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## Online Learning Models during the COVID-19 Pandemic: A Bibliometric Analysis

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### Abstrak

Pembelajaran daring sebagai metode pencegahan penyebaran COVID-19 menambah dimensi baru dalam melawan virus ini. Publikasi pertama dengan pembelajaran daring sebagai topik dapat ditelusuri kembali ke tahun 1986, *An Algorithm for Learning Without External Supervision and Its Application to Learning Control Systems* (Nikolić & Fu, 1986). Kajian ini bertujuan untuk menemukan dan menggambarkan arah perkembangan tren penelitian pembelajaran daring selama COVID-19. Penelitian ini menggunakan metode analisis bibliometrik. Ini memeriksa 1.594 artikel ilmiah dari 159 penulis di 110 negara dan 160 afiliasi. Informasi yang dikumpulkan antara 2019 dan 2021 relevan dengan topik. Untuk memvisualisasikan hasil penelitian, peneliti menggunakan aplikasi VOSviewer. Kajian tersebut menunjukkan bahwa penelitian tentang pembelajaran daring di masa pandemi COVID-19 meningkat secara konsisten dari tahun 2019 hingga tahun 2021. Kajian ini menemukan 1249 dokumen dalam jangka waktu tersebut. Yang H adalah penulis yang paling banyak bekerja sama. Sedangkan penulis paling produktif adalah Hong J.C, dengan 8 artikel. Pemetaan lapangan yang sistematis ini membantu dalam menggambarkan secara grafis evolusi publikasi serta mengidentifikasi bidang minat penelitian saat ini dan potensi penelitian di masa depan. Temuan ini memberikan dasar yang kuat untuk penelitian masa depan di bidang ini.

**Kata Kunci:** bibliometrik, covid-19, pembelajaran online, VOSviewer

### Abstract

*Online learning as a method of avoiding the spread of COVID-19 adds a new dimension to the fight against this virus. The first publication with online learning as a topic can be traced back to 1986, An Algorithm for Learning Without External Supervision and Its Application to Learning Control Systems (Nikolić & Fu, 1986). Online learning in the education sector has become increasingly prominent in recent years. The study aims to discover and illustrate the direction of trend development of research on online learning during COVID-19. The study used the bibliometric analysis method. It examined 1,594 scientific articles from 159 authors across 110 countries and 160 affiliations. The information gathered between 2019 and 2021 was relevant to the topic. To visualize the result of the study, the researcher used the VOSViewer application. The study shows that research on online learning during the COVID-19 pandemic increased consistently from 2019 to 2021. This study found 1249 documents in that period. Yang H is the most co-authored author while the most prolific writer is Hong J.C, with 8 articles. This systematic field mapping helps in graphically depicting the evolution of publications as well as identifying areas of current research interest and future research potential. These findings provide a solid basis for future research in this area.*

**Keywords:** bibliometric, covid-19, online learning, VOSviewer

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## INTRODUCTION

Bibliometric analysis is a scientific computer-aided review methodology that can identify core research or authors and their relationships by covering all publications related to a particular topic or field (Bellis, 2009). This bibliometric analysis can provide much relational information on the subject, making it possible to understand the intellectual landscape (Churruca et al., 2019). Early bibliometric analyzes were primarily based on author or citation information and examined their intellectual streams and most influential publications (Calero-Medina & Noyons, 2008; Feeley, 2008). Lately, network and sociometric analyses based on titles, keywords, and abstract data have been incorporated into the bibliometric analysis (Charu C. Aggarwal & Wang, 2011; De Rezende et al., 2018; Lee et al., 2016).

One learning model that utilizes technology during the COVID-19 pandemic is online learning. Online learning is an open and distributed learning system using pedagogical tools enabled via the Internet and network-based technologies to facilitate the formation of learning processes and knowledge through meaningful action and interaction (Dabbagh & Bannan-Ritland, 2005). The transition from traditional learning to online learning was due to unforeseen circumstances that created an emergency in the world of education, for example, where formal learning was not possible due to school closures as experienced in the recent COVID-19 pandemic (Atchison et al., 2021). Due to this pandemic and to prevent the spread of disease, many countries were adopting online distance learning as an alternative teaching model (OECD, 2020).

The combination of video conferencing, learning management systems, and instant messaging platforms, decreased barriers to online learning and improved lecturers' and students' familiarity with using online learning resources (Ritonga et al., 2021). Students responded well to online learning throughout the Covid-19 pandemic phase, and it is advised that instructors always instill strong motivation in their students in order to support them in the learning process (Rusdiantho & Elon, 2021).

