each article; percentage increase in output; authorship; gender of authors; frequency of publication by each author; number of citations received; country of authors; country of each journal; journal impact index; language used; accessibility relating to whether each article is open access; and the subject matter of each article. As well as the descriptive count, we carried out comparisons of groups, using Student's *t* test and analysis of variance, as well as the Kolmogorov-Smirnov normality test, the Shapiro-Wilk test and Levene's test depending on each case.

3. RESULTS AND DISCUSSION

3.1. Analysis of the development of scientific output

Figure 2 shows the evolution in publications with the keywords marked in all of the WoS databases, the total works indexed in JCR, the articles indexed in JCR and the articles indexed in JCR filtered by topic. Considerable growth in the number of works and articles is apparent, especially from 2016. If we compare the first year studied (2011) with the last (2020), publication of this type of article grew by 2050%.

FIGURE 2. Total number of papers and articles in WOS.



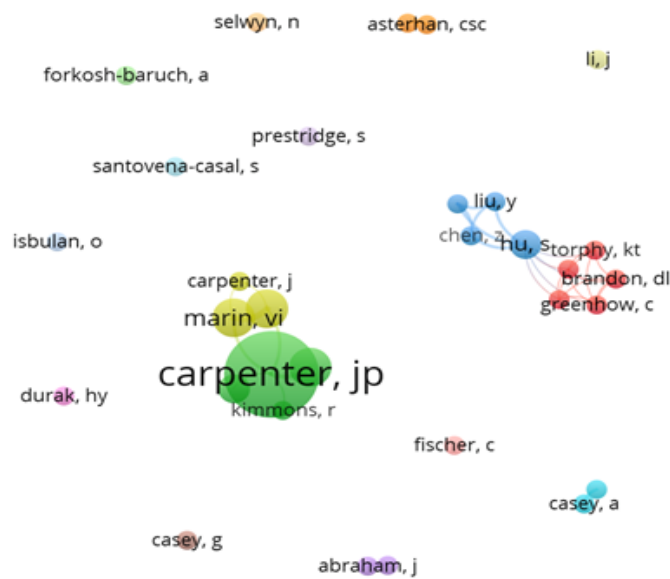
Earlier generic studies on networks already reflected an increase from 2010 following a slight slow-down over the previous two years (Li *et al.*, 2017). Another interesting piece of information is that the number of pages per article tended to decrease. Bruguera *et al.* (2019), this growth in scientific literature about networks in education can be explained by teachers' interest in integrating them as an educational resource or establishing networks among professionals. As shown *below*, these are in fact the two topics most often covered in the articles from the sample. However, unlike the data set out here, when analysing the professional use of networks in various settings these authors detected a stagnation in 2016, followed by a notable increase in 2017.

3.2. Relationships between authors, output, working networks, journals and impact of articles

A total of 346 names are used in the articles analysed, representing 340 different researchers. It should be noted that some authors use a variety of names. Carpenter, for example, sometimes used a single forename and sometimes included a middle name. In any case, the mean number of authors is 2.02 per article. This issue in bibliometric research has already been noted by some authors such as González and Osca (2015) or Calderón-Garrido and Gustems-Carnicer (2018).

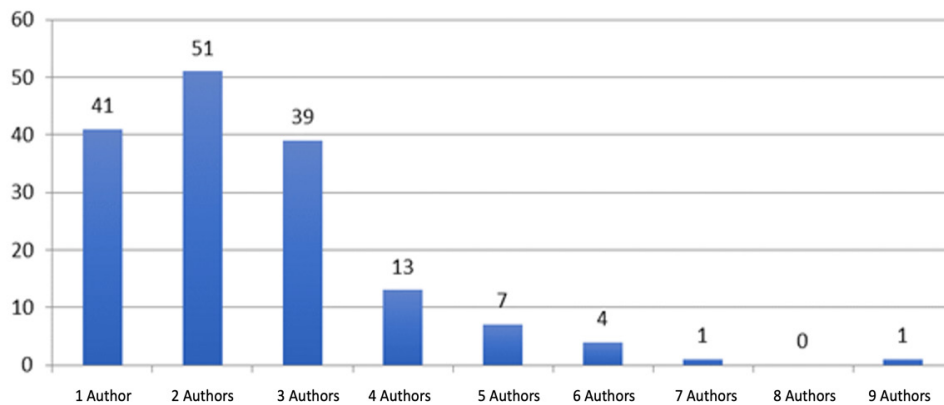
With regards to scientific output, the great majority of the authors ($n=310$, 91.18%) are occasional authors, in other words, they published a single article during the period studied; 26 authors (7.65%) are “intermediate” producers, as they authored two or three articles each, and only 4 (1.17%) are “major” producers who were authors of four or more articles. The author with the most articles published was Carpenter with 11. Figure 3 shows the interactions between the authors (only major and intermediate producers are included). These data, referring to the earliest years analysed, could be interpreted negatively, as they reflect a lack of continuity by authors of this type of analysis in relevant settings. Nevertheless, the occasional authors included in recent years could be a symptom of the incorporation of “new researchers” (Yu-Tang et al., 2019) who join academic output as it increases.

