

Global Scientific Output on Online Education during the Covid-19 Pandemic: Analysis of the 2020-2021 Periods

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Abstract

The study aims to characterize the global scientific production on online education during the Covid-19 pandemic in the period 2020-2021. To this end, the databases Scopus, Web of Science, Google Scholar, PubMed, Microsoft Academic, Dimensions and Crosreff were analyzed between January 2020 and April 2021. We worked with a universe of 1,411 articles obtained, in which the bibliometric indicators were measured using the Publish or Perish v. 7.19 software and the same analytical software of the databases chosen. The results showed a total of 3,293 citations with an average of 548.30 citations per year; 3.16 citations per article and 294.71 citations per author. On average, the publications have an h-index of 9.00, a g-index of 14.50 and an e-index of 11.54. Finally, the AW index was 15.75 and the AWCR was 401.17. These results show that the production of scientific articles on online education during the pandemic has experienced significant growth, which demonstrates the need to investigate this activity in order to measure its impact.

Key-words: Bibliometrics, Scientific Production, Online Education, COVID-19.

1. Introduction

The outbreak of Covid-19 was unexpected and forced governments to decide to paralyze their social, economic, educational and other activities almost immediately. As part of the consequences of

the quarantine measures, thousands of schools were closed indefinitely in March 2020. Others, such as universities, were forced to migrate from face-to-face to virtual in a short time (Gil-Vila et al., 2020; Tejedor et al., 2020). In this context, technology (in particular online work) took an important role in the development of educational activities drastically influencing learning environments. Online learning emerged in the late 1990s and was coined by this name in 2001 by the European Commission in its Official Journal. Although the transition to online learning was unexpected and rapid due to Covid-19, it took place in the midst of a broader ICT transformation process in educational systems that already had decades of experience in this modality (Selwyn 2012).

This modality positioned itself as the only way to make learning processes accessible, open and flexible at all levels (Harasim, 2000). Its use is justified by three situations. First, due to territorial dispersion; second, due to the need to educate large groups of students; and third, due to the need to continue teaching processes in exceptional situations, such as in cases of pandemics (Careaga-Butter et al., 2020). In the case of teachers, the pandemic prompted them to abandon traditional teaching methods to migrate to online teaching in a matter of weeks (Gülbahar and Adnan, 2020), leading to the emergence of various pedagogical models that make possible greater and faster communication and collaboration between students and teachers (Bozkurt et al., 2015).

Given this situation, the challenges faced by teachers (and students) go through adapting to online teaching and maintaining at least a minimum of communication with students in order to support learning and the development of their autonomy. However, the extent to which teachers have or will master these challenges is unknown. Extensive school closures occurred during an era that, in general, has been marked by the rapid transformation of technological innovations and digitization, especially in educational contexts (McFarlane 2019; Vilaverde, 2020).

While teachers can learn from reports on good practices for distance learning and, by extension, online learning, the school remains the mandatory environment for student learning with teachers responsible for providing structured learning opportunities (Lipowsky, 2015). Schools must evolve their concepts toward blended learning, i.e., a strategic combination of school presence and structured approaches to student learning at home.

Bibliometric analysis is an indispensable statistical tool for mapping the state of the art in a given area of scientific knowledge and identifying essential information for various purposes, such as prospecting research opportunities and testing scientific research (de Oliveira et al., 2019; Davis & Gonzalez, 2003; Gomez et al., 2012). It is, therefore, interesting to delve into the contents of the research itself and also to know other attributes of the contributions in the field of online education, such as the scientometric indexes of the publications, the most cited articles according to the

databases in which they are indexed, the most cited authors, the journals that present the largest number of publications on the subject, the type of research that is most published and the countries with the largest production on the subject. Therefore, the aim of the present study is to characterize the global scientific production on online education during the Covid-19 pandemic in the period 2020-2021. For this purpose, the databases Scopus, Web of Science, Google Scholar, PubMed, Microsoft Academic, Dimensions and Crosreff were analyzed between January 2020 and April 2021. This objective will be answered throughout the article, trying to give an overview of the progress of scientific production to those researchers who wish to direct their studies to online education.

