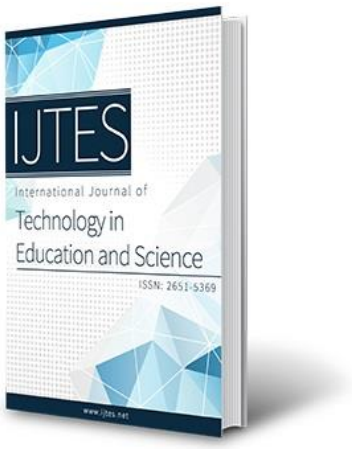

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Abstract

The study aims to reveal the studies' profile on COVID19 in journals in the field of education. For this purpose, we scanned the global COVID-19-related educational literature officially published and included in the Scopus database. “COVID”, “Coronavirus”, and “Corona” were used as the keywords to reach the relevant publications. 3039 publications were identified. Bibliometric analysis has been used to analyze these publications indexed by the SCOPUS database between January 2020 and May 2021. Within the scope of bibliometric analysis, Co-authorship networks researching the impact of COVID-19 on education, country collaboration, keyword co-occurrence, and organization collaboration were analyzed. According to the keyword co-occurrence analysis, "online learning" was the most used keyword, followed by "higher education" and "distance learning". The United States and the United Kingdom were leading countries in the number of publications and country co-authorship. The top-performing organization was the University of Hong Kong in terms of organizational collaboration.

Introduction

COVID-19 has changed all our habits and lives, and this causes people to turn to scientific and educational studies more to find a solution in this area. COVID-19 has become a global pandemic that surrounds the whole world, and for this, it has become essential to reach all resources and the information in them much faster and without errors. COVID-19 has undoubtedly caused so many people to get sick and die. In April 2022, the number of people infected with the disease in the world reached 512,989,831 and the number of people who lost their lives reached 6,259,720 (Worldometers, 2022). It is at its peak in the number of cases and deaths in the USA. So far, the number of people infected with the disease is 83,037,059, and the number of people who lost their lives is 1,020,660 (Worldometers, 2022). In India, which followed it, the number of people infected with the disease so far is 43,075,864 and the number of people who lost their lives is 523,601.

Bibliometric analyses look at the state and trends of a certain area of research. The method delivers strong analytics to support research retrospective and quantitatively and impartially evaluate the publication's historical trends in a variety of fields. This enables us to identify crucial topics and possible gaps in the literature, which aids in the development of new study concepts and paths (Dervis, 2019; Donthu et al., 2021; Ellegaard & Wallin, 2015; Lou, 2020). These investigations have been carried out in a variety of educational and non-educational domains

(ElHawary at all, 2020; Farooq at all, 2021; Patralekh at all, 2021; Verma & Gustafsson, 2020), but a limited number of them have been carried out on COVID19-related publications in the educational domain.

This method has been applied by researchers in a variety of fields. For instance, the findings of a bibliometric examination of COVID-19 literature in the business and management fields are reported in the study by Verma and Gustafsson (2020). A bibliometric analysis of global trends in distance learning research from 1961 to 2021 was carried out by Ndibalema (2022). Using bibliometric analysis, Fan and his colleagues (2020) compared education research from English and Chinese studies. During COVID19, Zhang and colleagues (2022) performed a bibliometric analysis of the research on online learning in higher education. Using bibliometric research, Mustapha and colleagues (2021) evaluated the efficiency of digital technology in education during the COVID-19 Pandemic. Gokce and Guner (2021) analyzed forty years of mathematics education using bibliometric analysis.

For this reason, this study aims to reveal the studies' profile on COVID19 in journals in the field of education. For this purpose, global COVID-19-related educational literature officially published and included in the Scopus database was scanned. “COVID”, “Coronavirus”, and “Corona” were used as the keywords to reach the relevant publications.

We scanned the global COVID-19-related educational literature officially published and included in the Scopus database. When Table 1 is examined, it is seen that the articles containing the words “COVID-19", "Coronavirus," and "Corona" were used as the keywords to reach the relevant publications. As a result of the filtering process, 3039 publications were identified.

Table 1. Criteria for Paper Inclusion

Topic	TS=((“COVID-19” **or** “COVID19” **or** “COVID” **or** “coronavirus” or “corona”)
Categories	education
Documents Type	Journal paper, review articles, conference paper
Period	January 2020-2021 May

The following research questions were investigated based on the paper's goal:

1. What were the bibliometric characteristics of research on COVID19 in educational journals?
    1.1 Who are the most influential authors?
    1.2 What are some of the most influential studies and sources?
2. What is the nature of important contributors' scientific collaborations?
3. What was the trend and distribution of author keywords in research on COVID19 in educational journals?

Methods

Bibliometric analysis has been used to analyze these publications indexed by the SCOPUS database between January 2020 and May 2021. Within the scope of bibliometric analysis, Co-authorship network researching the

impact of COVID-19 on education, country collaboration, keyword co-occurrence, and organization collaboration were analyzed.

The spread of COVID-19 studies in the field of education over the years is shown in Figure 1 as a pie chart. Since COVID-19 entered our lives two years ago, we have data showing only two years. In general, documents were published at very close rates every two years.