FIGURE 3. Networking among authors.



With regards to co-authoring, authors generally publish individually or in small groups. Figure 4 shows the distribution of articles by number of authors.

FIGURE 4. Number of authors of articles published during the period 2011-2020.

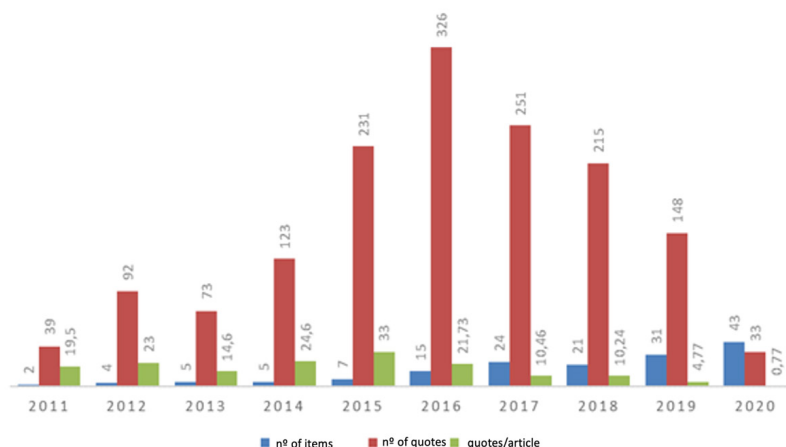


When analysing the question of authorship and co-authorship, we found that more than half of the articles were written by two authors, followed by those written by just one and those written by three researchers. The practice of working with a large number of authors was used a small number of times. In fact, only one article each had seven and nine authors. Networks of interpersonal collaboration, including institutional, have a weak matrix, as Figure 3 shows. This contrasts with the results of studies on generic use of social networks, such as that by Li *et al.* (2017), which observed strong networks of collaboration, or Aparicio-Martínez *et al.* (2019) on networks in the field of youth and health, which found intense contacts. Rhem *et al.* (2019) detected an identical trend, and even found that social networks are a common ground between disciplines given the intensity and variety of the networks of authorship.

When analysing output of articles by gender, it is apparent that there is a greater presence of women ($M = 1.27$; $SD = 1.1$) than men ($M = 1.19$; $SD = 1.01$) in the articles. Women represent 51.6% ($N = 81$) of lead authors. Accordingly, considering the gender of the authors, this study finds a slight dominance of women in the total count of authors. The order of authors displays the same trend, with women being lead authors more often. This finding contrasts with previous research such as that by Morales *et al.* (2017) in the field of music education—which found a greater presence of male authors— or studies in the field of psychology such as that of Barrios *et al.* (2013) or that by Malouff *et al.* (2010), which showed the same trend.

Regarding the number of citations, and taking into account the fact that the WoS database only shows citations made in works that are listed in the database, the articles analysed were cited a total of 1531 times, including 172 self-citations. The h-index is 22. It is notable that 23.6% had no citations. The mean is 9.75 citations ($SD = 15.2$) with a range of 0 to 85 citations. The number of citations does not correlate with the number of authors ($r = 0.029$; $p = 0.716$) but it does correlate negatively with year of publication ($r = -0.500$; $p < 0.01$). However, when observing the number of citations per year in relation to the articles published, no clear trend is apparent. Azer and Azer (2019) reflect on the fact that research institutions have used the number of citations to measure results, assuming that the greater the number of citations, the higher the possibility of being cited. But they note that this might not necessarily be true, because there is a body of evidence that shows that there are other important factors such as the position held by the authors or their prestige.

FIGURE 5. Number of articles, citations, and citation ratio per article.