2. Materials and Methods

A descriptive-retrospective bibliometric study was conducted on global scientific production, dealing with research on online education in Covid-19 times in the period from January 2020 to April 2021 (April 20). The variables studied were total number of articles, citations, average number of citations per year, per article, per author, per author per year, per author and per article; also analyzed were the h index, g index, contemporary h index (hc), individual h index (hI), normalized hI index, AWCR index, e index, number of authors, most cited articles and annual distribution of articles, as well as the type of publication, country of origin, journal with most publications and the ten authors with the highest number of citations for each base chosen (Arias-Chávez et al. , 2019a; 2019b). In the case of the Web of Science database, only metrics related to the total number of articles, citations, average number of citations per year, average number of citations per article and h-index were considered. In the case of PubMed and Dimensions, articles, authors, countries, journals and types of publication were considered.

In the case of the Scopus, Web of Science, Google Scholar, PubMed, Microsoft Academic and Crosreff databases, bibliometric indicators were calculated using the Publish or Perish v. 7.19 software. The analytical software of the chosen databases was also used in addition to Dimensions, PubMed and PubRe Miner. For the searches, the terms TI=(ONLINE* AND TEACHING * AND COVID * AND 19) were used, which had to appear in the title of the research.

The results were reviewed individually, forming a final universe of 1,411 results related to the subject of the study. The data obtained were exported to a database (MS Excel from Microsoft Corp) and then processed and analyzed with the help of the Vos Viewer software. The results are presented in tables and figures in order to clearly show the findings.

3. Results

The scientometric indices obtained from the analysis of the 1,411 articles can be seen in Table 1. An average of 594 citations, 487; 2 and 553 citations per year, citations per article and citations per author, respectively, were obtained. The publications on average have an h-index of 9.00, a g-index of 23 and an e-index of 19. Finally, the AWCR was 838.

Table 1 - Scientometric Indicators on Online Education during the Covid-19 Pandemic

Source	Google Scholar	Microsoft Academic	PubMed	Scopus	Crossref	Web of science
Articles	500.0	431.0	47.0	123.0	200.0	91.0
Cites	2188.0	751.0	0.0	297.0	120.0	194.0
Years	1.0	1.0	1.0	1.0	1.0	1.0
Appointments by year	2188.0	751.0		297.0	120.0	167.0
Appointments Cites by articles	4.4	1.7		2.4	0.6	2.1
Appointments by author	1345.1	473.0		297.0	87.3	
Articles by author	282.0	253.3	20.8	123.0	119.1	
Articles by author	2.4	2.6	3.6	1.0	1.6	
indice h	18.0	10.0		9.0	4.0	6.0
indice g	42.0	26.0		14.0	10.0	
indice hc	40.0	20.0		17.0	8.0	
indice hi	6.6	3.3		9.0	1.8	
normal h-index	13.0	7.0		9.0	3.0	
AWCR	2183.0	751.0		297.0	120.0	
indice e	34.5	21.9		9.9	8.5	

Tables 2, 3, 4, 5, 6 and 7 show the list of the most cited articles published in the chosen databases. Of particular note is the study by Virginia Gewen, a freelance science journalist based in Portland, Oregon. She writes frequently on food security, biodiversity loss and climate change. Her work appears in The Atlantic, Scientific American, bioGraphic, Nature and other journals. The article is entitled Five tips for moving teaching online as COVID-19 takes hold, which has received 50 citations in Scopus, 52 in Crossreff and 46 in Web of Science since its publication on March 24, 2020 in Nature.

Also noteworthy is the article COVID-19 and online teaching in higher education: A case study of Peking University by Wei Bao, senior lecturer at Peking University; published in the journal Article Human Behavior and Emerging Technologies, in April 2020. This publication has 547 citations in Google Scholar, 259 in Dimensions and 244 in Microsoft Academic. Finally, Johannes König, Daniela J. Jäger-Biela and Nina Glutsch published the article entitled Adapting to online

teaching during COVID-19 school closure: teacher education and teacher competence effects among early career teachers in Germany, which has 30 citations in Scopus and 24 in Web of Science. The article was published in the European Journal of Teacher Education on August 18, 2020.