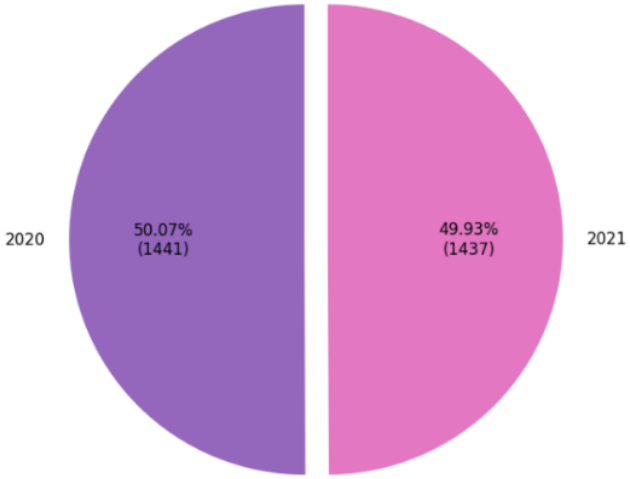

Figure 1. Number of Documents by Year

Results

Co-occurrence Analysis Results for Author Keywords

Words repeated at least 20 times were included in the author keywords analysis using the co-occurrence analysis type on author keywords. As a result of this analysis, the number of 6348 keywords was reduced to 59 keywords. As a result of this reduction, the no normalization analysis method was used to observe the author's keywords more clearly on the graph. In the analysis, it was determined that the COVID-19 author keyword, the most prominent red node belonging to cluster 1, was at its peak with 1085 occurrences, and it was seen that this keyword had 1045 connections. As seen in Figure 2, this keyword was followed by the COVID-19 Pandemic, online teaching, and remote learning author keywords for the same cluster.

On the other hand, the COVID-19 pandemic author keyword was found to have 116 occurrences, and it was seen that this keyword had 98 connections. The online teaching author keyword has occurred 103 times and is related to 146 author keywords. The remote learning keyword has occurred 45 times and has connections with 85 nodes. When the graph is examined, it is remarkable that the weight of cluster 1 (red node) is high and especially compared to cluster 6 (blue node). The fact that the COVID-19 author keyword, which is far ahead in the number of repetitions and links compared to other author keywords, has a link weight value of 44 with all nodes also shows that this keyword, which is at the top, has a strong relationship with author keywords from all clusters. We see that the weight of the blue nodes in Cluster 6 is in the weakest group compared to the author keywords. In this cluster, keywords lockdown, mental health, and leadership are the top author.

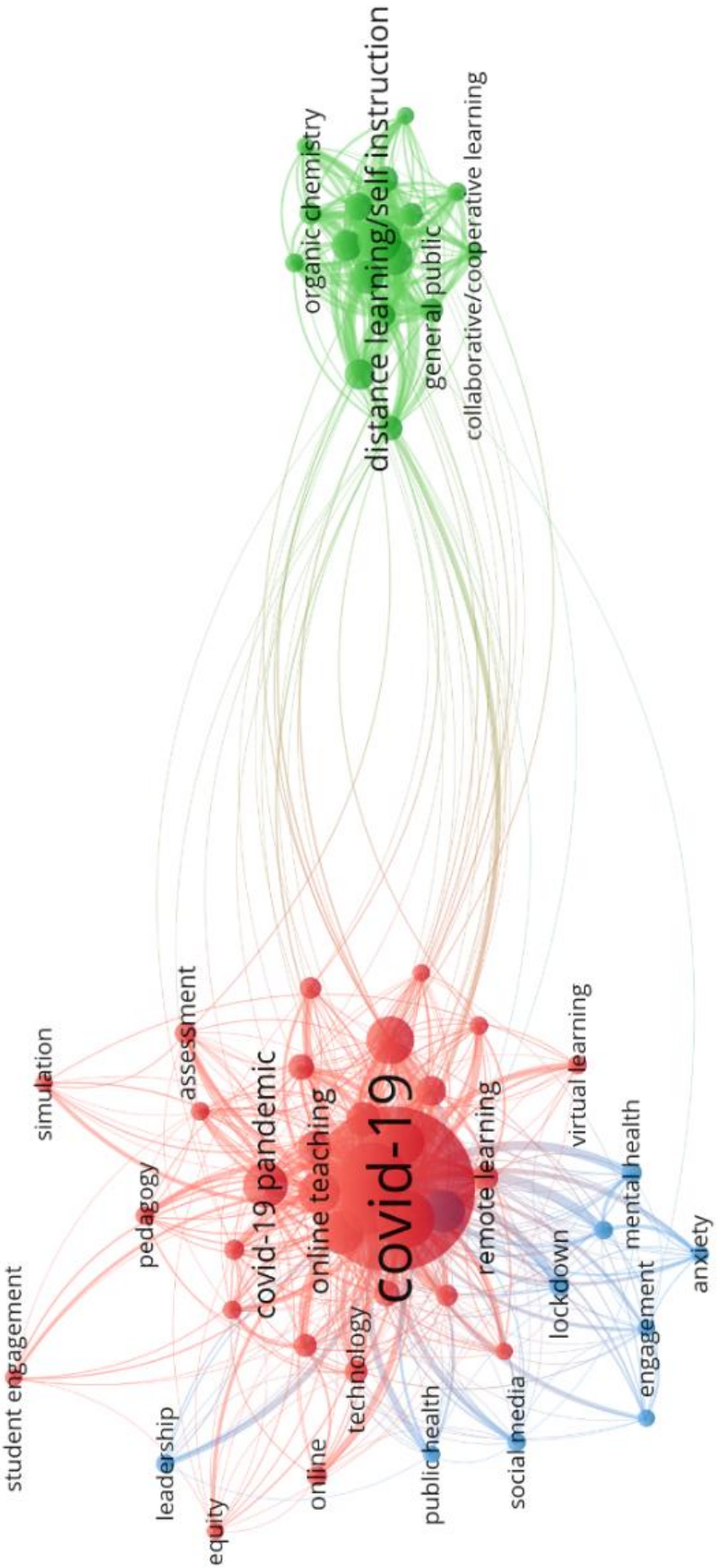

Figure 2. Most Frequently used Author Keywords in Studies on COVID-19 in Educational Education

On the other hand, the green group has an effective connection rate, although it is not as strong as the red group. There are many node connections in the green group, with the keyword distance learning/self-instruction author at the top. As seen in Table 2, the Distance learning/self-instruction author keyword was found to occur 108 times, and it was seen that this keyword had 386 links. From here, we can conclude that he has a robust relationship with other nodes and is a viral author keyword, although his repeat is not much.