Similarly, and with regards to citations, differences were apparent between articles published in open-access journals and ones that are not, with the former being cited more. There does not seem to be a correlation between the number of citations and the number of authors listed on the articles. This might partly be because the number of self-citations is not very high, since, as Pandita and Singh (2017) noted in a study that covered various disciplines, a significant part of the citations that an article receives come from its own authors. Furthermore, authors who collaborate tend to work on similar concepts, which means that they frequently cite one another (Kapoor *et al.*, 2018). Hence, taking into account the fact that, as we have already seen, authors in the sample analysed tend to work alone or in small groups, the potential for citations by one of them is reduced. On the other hand, and as most of them are occasional authors, we could also argue that as they do not focus on the subject matter, they do not have the chance to cite their own works. Although social networks belong to the digital sphere, which is characterised by rapid changes and transformations, the oldest works continue to arouse interest, unlike in other fields such as medicine (Villar *et al.*, 2007). Hancock and Price (2016), in a work on music education, observed that articles in their discipline took longer to be cited than ones from psychology.

Nonetheless, the open-access variable did not display any statistically significant differences with regards to the number of citations ($t_{155} = 0.740$; $p = 0.460$). Table 2 shows these differences.

TABLE 2. Differences between quotes in open access and non-open access journals.

	Open access	Non-open access
Number of publications	21	136
Number of quotes received	228	1303
Average number of quotes per paper	10,86	9,58

With regards to the country of affiliation of the authors, the USA was most productive with 53 articles (33.76%), followed by Spain (N=19; 12.10%), Australia and Turkey with 15 articles each (9.55%) and the United Kingdom (N=11; 7%). There was also a series of countries with fewer than 10 works, giving a total of 38 countries. Works in open access publications were cited only slightly more often, as Table 1 shows. Although being published in journals that can be consulted for free might result in greater dissemination and therefore more citations, this fact is explained by the small number of this type of works in JCR. Only 13.37% of the works in this study were published in this way. This percentage is notably lower than the one observed by Abadal (2017), who found that in the field of social sciences, 30% of journals were open access.

Regarding the language of the articles, almost all of them (N=154, 98.01%) were written in English. There was one work each in Portuguese, Spanish and Turkish (0.64% each). Various studies, such as that by López-Navarro *et al.* (2015), show that using English as the vehicular language for scientific output improves the impact of works. Indeed, some systematic review works on the subject matter in question only include articles published in English (Rhem *et al.*, 2019) in their selection.

The provenance of output was varied, as the 157 works came from a total of 38 countries. The leading ones in order were the USA, Spain, Australia and Turkey. If we compare this with the information about articles published in JCR on education in general in the 2011–2020 period —without defining the specific

area— the countries with the most articles published were the USA, the UK, Australia and Spain. In the work by Yu-Tang *et al.* (2019), which used another keyword and referred to the period between 2010 and 2018, the USA was still the leading producer but it was followed by the United Kingdom, Spain and Australia, with Turkey outside the top four. Therefore, in the study of networks and their educational use, Spain had a more significant position than in studies on education in general while the United Kingdom had a lower output than Turkey. We should note that the output of the United Kingdom displayed a downward trend, already apparent in this analysis for the years 2019 and 2020. In the work by Li *et al.* (2017), who completed their analysis of networks in general in 2014, Spain was outside their focus, something which, even though this work refers to the educational field, could be a reflection of a “lift off” in the scientific literature of this country. In any case, it is striking how this trend does not correspond with the population of each country. For example, if we compare the USA, Spain and Australia by number of inhabitants, we can see that Spain published 2.86 times more articles than the USA and Australia 3.72 times more than the USA.

In regard to journals, the articles studied were published in a total of 79 journals. Analysis of these data shows that only seven journals published five or more articles. These journals contain 31.21% of the total number of articles.

TABLE 3. Journals that have published the most articles, areas and impact factor.

JOURNAL	N	Impact factor*	Research areas	JCR categories	Quartile in category**
<i>Teaching and Teacher Education</i>	11	2,686	Education and Educational Research	Education and Educational Research	Q1
<i>Computers Education</i>	10	5,296	Education and Educational Research; Computer Science	Education and Educational Research; Computer Science	Q1
<i>Education and Information Technologies</i>	6	1,912	Education and Educational Research	Education and Educational Research	Q2
<i>International Review of Research in Open and Distributed Learning</i>	6	2,297	Education and Educational Research	Education and Educational Research	Q1
<i>Technology Pedagogy and Education</i>	6	1,481	Education and Educational Research	Education and Educational Research	Q3
<i>Interactive Learning Environments</i>	5	1,938	Education and Educational Research	Education and Educational Research	Q2
<i>Teachers College Record</i>	5	0,970	Education and Educational Research	Education and Educational Research	Q4