Table 2 - Five Most Cited Articles of the Scientific Production on Online Education during the Covid-19 Pandemic in Scopus

N°	Authors	Title	Cites	Type	Source
1	Virginia Gewin	Five tips for moving teaching online as COVID-19 takes hold	50	Note	Nature
2	Johannes König, Daniela J. Jäger-Biela y Nina Glutsch	Adapting to online teaching during COVID-19 school closure: teacher education and teacher competence effects among early career teachers in Germany	30	Article	European Journal of Teacher Education
3	Kaup, Soujanya; Jain, Rashmi; Shivalli, Siddharudha; Pandey, Suresh y Kaup, Soumya	Sustaining academics during COVID-19 pandemic: The role of online teaching-learning	22	Letter	Indian Journal of Ophthalmology
4	Peter D. MacIntyre, Tammy Gregersen y Sarah Mercer	Language teachers' coping strategies during the Covid-19 conversion to online teaching: Correlations with stress, wellbeing and negative emotions	16	Article	Telemedicine And E-Health
5	Ting Zhou, Sufang Huang, Jing Cheng y Yaru Xiao	The distance teaching practice of combined mode of massive open online course micro-video for interns in emergency department during the COVID-19 epidemic period	16	Article	System

Table 3 - Five Most Cited Articles of the Scientific Production on Online Education during the Covid-19 Pandemic in Web of Science

N°	Authors	Title	Cites	Type	Source
1	Gewin, Virginia	Five tips for moving teaching online as COVID-19 takes hold	46	Note	Nature reviews drug discovery
2	Koenig, Johannes; Jaeger-Biela, Daniela J.; Glutsch, Nina	Adapting to online teaching during COVID-19 school closure: teacher education and teacher competence effects among early career teachers in Germany	24	Article	Acs central science
3	Kaup, Soujanya; Jain, Rashmi; Shivalli, Siddharudha; Pandey, Suresh; Kaup, Soumya	Sustaining academics during COVID-19 pandemic: The role of online teaching-learning	17	Letter	Indian Journal of Ophthalmology
4	Zhou, Ting; Huang, Sufang; Cheng, Jing; Xiao, Yaru	The Distance Teaching Practice of Combined Mode of Massive Open Online Course Micro-Video for Interns in Emergency Department During the COVID-19 Epidemic Period	10	Article	New England journal of medicine
5	MacIntyre, Peter D.; Gregersen, Tammy; Mercer, Sarah	Language teachers' coping strategies during the Covid-19 conversion to online teaching: Correlations with stress, wellbeing and negative emotions	9	Article	Lancet

Table 4 - Five Most Cited Articles of the Scientific Production on Online Education during the Covid-19 Pandemic in Google Scholar

N°	Authors	Title	Cites	Type	Source
1	W Bao	COVID-19 and online teaching in higher education: A case study of Peking University	547	Article	Human Behavior and Emerging Technologies
2	C Rapanta, L Botturi, P Goodyear, L Guàrdia, M Koole	Online university teaching during and after the Covid-19 crisis: Refocusing teacher presence and learning activity	201	Article	Postdigital Science and Education
3	L Mishra, T Gupta, A Shree	Online teaching-learning in higher education during lockdown period of COVID-19 pandemic	137	Article	International Journal of Educational Research Open
4	V Gewin	Five tips for moving teaching online as COVID-19 takes hold.	113	Article	Nature
5	J König, DJ Jäger-Biela, N Glutsch	Adapting to online teaching during COVID-19 school closure: teacher education and teacher competence effects among early career teachers in Germany	109	Article	European Journal of Teacher Education

Table 5 - Five Most Cited Articles of the Scientific Production on Online Education during the Covid-19 Pandemic in Crossref

N°	Authors	Title	Cites	Type	Source
1	Virginia Gewin	Five tips for moving teaching online as COVID-19 takes hold	52	journal-article	Nature
2	Lokanath Mishra, Tushar Gupta, Abha Shree	Online teaching-learning in higher education during lockdown period of COVID-19 pandemic	28	journal-article	International Journal of Educational Research Open
3	Rishi Sharma, Sai Krishna Tikka	COVID-19 online surveys need to follow standards and guidelines: Comment on “Does COVID-19 pandemic affect sexual behaviour? A cross-sectional, cross-national online survey” and “Binge watching behavior during COVID 19 pandemic: A cross-sectional, cross-national online survey”	4	journal-article	Psychiatry Research
4	Ramona Maile Cutri, Juanjo Mena, Erin Feinauer Whiting	Faculty readiness for online crisis teaching: transitioning to online teaching during the COVID-19 pandemic	4	journal-article	European Journal of Teacher Education
5	David Michael Telles-Langdon	Transitioning University Courses Online in Response to COVID-19	3	journal-article	Journal of Teaching and Learning