Table 2. Top 15 Most Used Author Keywords

Author Keywords	**Links**	**Total link strength**	**Occurrences**
COVID-19	44	1045	1085
Online learning	38	323	234
Pandemic	39	301	176
Higher education	38	246	160
Distance learning	46	196	126
COVID-19 Pandemic	29	98	116
Distance learning/self-instruction	16	386	108
Education	28	153	108
E-learning	29	156	107
Online teaching	29	146	103
Coronavirus	32	171	101
First-year undergraduate/general	17	268	76
Medical Education	28	111	72
Internet/web-based learning	17	243	70

Co-authorship Analysis Results

The size of the circles is large in direct proportion to the number of publications of the author. Connections between circles show cooperation with each other. There are a total of 9230 authors who have worked in this field. The co-authorship analysis included the authors with at least three publications on COVID19. Sixty-two authors meet the thresholds. It is shown in Figure 3.

It is clear from looking at the co-authorship network visualization map in Figure 3 that there is little collaboration going on amongst the clusters of scholars working in the COVID-19 sector of education. There are 38 clusters in total. The largest cluster consists of the red cluster with six authors. Remarkably, there are not many prominent authors in this cluster regarding the number of publications. Two authors published the most prominent publications in this cluster, Y. Yang and L. Liu. Two authors have published five documents. After this cluster, two other clusters stand out by collaborating.

The blue cluster and the green cluster also have the same number of authors. They are sets of 5 authors. There are no prominent authors in the blue cluster with the number of documents they have published. Each author has published three documents in this cluster. However, a remarkable detail in this cluster is that the two authors are

two of the authors who have citations the most.

M.A. Peters and M. Tesars gave 25 citations. Another small cluster, the lilac cluster, has two authors, and a remarkable statistic is that the author with the most publications is in this cluster.