* JIF (Journal Impact Factor) referring to 2019

** Quartile in 2020

Seven of them published between 5 and 11 works on the reference topic. Of these, three are indexed in Q1 and two in Q2. This analysis shows that the journals with the greatest influence in this field and topic, both by number of publications and by position (Q1) were *Teacher and Teaching Education* and *Computer Education*, which only differed by one publication, *International Review of Research in Open and Distributed Learning* and *Education and Information Technologies*, all of which are in JCR’s “education and educational research” category and domain. *Computer Education* had the highest impact factor. This study essentially matches the details set out in the work by Yu-Tang *et al.* (2019), which also found this to be the journal with the highest impact among those studied and the one that published the most articles. It is also notable that in the study by Bruguera *et al.* (2019), *Teacher and Teaching Education* was the journal with the second most works published, despite the journal’s specificity contrasting with the generic analysis of the general professional use of networks that the authors performed.

3.3. Thematic lines

Regarding the subject matter, five major lines of research were found. The most common of these relates to social networks as an element that provides a vehicle for the creation of virtual settings and educational communities ($n=51$; 32.5%). In this sense, it can be seen that the subject matter does not affect the number of citations ($F_{(4,152)} = 1.375$; $p = 0.245$) nor does the number of participating authors ($F_{(4,152)} = 0.701$; $p = 0.592$). Table 4 shows the differences in citation and authors depending on the topic.

TABLE 4. Distribution of quotes and authors according to the subject matter of the articles.

THEMES	N %	Quotes	Authors
		Mean SD	Mean SD
<i>Social networks as a vehicle for the creation of virtual environments and educational communities</i>	51 32,5%	6,90 9,454	2,61 1,343
<i>The teaching-learning process mediated by social networks as a didactic resource</i>	47 29,9%	13,17 17,897	2,51 1,545
<i>Digital competence and teaching digital competence. Implementation and motivational aspects</i>	31 19,7%	10,32 18,284	2,39 1,383
<i>Problems, ethical dilemmas and addictions derived from the use of social networks: their treatment in the classroom</i>	21 13,4%	10,29 16,496	2,38 1,322
<i>Social movements and demands in the field of education through social networking sites</i>	7 4,5%	3,43 4,685	1,71 0,488

Of the articles, 62.4% tackled the first two aspects. The first line of research considered networks as a vector and factor for environments and communities. The works in this group cover how they are produced between the different agents in the educational process —teachers, learners and educational community— and how they relate to one another by configuring educational settings and networks of social capital. The most cited and disseminated works in this category were those by Rehm and Notten (2016) and Sarapin and Morris (2015). The second topic comprises analysis of networks as an educational resource for learning, and the authors consider all educational levels, with a particular interest in the university level (Barry *et al.*, 2016; Goodyear *et al.*, 2014). Digital competence and educators’ digital competence in their aspects of implementation and motivational aspects represented 19.7%, as in the case of the works by Carpenter and Krutka (2015) and Matzat (2013). The fourth topic —problems, ethical dilemmas and addictions deriving from the use of social networks and their treatment in class— represented 13.4% of the total (Cam, & Isbulan, 2012). Finally, the analysis of social movements and demands in the educational sphere through networks is the topic that received the least attention (4.5%) (Ajayi, 2015). There is no clear correlation with regards to topic, number of authors that decided to choose it and the number of citations received.

Social networks, in general, as stated above, have been covered from a variety of disciplines and perspectives. Kapoor *et al.* (2018) found that up to 2011, the principal concern of researchers was to consider content created by users as an innovative form of online production. Their interest then shifted towards other more diverse aspects, especially behavioural aspects and the creation and management of online communities and social capital.

Li *et al.* (2017) found 221 thematic categories defined by 20 principal topics. López *et al.* (2018), in their systematic review established that in the last 20 years, the most interesting topics on educational networks were reforms to educational policies, leadership, learning communities, initial teacher training and collaboration between agents in the educational process. Hâncean *et al.* (2016) classified this collaborative work according to the level of analysis: node, dyad or network.

Other authors such as Yu-Tang *et al.* (2019) simplified the thematic lines into three: personal relations in networks; networks for learning; and network-based methodologies. These authors also found no correlation between these lines of study and the number of citations. It is worth noting that, in fields other than education, the use of networks that connect the non-formal and informal realms in different disciplines such as STEM, music, social work, and engineering, has been an abundant source of studies (Bruguera *et al.*, 2019), while in the field of education it has been addressed, albeit with less intensity.