Table 6 - Five Most Cited Articles of the Scientific Production on Online Education during the Covid-19 Pandemic in Microsoft Academic

N°	Authors	Title	Cites	Type	Source
1	Wei Bao	COVID-19 and online teaching in higher education: A case study of Peking University	244	journal-article	Human Behavior and Emerging Technologies
2	Chrysi Rapanta, Luca Botturi, Peter Goodyear, Lourdes Guàrdia, Marguerite Koole	Online University Teaching During and After the Covid-19 Crisis: Refocusing Teacher Presence and Learning Activity	133	journal-article	Postdigital Science and Education
3	Virginia Gewin	Five tips for moving teaching online as COVID-19 takes hold.	73	journal-article	Nature
4	Johannes König, Daniela J. Jäger-Biela, Nina Glutsch	Adapting to online teaching during COVID-19 school closure: teacher education and teacher competence effects among early career teachers in Germany	31	journal-article	European Journal of Teacher Education
5	Lokanath Mishra, Tushar Gupta, Abha Shree	Online Teaching-Learning in Higher Education during Lockdown Period of COVID-19 Pandemic	22	journal-article	International Journal of Educational Research Open

Table 7 - Five Most Cited Articles from the Scientific Output on Online Education during the Covid-19 Pandemic in Dimensions

N°	Authors	Title	Cites	Type	Source
1	Bao, Wei	COVID-19 and online teaching in higher education: A case study of Peking University	225	Article	Human Behavior and Emerging Technologies
2	Dhawan, Shivangi	Online Learning: A Panacea in the Time of COVID-19 Crisis	146	Article	Journal of Educational Technology Systems
3	Zhang, Wunong; Wang, Yuxin; Yang, Lili; Wang, Chuanyi	Suspending Classes Without Stopping Learning: China's Education Emergency Management Policy in the COVID-19 Outbreak	99	Article	Journal of Risk and Financial Management
4	Rapanta, Chrysi; Botturi, Luca; Goodyear, Peter; Guàrdia, Lourdes; Koole, Marguerite	Online University Teaching During and After the Covid-19 Crisis: Refocusing Teacher Presence and Learning Activity	93	Article	Postdigital Science and Education
5	König, Johannes; Jäger-Biela, Daniela J.; Glutsch, Nina	Adapting to online teaching during COVID-19 school closure: teacher education and teacher competence effects among early career teachers in Germany	49	Article	European Journal of Teacher Education

Regarding PubMed, it can be seen that Zhang and Li are the authors with the highest number of publications. In the case of Web of Science, Huang and Sha'aban are the authors with the most publications. Finally, in Scopus, Bryson and Tandon are the most prominent authors (see Table 8).

Table 8 - Authors with the Highest Number of Publications in PubMed, Web of Science and Scopus

PubMed		Web of Science		Scopus	
Zhang Y	17	Huang J	2	Bryson, JR.	2
Li X	15	Sha'aban A	2	Tandon, U	2
Wang Y	15	Aamer S	2	Abdelwahed, A.	1
Wang C	11	Ab Latib H	1	Abi-Rafeh, J.	1
Yang Y	11	Abdelwahed A	1	Abidi, T.	1
Chen Y	10	Abi-Rafeh J	1	Abuhmaid, AM	1
Grover S	10	Abidin Mjz		Adarkwah, MA.	1
Liu Y	10	Abuhmaid Am	1	Adhikari, K.	1
Shao S	10	Acharya S	1	Aduba, DE	1
Yang X	10	Adarkwah MA	1	Ajmal, M.	1

Regarding the journals where the articles are published, the Journal of Chemical Education with 10 in Web of Science and 10 in Scopus is the most outstanding (see Table 9).