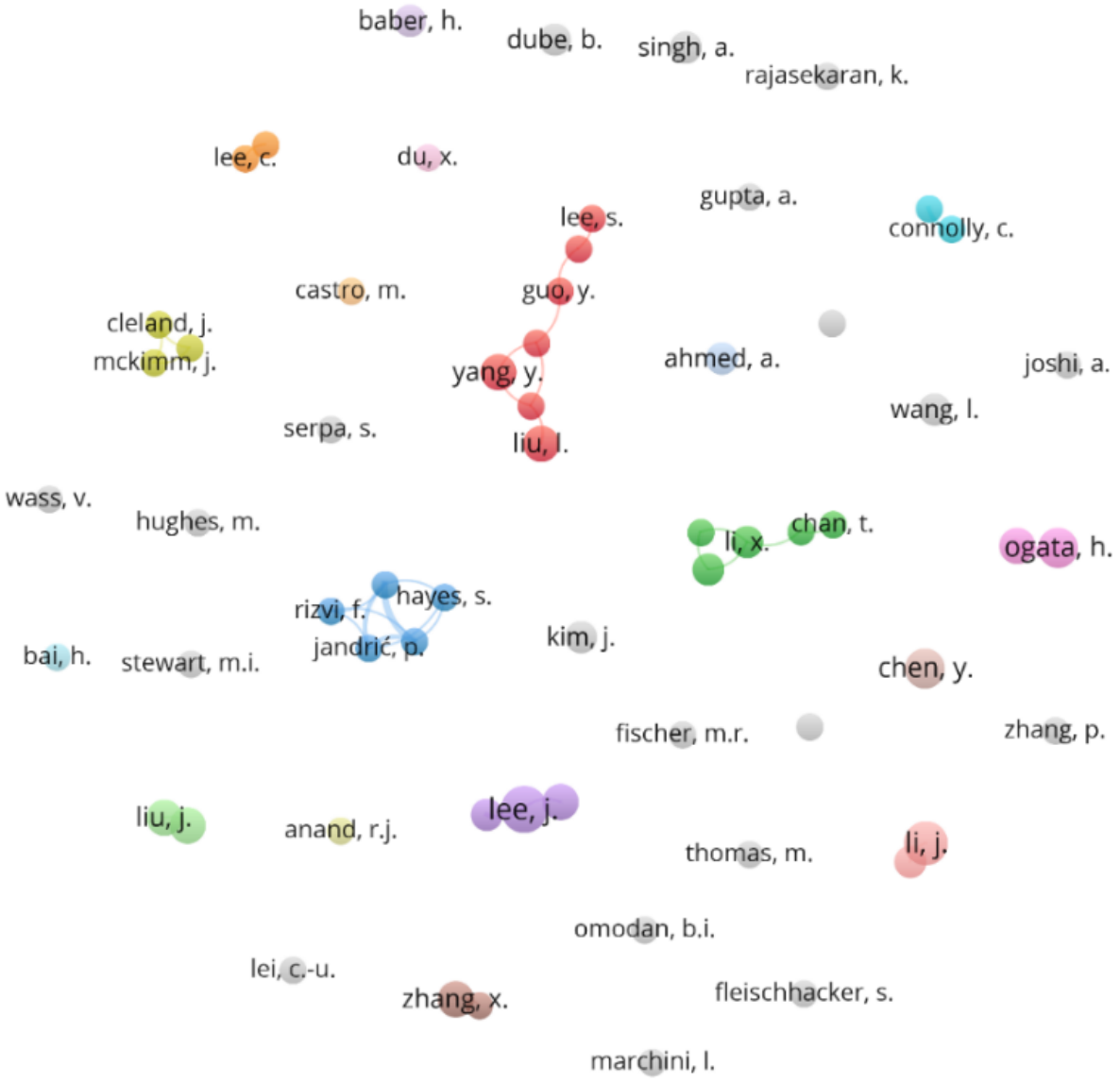

Figure 3. Co-authorship Network Studying the Impact of COVID-19 on Education

As seen in Table 3, J. Lee is an author who has published the most documents in this field with a total of 8 documents. There are also 4 citation values. In addition, the author with the highest citation value is J. Cleland. It has 38 citations in total. It is in the yellow cluster. As a result, co-authorship connections were not seen in inter-cluster collaborations in studies conducted under the name of the impact of COVID-19 on education. Clusters have established joint works by establishing connections among themselves. Only authors with three or more publications were included in the analysis.

Table 3. Table of Author

Author	Links	Total link strength	Documents	Citations
Lee, j.	2	3	8	4
Li, j.	1	1	7	8
Chen, y.	0	0	6	6
Ogata, h.	1	5	6	1
Moorhouse, b.l.	1	1	5	66
Liu, j.	1	1	5	34
Zhang, x.	1	1	5	28
Yang, y.	2	2	5	12
Liu, l.	1	1	5	2
Majumdar, r.	1	5	5	1
Zhang, y.	1	1	5	1
Kim, j.	0	0	4	20
Dube, b.	0	0	4	17
Baber, h.	0	0	4	14
Ahmed, a.	0	0	4	7