The research focused on generating a profile of research trends in online physics learning during the COVID-19 pandemic with bibliometric analysis. Retrieval of 2020 – 2021 from the Scopus database in August 2021, Results of 1007 documents with the keyword online physics learning. Research showed that the COVID-19 pandemic has positively impacted online learning in developing countries. Another finding was that online learning effectively improved student learning outcomes in physics learning (Jatmiko et al., 2021).

Similar research analyzed digital readiness and resources to improve learning outcomes and student development through online learning environments. In conducting the study, literature was accessed from Scopus and Web of Science databases. A systematic review was used, and the criteria were finally adjusted. Thirty-two articles were selected. Bibliometric analysis was performed to identify cluster themes based on the frequency of writing. The research findings cover three main themes: digital readiness in learning management, digital readiness for students, and digital readiness for educators (Van et al., 2021). Two previous studies focused on physics learning, digital healthcare readiness, and online learning during the COVID-19 pandemic.

In this era of technological advancement, which is evolving so quickly, analysis of bibliometric data visually displayed through mapping tools is quite important (Nandiyanto et al., 2020). Analysis of bibliometric data visually displayed using mapping tools is highly significant in this era of rapid technological improvement. One mapping tool that can be used for bibliometric data analysis is VOSViewer (Jaradat et al., 2022). It was needed to get the results of various data descriptions on science development and research efficacy.

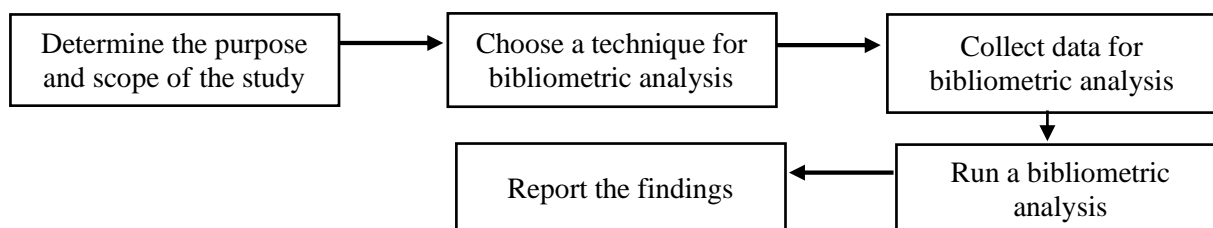
Bibliometric map visualizations taken from the website [www.vosviewer.com](http://www.vosviewer.com) are shown using Vosviewer. VosViewer's bibliometric map presentation can be shown as a label, sketch, density maps, and clusters based on the author's name, the journal's co-citation data, or keywords with co-occurrence data (van Eck & Waltman, 2010). Vosviewer's map displays clusters in multiple color-coded ways. A clustering algorithm that operates on each parameter and may be altered to produce more or fewer clusters is used (Leydesdorff et al., 2013).

The study is a bibliometric analysis model focusing on online learning during a pandemic without limiting specific fields. Given the enormous number of studies conducted on the subject, it would be interesting to look

at the research trends in online learning. As a result, the current study uses a bibliometric approach to examine the environment or state of online learning during the COVID-19 epidemic. The aim of this paper is to analyse the metadata of all the papers indexed in Scopus based on the topic “online learning during COVID-19”. This study will find the trend of research, institution collaboration, keyword occurrence, co-authorship relation, and the most productive author in the field of online learning.

## METHOD

This study used the bibliometric analysis method. Bibliometric is a quantitative evaluation of all macro and micro communication publication patterns and their authorship by mathematical and statistical calculation (Mathankar, 2018). The steps of the bibliometric analysis carried out in this study are 1) determine the purpose and scope of the bibliometric study, 2) choose a technique for bibliometric analysis, 3) collect data for bibliometric analysis, 4) run a bibliometric analysis, and 5) report the findings (Donthu et al., 2021).



**Figure 1. Bibliometric analysis step (Donthu et al., 2021)**

The method used for the analysis was bibliometric. The techniques for bibliometric analysis used performance analysis and the science mapping category. Since it is common practice in reviews to present the performance of various research constituents (such as authors, institutions, countries, and journals in the field), performance analysis can be found in most reviews, even in those that do not engage in science mapping. This is similar to the background or participant profile that is typically presented in empirical research but is done more analytically (Donthu et al., 2021). Whereas, scientific mapping looks at the connections between research constituents. The analysis is focused on the structural relationships and intellectual interactions among research participants. Citation analysis, co-citation analysis, bibliographic coupling, co-word analysis, and co-authorship analysis are only a few of the science mapping methodologies (Baker, Kumar, & Pandey, 2021; Cobo et al., 2011; Ramos-Rodríguez & Ruíz-Navarro, 2004). The presentation of the bibliometric structure and intellectual structure of the study area is made possible by these methodologies when used in conjunction with network analysis (Baker, Kumar, & Pattnaik, 2021; Tunger & Eulerich, 2018).