Table 9 - Journals with the Highest Number of Publications in Pubmed, Web of Science and Scopus

Scopus		PubMed		Web of Science	
Journal of Chemical Education	10	Int J Environ Res Public Health	83	Journal of Chemical Education	10
Journal of Physics Conference	5	Plos One	40	Basic Clinical Pharmacology Toxicology	4
European Journal of Teacher Education	4	Front Psychol	38	European Journal of Teacher Education	4
Biochemistry And Molecular Biology Education Show	3	J Med Internet Res	31	Pharmacy Education	4
Education Sciences	3	Front Psychiatry	22	Biochemistry and Molecular Biology Education	3
Iop Conference Series Earth and Environmental Science	3	Front Public Health	22	Education Sciences	3
Journal of Baltic Science Education	3	Med Educ Online	22	Journal of Baltic Science Education	3
Communications in Computer and Information Science	3	BMC Public Health	18	Education And Information Technologies	2
Education and Information Technologies	2	Biochem Mol Biol Educ	17	Indian Journal of Ophthalmology	2
Human Behavior and Emerging Technologies	2	Heliyon	17	Basic Clinical Interactive Learning Environments	2

Regarding the types of research (see Table 10), original scientific articles predominate in PubMed, Web of Science and Scopus.

Table 10 - Types of Publications in PubMed, Web of Science and Scopus

PubMed		Web of Science		Scopus	
Journal Article	1564	Article	75	Article	83
Research Support, Non-U.S. Govt	83	Early Access	13	Conference Paper	23
Review	62	Letter	5	Letter	6
Letter	44	Meeting Abstract	5	Note	4
Editorial	19	Editorial Material	4	Review	4
Multicenter Study	16	Review	2	Book Chapter	2
English Abstract	14			Editorial	1

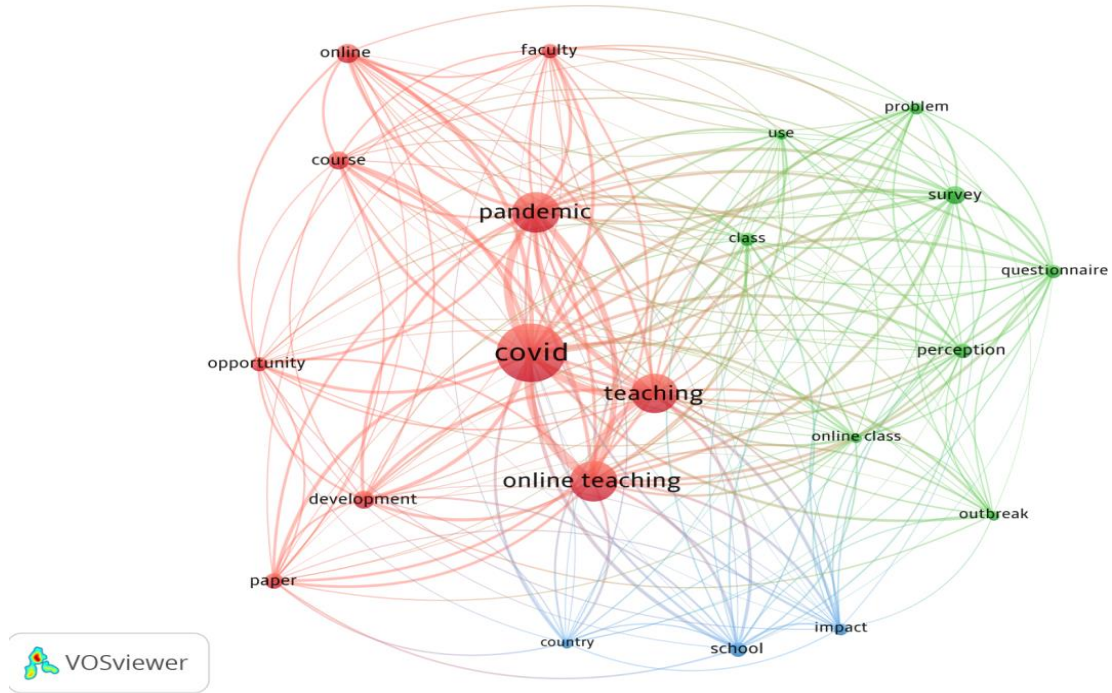
With respect to the countries of origin of the research (see Table 11), China and India stand out in Scopus and Web of Science and the United States and the United Kingdom in PubMed.