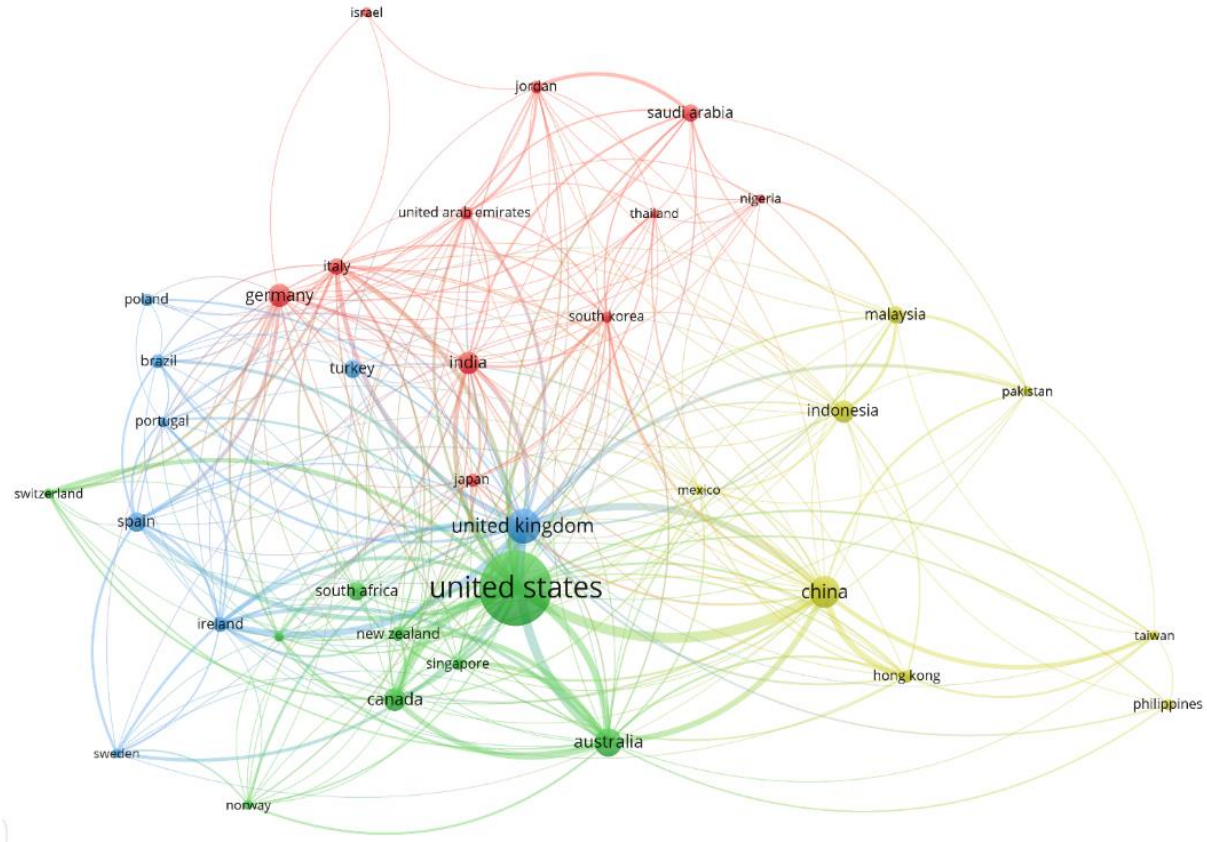

Figure 4. The Country Co-authorship on COVID19 in Educational Publications

Co-authorship Analysis Results of Countries

The map includes 4 clusters with countries that have done at least 1 citation and 20 papers in the field of COVID-19 education. The clusters are not separate, showing that they work together in co-authorship. We know that a total of 117 countries are working in this field, but the number of countries that have published at least 20 documents is 36, which can be seen in Figure 5. The countries in the graphs exhibit poor coordination with the clusters they are linked to. It may be inferred that the United States (green cluster), the United Kingdom (blue cluster), Germany (red cluster), and China are the nations with the greatest influence in the field of COVID-19 education (yellow cluster). The red cluster, which has a network of 11 countries, appears to have the greatest co-authoring network. Germany has the most articles in this cluster than any other nation. The blue and yellow clusters are in the second row. The United Kingdom had the most broadcasts in the blue cluster of countries. China is the nation with the most articles in the yellow cluster. The most prominent country in the green cluster is the United States. As seen in Table 4, among the studies published in this field, the United States holds first place with a number of 917 documents. 917 documents originate from the United States, and 181 of these 917 documents consist of studies conducted in different countries, and the number of these different countries is 32. The second most published country is the United Kingdom, with 232 documents. 232 documents originate from the United Kingdom, and 169 of these 232 documents consist of studies conducted in different countries, and the number of these different countries is 34.

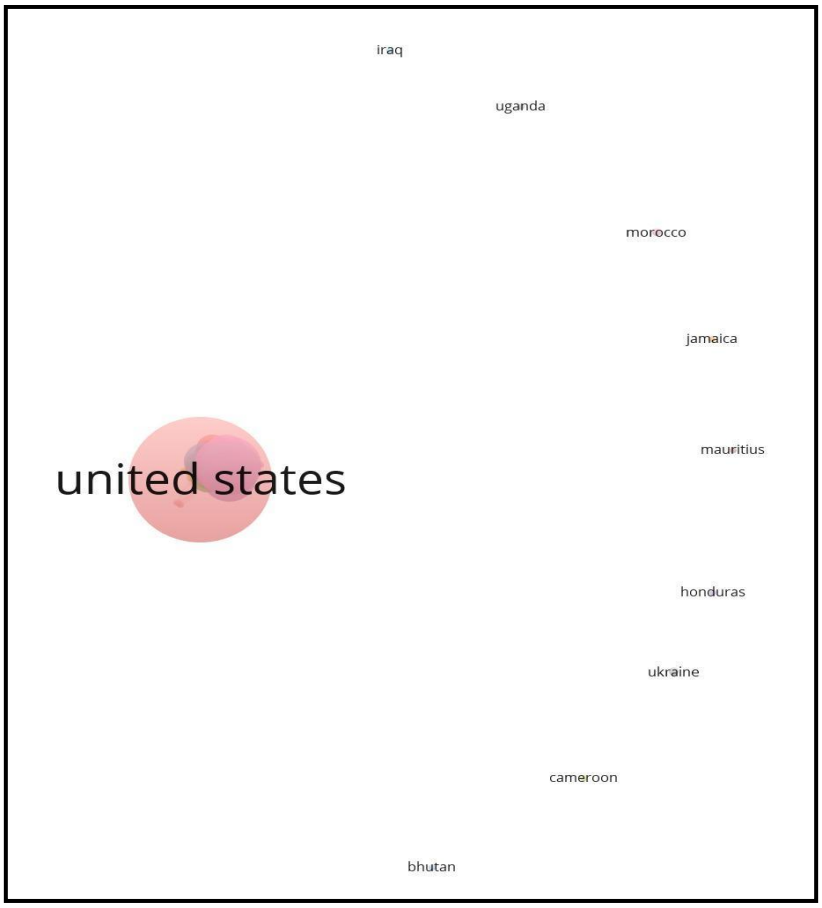

Figure 5. Countries having No Co-authorship

Figure 5 shows countries that have not cooperated with any country. Although these countries published the least two documents, they did not cooperate with any country. These countries are Bhutan, Cameroon, Ukraine, Honduras, Mauritius, Jamaica, Morocco, Uganda, and Iraq.

Table 4. The top 15 Countries having the Most Co-authorship

Country	Links	Total link strength	# ofDocuments	# of Citations
United States	32	181	917	1576
United Kingdom	34	169	232	485
Australia	26	104	157	247
China	26	98	194	164
Canada	20	64	111	223
Ireland	21	55	52	126
Italy	27	55	59	64
India	24	52	106	58
New Zealand	21	51	45	162
Germany	27	46	112	127
Spain	18	43	80	287
Hong Kong	14	36	39	106
South Korea	20	36	30	55
United Arab Emirates	19	33	37	63
Singapore	17	32	30	128

Co-occurrence Analysis Results for Abstract and Title Keywords

For the word in title and abstract fields, binary counting was used, and words repeated at least 200 times were analyzed. As a result, the number of 46161 keywords has been reduced to 56 keywords. As a result of this reduction, the Linlog analysis method was used to observe the keywords more clearly on the graph. The nodes' size tells us how often the word is repeated. In the analysis, the COVID word, the green largest node belonging to cluster 1, was found to be at the peak with 2653 occurrences, and it was seen that this keyword had 19045 connections. As seen in Figure 6 and Table 5, this keyword was again followed by the word *Pandemic* for the same color group with a very high repetition rate. The word *Pandemic* was found to occur 1905 times, and it was seen that this word had 14332 connections. It is noteworthy that there is a significant difference between the two-word groups that come after these two major nodes of the green group. The practice keyword has occurred 604 times and is associated with 4952 words.