The data were collected from the Scopus database using online learning and COVID-19 or pandemic keywords and title during the COVID-19 pandemic's 2019–2021 time frame. All articles were searched using the Scopus.com website in January 2022. The search was done in public databases, and thus ethical approval was not required. The search criteria were topic (online learning AND COVID-19 OR COVID-19), refined by, document type (article OR conference paper), language (English), and period (2019-2021). The analytic function of Scopus allowed us to identify publication trends in online learning research and their distribution in countries, regions, and institutions, as well as the top VOSviewer software. The chosen data were obtained in \*.csv format from the Scopus database and then analyzed using VOSviewer. Additionally, bibliometric maps representing trends were visualized and analyzed using VOSviewer (van Eck & Waltman, 2010). The VOSviewer may create network-based publishing maps, nation maps, journal maps, or keyword maps based on shared networks (Hudha et al., 2020). It can also be used to aggregate items that were retrieved from a database source and perform mining, mapping, and these operations (Xie et al., 2020).



**Figure 2. Document results of the Scopus database**

The bibliometric analysis must be conducted and the results must be reported as the last stage. The running of the bibliometric analysis (and the creation of the summary that goes along with it) and the authoring of the bibliometric review are typically defined as different phases in theory. However, these action items frequently work together in practice. For instance, the clustering of the network and the creation of visual network summaries immediately influence the drafting of the paper, and the requirement to support the paper's content might then lead to the inclusion of bibliometric summaries. This work presents the running of the bibliometric analysis, which provides bibliometric summaries, and the publishing of the findings as a single phase, taking into account the feedback loop.

In this step, the writing style is also crucial. The journal the researcher is aiming for and the subject area of the study are the two factors that most frequently influence the writing style. For instance, one journal might prefer that researchers concentrate on the theoretical aspects of the study (e.g., journals that place a strong emphasis on theory and have a flexible page or word limit), whereas another journal might prefer that researchers start with a summary of the study's findings (e.g., journals with a strict and specified page or word limit). This paper advises researchers to ask target journals whether they have a history of publishing review papers and, if so, to retrieve those papers, preferably those that use bibliometrics, in order to create a comparable writing style.

**FINDINGS AND DISCUSSION**

From search by title and keyword: TITLE-ABS-KEY("Online learning"AND covid 19 OR covid-19) AND (LIMIT-TO(PUBYEAR,2021) ORLIMIT-TO(PUBYEAR,2020) OR LIMIT-TO(PUBYEAR,2019))AND (LIMIT-TO(DOCTYPE,"ar")OR LIMIT- TO(DOCTYPE,"cp"))AND(LIMIT-TO(LANGUAGE,"English")) AND(LIMIT- TO(SUBJAREA,"SOCI")OR LIMIT-TO(SUBJAREA,"PSYC")). The Scopus database search from 2019 to 2021 yielded 1594 documents from 160 affiliations from 110 countries. The document focused on articles and conference papers.