Table 11 - Countries of Origin of Publications in PubMed, Web of Science and Scopus

Scopus		Web of Science		PubMed	
China	23	China	16	United States	333
India	16	India	13	United Kingdom	281
United States	16	United States	13	China	225
United Kingdom	11	United Kingdom	9	India	132
Germany	6	Canadá	5	Italy	100
Indonesia	6	Germany	5	Australia	79
South Afric	6	Malaysia	5	Spain	79
Canadá	5	Pakistán	4	Canadá	68
Saudi Arabia	5	Spain	4	Germany	64
Australia	3	Saudi Arabia	3	Saudi Arabia	60

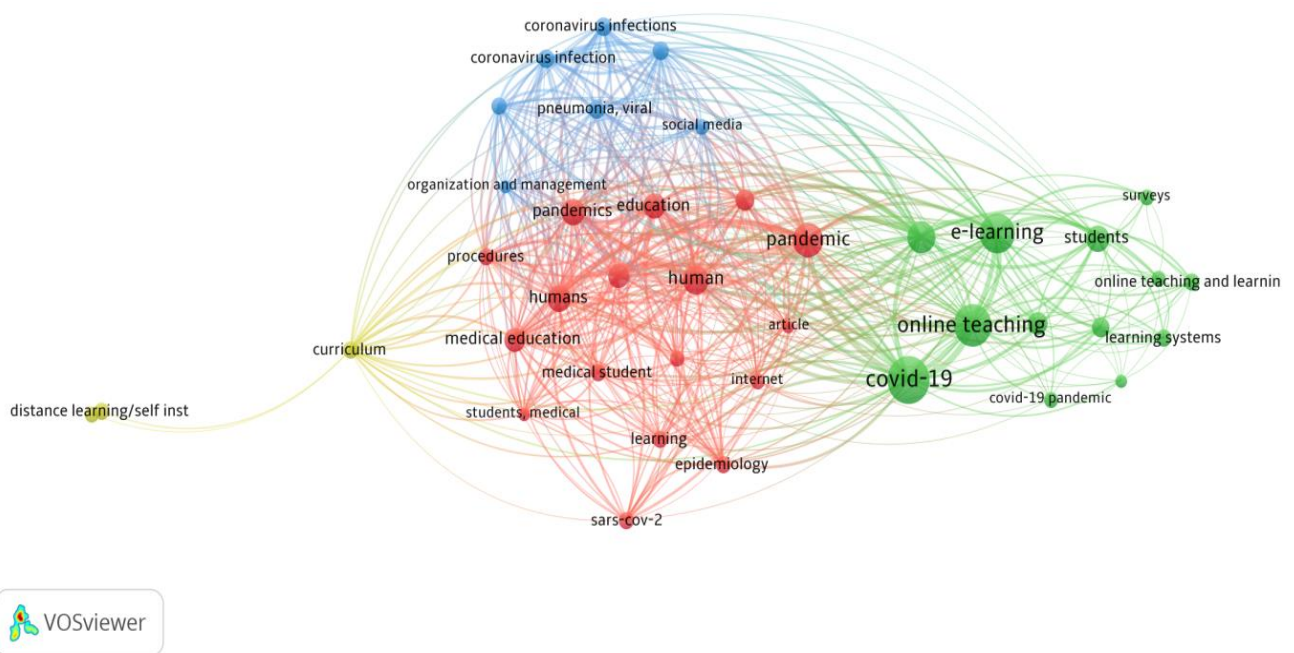
Finally, with regard to the network analysis of the titles and abstracts of the Web of Science database, 3 clusters, 21 items, 203 links and total link strength of 1514 were created. Cluster 1, which originates from Covid and presents 10 items, cluster 2 with Survey and 8 items and cluster 3 with School and 3 items (see graph 1).

Graph 1. Analysis of network visualization in Web of Science



Regarding the network analysis of the titles and abstracts of the Scopus database, we observed the creation of 4 clusters, 40 items, 491 links and a total link strength of 2136. Cluster 1 is born from pandemic and has 17 items, cluster 2 with Covid 19, cluster 3 with Coronavirus infection with 7 items and cluster 4 with Currículum and only 3 items (see graph 2).