The word Paper has occurred 681 times and is connected to 5399 nodes. When the graph is examined, it is noteworthy that the weight of the green nodes is high and especially compared to the orange node. We see that

the weight of the orange nodes in Cluster 1 is in the weakest group compared to the other words in the title and abstract fields. In this cluster, the top keywords are school and teacher. It has been determined that the word School has 593 occurrences and this keyword has 5096 connections, the teacher has 591 occurrences, and it has been determined that this keyword has 5332 connections. Here, as we have just detected, we see a strong relationship with other words, even in the weakest node group. We confirm that each word has a powerful relationship, from the most to the least used.

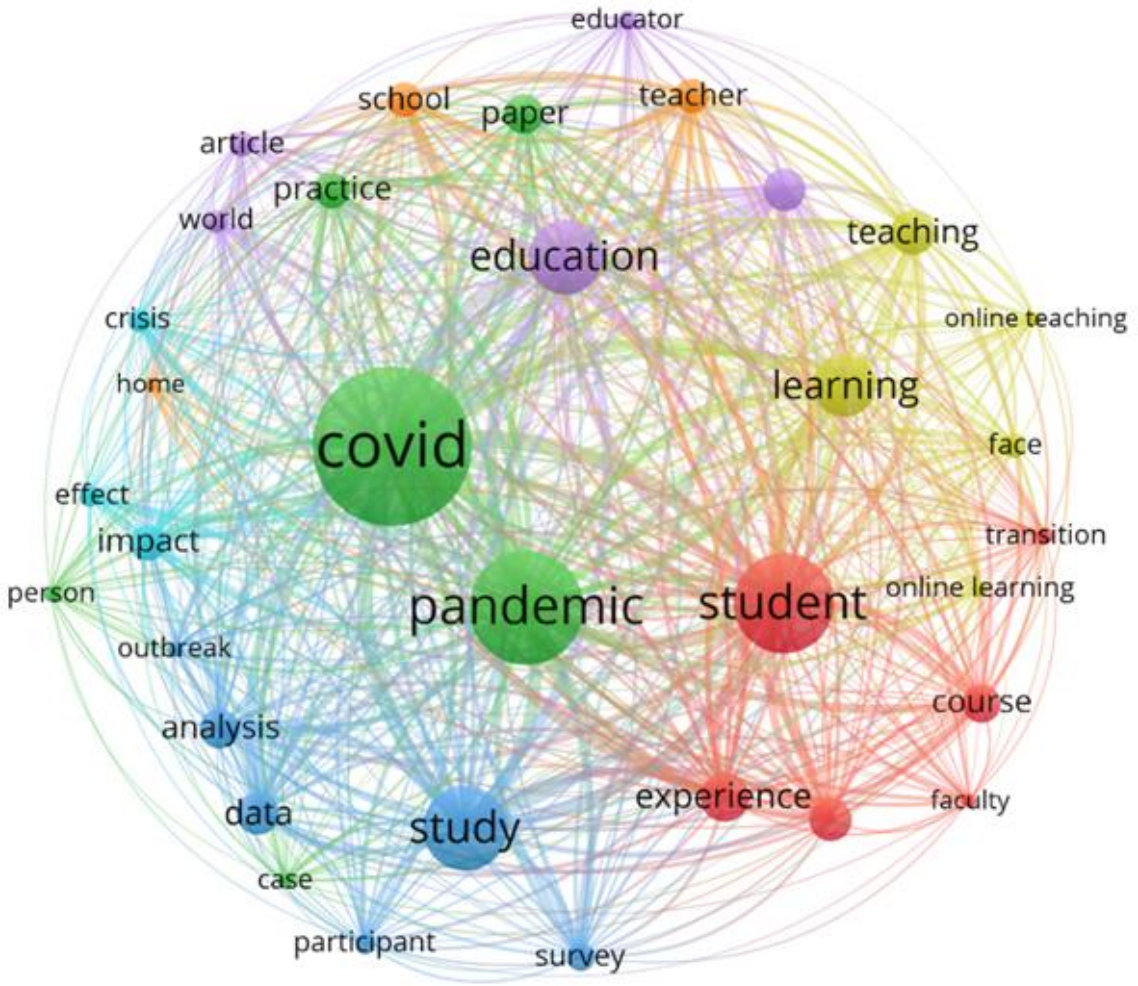

Figure 6. Most frequently used Words in the Title and Abstract Fields of Educational Studies on COVID-19

On the other hand, the words Student and experience stand out in the red group. The word Student has occurred 1665 times and has 13415 connections, which is a near-peak result. The word experience has occurred 832 times and has 7066 connections. The blue group has many node connections, with the study keyword at the top. It has been determined that the keyword Study has occurred 1426 times and it has been seen that this keyword has 11490 links. Blue is undoubtedly the most recurring word of the group. In the yellow group, learning and teaching are the main words. From here, we can conclude that he has a robust relationship with other nodes and is a viral keyword, although his repeat is not much. The learning word has 1051 occurrences and 9249 node connections. The word teaching has 751 occurrences and 6661 links. Finally, the most recurring word in the purple group is education. Although the word education has 1245 occurrences, it shows that it is a critical and popular word with a link count of 10150.