With regards to the methodology used, empirical studies stand out, as some review studies on social networks show (Van Den Beemt *et al.*, 2020). The main techniques used in this selection were qualitative—almost half—and methods were used that include case studies, interviews, ethnographic data and analysis of accounts. These are followed by mixed methods and quantitative methods and, to a lesser extent, techniques for the systematic review of scientific literature. This matches the sample of Yu-Tang *et al.* (2019), where half of the most-cited articles used qualitative techniques. There is a discrepancy in the more general sphere of the use of networks for professional purposes as quantitative methods were used more, especially analysis of questionnaires (Bruguera *et al.*, 2019; Kapoor *et al.*, 2018). This is also the case in works on educational uses of specific networks (Chug, & Ruhi, 2017).

3.4. Needs and challenges detected

Certain shortcomings can be seen in the studies, suggesting that there is interesting potential for future works. While there are some topics related to social networks that are in “good health”, others, such as non-formal learning or problems, ethical dilemmas and addictions, have been covered by other areas thanks to their interest, but have been considered to a lesser extent by educational sciences, or at least have not made their way into high-impact journals. Limited collaboration and the establishment of networks of publication between peers are also matters that have not been considered in sufficient depth.

4. CONCLUSIONS, LIMITATIONS AND FUTURE POSSIBILITIES

In the case of the how production of academic works development of output of academic works on the educational use of social networks in journals indexed in JCR has evolved, we found a noticeable increase in number in the period between 2011 and 2020, which accelerated from 2016. This is because researchers considered two educational needs, which from that moment became crucial: the incorporation of social networks as an educational resource and the use of them to establish professional and academic networks.

With regards to authorship, this study shows something of an imbalance between the number of names used and the total number of producers. Among other reasons this is because some authors sometimes use their middle name when publishing and sometimes do not, as in the case of a “major” producer like Carpenter.

As for the frequency of authorship, a large majority of researchers only published one article on social networks in education in JCR in the period analysed. A minority can be considered to be “intermediate” and, as shown *above*, only four authors can be described as “major” producers. Observing the earliest years of the analysis, this information about authorship, which is so polarised, could be interpreted as authors losing interest in the subject, but if we shift the focus to more recent years, we find that new researchers emerge who cover educational needs arising from the digitalisation of society. Women make up the majority of the authors and they are more often the lead authors.

The 157 works came from a total of 38 countries. The leading ones in order were the USA, Spain, Australia and Turkey. The articles are distributed across a large number of journals, with only 7 having published 5 or more articles on this topic.

Among the research questions, they set out to determine what thematic lines of research have been pursued, what methodologies have been used and the directions in which they are evolving. The distribution of themes in the articles shows that the topics that have inspired researchers’ interest predominantly relate to social networks as an element that provides a vehicle for the creation of virtual environments and educational communities and also to the teaching-learning process mediated by social networks as a teaching resource. The literature gathers and analyses practices implemented through networks that guarantee innovation. These are followed by works on digital competence and educators’ digital competence, frequently related to motivational aspects, good practices, creation of communities and network-mediated virtual environments. The literature has also addressed addictions and negative aspects of networks in education, as well as legal and ethical questions. To a lesser extent, there are also works that can be subsumed in the analysis of social movements and demands in the field of education using networks as an instrument.

The limitations of this work relate to the choice of databases. It has enabled us to establish what trends exist among high-ranking literature, but there is bias, as the results are always positive. Furthermore, the quality of the articles is more homogeneous. Using other broader databases, such as ERIC or Google Scholar and the addition of grey literature would offer a more “realistic” and complete vision. The choice of a bibliometric methodology limits the focus of the research questions to very specific aspects. Future works could consider nuances that are more specific and which cover the content and results of the works.

In short, the use of networks in education is experiencing a high point in academic literature, which has confirmed the benefits and effectiveness of the practices implemented using them. This work has found that authors tend to work independently or in small groups, and that they establish limited networks of collaboration. Taking into account the sociological aspect that is characteristic of social networks, one interesting future possibility would be to establish collaborations between institutions and carry out comparative studies across different countries. Bearing in mind that there are more qualitative or mixed-method studies, one possibility would be to carry out studies using quantitative methodologies, which are much more numerous in other fields. The intersection between formal, non-formal and informal settings is especially relevant owing to the intrinsic characteristics of social networks and should be analysed in greater depth.

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