Graph 2 - Analysis of Network Visualization in Scopus



4. Conclusions

The scientometric indices obtained from the analysis of the 1,411 articles are summarized as an average of 594 citations, 487, 2 and 553 citations per year, citations per article and citations per author, respectively. The publications on average possess an h-index of 9.00, a g-index of 23 and an e-index of 19. Finally, the AWCR was 838. Amoozegar et al. (2018) conducted a research similar to the present one basing their search on an inclusive set of keywords referring to distance education, resulting in a sample of 6,141 articles published in WoS during the period 1980-2016, from which 500 were selected for their research. It should be emphasized that the present research was based only on the years 2020 and part of the year 2021, years in which the Covid-19 pandemic developed, and in which an increase in global scientific production on online education was observed. Given the current context, it is necessary to measure the areas that have been affected and/or modified by the pandemic, being education, as well as the economy, the one that has assumed greater changes.

As for the authors and most cited articles in the six databases analyzed, the study by Virginia Gewen entitled Five tips for moving teaching online as COVID-19 takes hold stands out, receiving 50 citations in Scopus, 52 in Crossreff and 46 in Web of Science. The article was published in the journal Nature. Also noteworthy is the article COVID-19 and online teaching in higher education: A case study of Peking University by Wei Bao, which was published in the journal Article Human Behavior and Emerging Technologies. This publication has 547 citations in Google scholar, 259 in Dimensions and 244 in Microsoft Academic.

Regarding the journals that publish research on online education, the one that shows the highest number is the Journal of Chemical Education with 10 articles in Web of Science and 10 in Scopus. However, the research by Chen et al. (2021) highlights the journal Lecture Notes in Computer Science as the scientific medium with the highest number of published articles related to online education (34 articles) and the highest H-index value of seven. Other equally prolific journals are Smart Innovation, Systems and Technologies (32 articles), ACM International Conference Proceeding Series (22 articles) and Lecture Notes in Educational Technology (22 articles). It should be noted that this research dealt with intelligent learning and not specifically with online education.

For their part, Amoozegar et al. (2018) evidenced in their study on the main trends in distance education research that developed countries such as the USA and the UK produce the majority of distance education-oriented publications, in addition to being the most active countries in collaboration with other researchers (co-authorship). However, in the present research, the countries of origin of the research that stand out are China and India in Scopus and Web of Science, and the

United States and the United Kingdom in PubMed. For their part, Oliveira et al. (2019) in their bibliometric study on video and online learning in higher education, point out that Europe and the USA lead in scientific publications on online education.

Regarding the types of research, the present study shows that original scientific articles predominate. It should be noted that the study by Oliveira et al. (2019) also highlights original publications, which have increased since 2014. The theme that stands out in the study of Oliveira et al. (2019) are about the importance of distance education, a theme that became relevant between 2010 and 2015, and reinforcing its trend in 2017.

Caution is recommended in certain aspects of the present research, since the scientometric instruments still present significant errors. The present study has the weakness that the databases included may not represent the totality of scientific and biomedical publications currently available that address the subject of online education in times of Covid-19, since, it is likely that there are several articles with transcendent information that are not indexed in the databases used. However, the publications included in the six databases analyzed, due to their coverage and importance, show that the selected documents constitute a more than representative sample of international research on online education in times of Covid-19, a pandemic that is still present worldwide with unpredictable results in all aspects of society, including education.

According to the review conducted, it is concluded that this is the first bibliometric profile conducted worldwide that measures the scientific production concerning online education research in times of Covid-19, evidencing that the production is limited and should be enhanced. Rodrigues et al. (2020) also highlight the scarcity of studies on the subject, that is, empirical studies on the effects of this pandemic on science, research and education, effects that will undoubtedly manifest themselves over time.

References

- Amoozegar, A., Khodabandelou, R. & Ale Ebrahim, N. (2018). Major trends in distance education research: a combination of bibliometric and thematic analyze. *International Journal of Information Research and Review*, 5(2), 5352-5359. <https://doi.org/10.6084/m9.figshare.6210536.v1>
- Arias-Chávez, D., Aguinaga-Villegas, D., Nieto-Gamboa, J., Gálvez-Suarez, E., Garro-Aburto, L., Gallarday-Morales, S. & Hernández Vasquez, RM. (2019a). Bibliometric analysis of Latin American scientific production on juvenile delinquency. *Revista Científica de la UCSA*, 6(2), 67-74. <https://dx.doi.org/10.18004/ucsa/2409-8752/2019.006.02.067-074>
- Bozkurt, A., Ozbek, E.A., Yilmazel, S., Erdogan, E., Ucar, H. & Guler, E. (2015). Trends in Distance Education Research: A Content Analysis of Journals 2009-2013. *The International Review of Research in Open and Distributed Learning*, 16(1), 1-19.