Table 5. Top 15 Most Used Keywords in Title and Abstract Part

Keywords	Total link strength	Occurrences
COVID	19045	2653
Pandemic	14332	1905
Student	13415	1665
Study	11490	1426
Education	10150	1245
Learning	9249	1051
Experience	7066	832
Teaching	6661	751
University	6086	708
Challenge	6047	712
Data	5911	709
Analysis	5661	667
Paper	5399	681
Teacher	5332	591
Course	5280	644

Co-authorship Analysis Results for Organizations

Organizations with at least ten documents were included in the co-authorship analysis. As a result of this analysis, the number of 3056 organizations was reduced to 28. As a result of this reduction, the Linlog analysis method was used to observe the keywords more clearly on the graph. The size of the nodes shows us how many documents the organizations (universities) publish. The lines between two nodes represent the linked organizations having co-authorship. In the analysis, University Negeri Malang, the largest node in the only pink group belonging to cluster 9, was found to be at the peak with 21 document publications, and it was seen that this organization had 0 total link strength. As seen in Figure 7, this organization has published the largest number of documents even though it has no affiliation with any other organization. Likewise, the University of Jordan has published 15 articles and the University of the Free State has published 14 articles but has not contacted any other organization. When we look at the blue group, we see that the university of Hong Kong comes to the fore, and it has been determined that the university has published eight documents and has relationship weight in 8 other nodes.

Hong Kong Polytechnic University is also connected to this primary node. We can easily say that this university is one of the universities that realizes the lowest number of articles we have determined and publishes the lowest number of articles in our graph at this point. When we look at the yellow group, we can talk about two significant nodes. These are Monash University and the University of Melbourne. Table 6 shows Monash University has published 13 articles, and other universities have an affiliation score of 9. The University of Melbourne has published ten articles, and its link weight with other organizations is 12. This shows us that he has a strong relationship with other organizations, even though he has not published much. When we come to the green group, the University of Toronto and The University of Auckland draw attention.

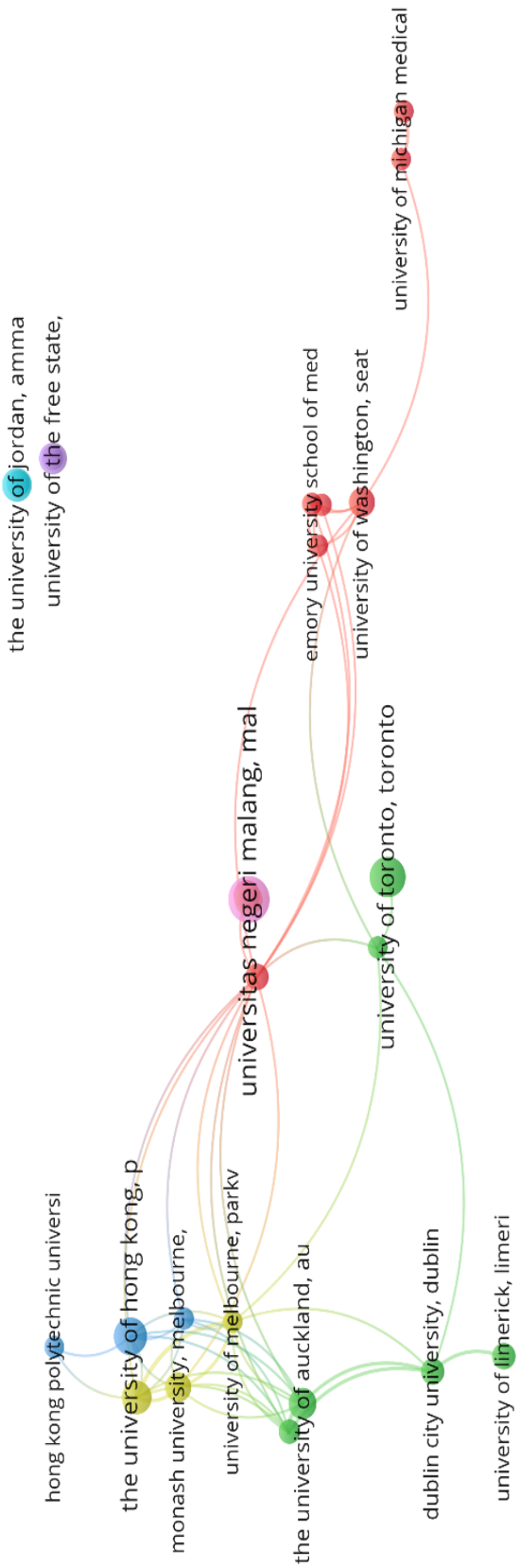

Figure 7. Graph of Organizations having Most Publications on COVID-19 in Educational Studies

When the graph is examined, it is seen that the weight of the green nodes and red nodes is higher than the other nodes. It is noteworthy that the University of Toronto is at the top of the chart with 18 articles. It has been

determined that The University of Auckland has 14 article publications and 11 link weights. Finally, when we look at the red group, we see that the weight of the university of Washington, the University of Michigan, and Emory university school of medicine is high. We see that the weight of these nodes in Cluster 1 is at an effective rate compared to the overall graph. We see that the University of Washington has 13 article publications and six node connection weights, the University of Michigan's 10 article publications have two node connections, and the Emory university school of medicine's 10 article publications have five node connections.

Organizations with at least 15 publications were included in the organization co-authorship analysis. According to the result, 2833 institutions have published in the field, and 40 organizations met this threshold. The co-authorship status of publications is presented in Figure 7 4. In the analysis, 40 organizations were classified with 22 different colored clusters. The links between two circles represent the linked organizations having publications together. The size of the circle represents the number of publications of the organization. As seen in Figure 7, only 7 clusters (containing 21 organizations) surrounded by lines were interconnected, while the other 15 clusters were not connected. In other words, they had no co-authorship.