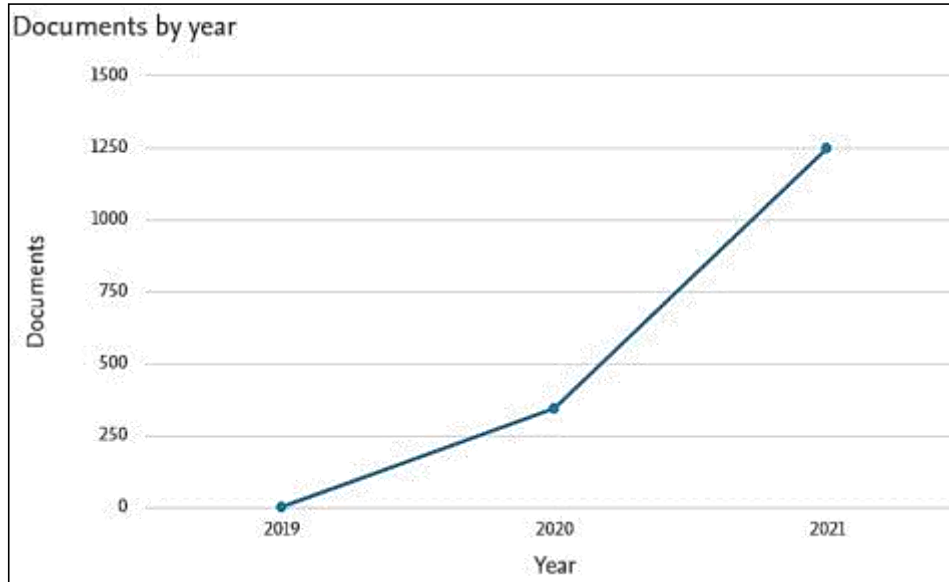
**Table 1. Document Type**

No	Type	Number
1	Article	1300
2	Conference Paper	294

Table 1 shows the document types, 1300 articles, and 294 conference papers. Bibliometric mapping of scientific publications on online learning during the COVID-19 (2019-2021) pandemic.

**Table 2. Number of Documents by year**

No	Year	Number
1	2019	1
2	2020	344
3	2021	1249

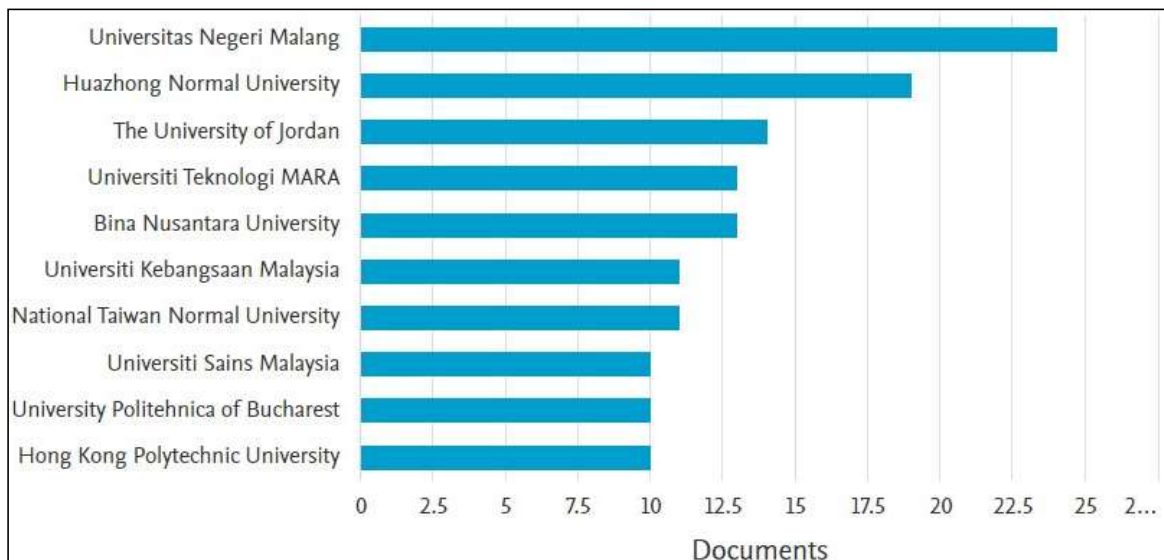


**Figure 3. Number of studies from 2019 to 2021**

The Figure above shows that research on online learning during the COVID-19 pandemic has been carried out since 2019 with 1 document. Research continues to increase, with the number of 344 papers in 2020. Research is in 2021, with the results of 1249 documents. The total number of records from 2019 to 2021 is 1594. The number of articles increased significantly between those years.

**Table 3. Documents by Affiliation**

No	Year	Number
1	Universitas Negeri Malang	24
2	Huangzhong Normal University	19
3	The University of Jordan	14
4	Universiti Teknologi MARA	13
5	Bina Nusantara University	13
6	Universiti Kebangsaan Malaysia	11
7	National Taiwan Normal University	11
8	Universiti Sains Malaysia	10
9	University Politehnica of Bucharest	10
10	Hong Kong Polytechnic University	10