- Careaga-Butter, M., Badilla, M., & Fuentes-Henríquez, C. (2020). Critical and prospective analysis of online education in pandemic and post-pandemic contexts: Digital tools and resources to support teaching in synchronous and asynchronous learning modalities. *Aloma: revista de psicología, ciències de l'educació i de l'esport Blanquerna*, 38(2), 23-32. <https://www.raco.cat/index.php/Aloma/article/view/377756>
- Chen, X., Zou, D., Xie, H., & Wang, F. L. (2021). Past, present, and future of smart learning: a topic-based bibliometric analysis. *International Journal of Educational Technology in Higher Education*, 18(1), 1-29. <https://doi.org/10.1186/s41239-020-00239-6>
- Davis, J.C. & González, J.G. (2003). Scholarly journal articles about the Asian tiger economies: Authors, journals, and research fields, 1986-2001. *Asian Pacific Economic Literature*, 17(2), 51-61. <https://doi.org/10.1046/j.1467-8411.2003.00131.x>
- de Oliveira, O., da Silva, F., Juliani, F., Ferreira, L. & Vieira, T. (2019). *Bibliometric Method for Mapping the State-of-the-Art and Identifying Research Gaps and Trends in Literature: An Essential Instrument to Support the Development of Scientific Projects*. <https://doi.org/10.5772/intechopen.85856>
- Gil-Villa, F., Urchaga, J.D. & Sánchez-Fdez, A. (2020). Process of digitization and adaptation to non-face-to-face teaching motivated by the COVID-19 pandemic: analysis of perception and impact on the university community. *Revista Latina de Comunicación Social*, 78, 99-119. <https://www.doi.org/10.4185/RLCS-2020-1470>
- Gómez, A., Ramiro, M.T., Ariza, T., & Reina, M. (2012). Bibliometric Study of Education XXI. *Educación XXI: Revista de la Facultad de Educación*, 15(1), 17-41.
- Gülbahar, Y. & Adnan, M. (2020). Professional development of teachers in creating meaningful teaching and learning experiences online. In *Research Manual on Creating Meaningful Experiences in Online Courses*, edited by L. Kyei-Blankson, E. Ntuli and J. Blankson, 37 - 58. IGI Global. <https://doi.org/10.4018/978-1-7998-0115-3.ch004>
- Harasim, L. (2000). Shift happens: Online education as a new paradigm in learning. *The Internet and Higher Education*, 3(1), 41-61.
- McFarlane, A. (2019). Devices and desires: contraposed visions of a good education in the digital age. *British Journal of Educational Technology* 50(3), 1125-1136. <https://doi.org/10.1111/bjet.12764>
- Oliveira, L., Fontes, R., Collus, J. & Cerisier, J. (2019). Video and online learning in higher education: a bibliometric analysis of the open access scientific production, through web of science. *INTED2019 Proceedings*, 8562-8567. <https://library.iated.org/view/OLIVEIRA2019VID>
- Rodrigues, M., Franco, M. & Silva, R. (2020). COVID-19 and Disruption in Management and Education Academics: Bibliometric Mapping and Analysis. *Sustainability*, 12(18), 7362. <https://doi.org/10.3390/su12187362>
- Selwyn, N. (2012). *Education in a digital world: global perspectives on technology and education*. Routledge
- Tejedor, S., Cervi, L., Tusa, F. & Parola, A. (2020). Pandemic-time education: reflections by students and teachers on virtual university education in Spain, Italy and Ecuador. *Revista Latina de Comunicación Social*, 78, 1-21. <https://www.doi.org/10.4185/RLCS-2020-1466>
- Vilaverde, E. (2020): Online instruction. A system for educational inclusion in the university setting *Culture and Education*. <https://doi.org/10.1080/11356405.2019.1705561>