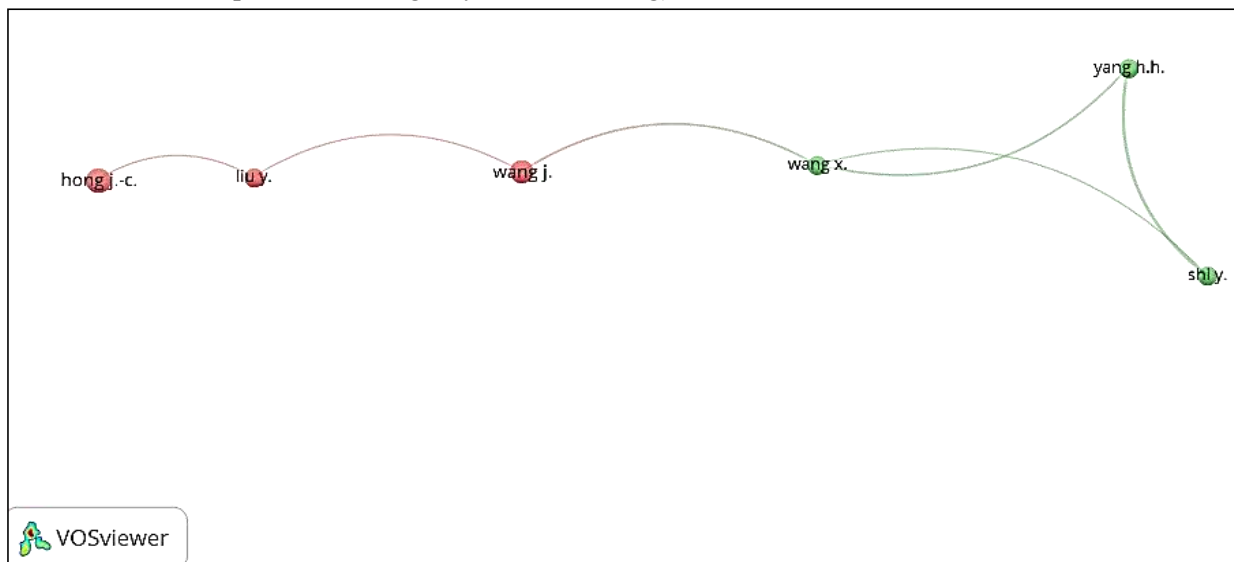
**Figure 4. The number of documents from the top 10 affiliates**





10	Su Y.S	5	152	0
11	Wang L	5	14	0

With 8 articles produced over the examined time, Hong J.C. of the National Taiwan Normal University is the most productive author. In terms of the number of citations in this field of study, Hong J.C. came in second. With a total of 7 research articles, Zhejiang University, Wang J. came in second. With 6 publications, Lee J. of Ewha Womans University and Luo H of Central China Normal University. Interestingly, Lee J. and Luo H. who placed third overall with 6 publications, had no collaboration with other researchers. It happened with Crick T with the highest citation of 349 and had no collaboration with other researchers. Our research revealed that the majority of successful authors tend to favor online learning-related research (such as Refocusing Teacher Presence and Learning, Impacts of the COVID-19 pandemic on life of higher education students, Risk and Protective Factors for Prospective Changes in Adolescent Mental Health, and College students' use and acceptance of emergency online learning).



**Figure 7. Visualization of authorship collaboration networks**

Based on the co-authorship study, Figure 7 shows a collaboration map between the major authors who have written about online learning. The size of the circle shows the number of papers published by each author, while the colors stand for working groups. The network is widely dispersed, which might facilitate rapid research area expansion. The co-authorship network has several "star actors"—actors with an excessive number of links—that are part of the network's core. Authors like Yang H.H., Shi Y., Wang X., Wang J., Liu Y., and Hong J.C. were included in the cores. The analyses show that Yang H.H., Shi Y., and Wang X. formed a highly productive investigative team and collaborated on multiple projects that were published in the leading journals in the area. The other three authors, Wang J, Liu Y, and Hong J. C, worked together separately while Liu Y served as a liaison between them. The most productive author, as shown in Table 4 is Hong J C, with 8 documents. This research is limited by the use of those apps, even though there are still other bibliometric analysis applications. The same restrictions apply to bibliographic databases that use a single Scopus database and year frame.

## CONCLUSION

In this work, data from research on online learning models conducted during the COVID-19 epidemic were analysed. The outcome of the bibliometric analysis demonstrates that the volume of publications on the subject rose over time. The majority of the contributions came from Universitas Negeri Malang, among many other affiliations that published the publications. In addition, scholars who worked in teams or individually developed co-authorship relationships, with Hong J. being the most productive author. An overview of the



scientific research on online learning is given by this bibliometric analysis. This study's bibliometric analysis may be one alternative for researchers when fieldwork must be delayed because of Covid-19. Flipped classrooms are a useful tool for enhancing the teaching and learning process that puts the student at the centre of learning. Inter-institutional collaboration can benefit research choices for the flipped classroom.

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