Table 6. The Top 15 Organizations considering Number of Publications

Organizations	**Total link strength**	**Documents**	**Citations**
Universitas Negeri Malang, Indonesia	0	21	6
University Of Toronto, Canada	1	18	39
The University Of Hong Kong, Hong Kong	8	17	91
The University Of Jordan, Amman	1	15	29
Deakin University, Australia	11	15	24
The University Of Auckland, New Zealand	11	14	42
University Of The Free State, South Africa	1	14	24
Michigan State University, United States	0	14	6
Monash University, Australia	9	13	49
University Of Washington, United States	6	13	12
University Of California, Los Angeles, United States	1	13	11
The University Of North Carolina-Chapel Hill, United States	13	12	39
Dublin City University, Ireland	8	12	12
İmam Abdulrahman Bin Faisal University, Saudi Arabia	1	12	12
University Of Limerick, Ireland	2	12	10

To make it more precise, the top 15 most cited institutions and related information are listed in Table 7. When the table is examined, a significant portion of the organizations is from the United States and Australia (4 organizations each). The University of Hong Kong has published just 17 papers in the area but has gained the highest citation score. The University of Melbourne and Beijing Normal University have published 10 and 11 papers, respectively, and have been cited 90 and 64 times. Table 7 shows that the University of Johannesburg has no co-authorship with other organizations. The University of North Carolina has the highest collaboration value. It has collaborated 13 times with other organizations. The University of Melbourne has the next highest collaboration value with 12.

Table 7. The Top 15 Organizations considering Citation Score

Organizations	Citations	Total link strength	Documents
The University Of Hong Kong, Hong Kong	91	8	17
University Of Melbourne, Australia	90	12	10
Beijing Normal University, China	64	11	11
Monash University, Australia	49	9	13
The University Of Auckland, New Zealand	42	11	14
University Of Toronto, Canada	39	1	18
The University Of North Carolina, United States	39	13	12
Harvard Medical School, United States	35	5	10
The University Of Jordan, Jordan	29	1	15
The University Of Sydney, Australia	25	7	10
University Of Michigan, United States	25	2	10
Deakin University, Australia	24	11	15
University Of The Free State, South Africa	24	1	14
Arizona State University, United States	21	5	10
University Of Johannesburg, South Africa	14	0	10

Conclusions

The papers in the Scopus database are the only ones from which this study's conclusions can be drawn. Following a review of the pandemic-era studies on education, the following conclusions were reached:

- The two countries that get the most citations for distance learning during the pandemic are the USA and United Kingdom.
- The most frequently used keywords in educational journals during the pandemic are COVID-19, Pandemic, Higher education, and Distance education.
- When the most productive countries were analyzed, it was concluded that USA and United Kingdom were the countries that produced the most articles (Wang& Tian, 2021; Dehghanbanadaki et al., 2020).
- Among the studies published in this field, the United States holds first place with a number of documents. The second most published country is the United Kingdom. Some countries that have not cooperated with any country. Zhang et al. (2022) reached the same conclusion that United States was the most published country in this field. Although these countries published at least two documents, they did not cooperate with any country. These countries are Bhutan, Cameroon, Ukraine, Honduras, Mauritius, Jamaica, Morocco, Uganda, and Iraq.
- According to the result of the study, it was concluded that the most cited authors are Moorhouse, Liu and Zhang. Lee, Li, Chen and, Ogata were the prominent authors with the number of documents they have published.
- Most Used Keywords in Title and Abstract Part were COVID, Pandemic, Student and Study.

- The University of Hong Kong has published most papers in the area but has gained the highest citation score.
- When we consider the number of documents the organizations (universities) publish, University Negeri Malang is organization having most co-authorship.

Future researchers can consider the following recommendations in light of the study's findings:

- Expand the sample size by including studies from various databases;
- Increase the number of similar bibliometric studies in other domains.
- It is advised to conduct studies that will capture the entire COVID-19 period after the epidemic is over, increasing the number of studies on this subject in other nations or fields.

References

COVID-19 Coronavirus Pandemic (2022, April) Retrieved from https://www.worldometers.info/coronavirus/

Dehghanbanadaki, H., Seif, F., Vahidi, Y., Razi, F., Hashemi, E., Khoshmirsafa, M., & Aazami, H. (2020). Bibliometric analysis of global scientific research on Coronavirus (COVID-19*). Medical journal of the Islamic Republic of Iran*, *34*, 51.

Dervis, H. (2019). Bibliometric analysis using Bibliometrix an R Package. *Journal of Scientometric Research*, *8*(3), 156-160.

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, *133*, 285-296.

Ellegaard, O., & Wallin, J. A. (2015). The bibliometric analysis of scholarly production: How great is the impact?. *Scientometrics*, 105(3), 1809-1831.

ElHawary, H., Salimi, A., Diab, N., & Smith, L. (2020). Bibliometric analysis of early COVID-19 research: the top 50 cited papers. *Infectious diseases: research and treatment*, 13, 1178633720962935.

Gokce, S. & Guner, P. (2021). Forty Years of Mathematics Education: 1980-2019. *International Journal of Education in Mathematics, Science, and Technology (IJEMST), 9*(3), 514-539. https://doi.org/10.46328/ijemst.1361

Fan, J., Gao, Y., Zhao, N., Dai, R., Zhang, H., Feng, X., ... & Bao, S. (2020). Bibliometric analysis on COVID-19: a comparison of research between English and Chinese studies. *Frontiers in public health*, *8*, 477.

Farooq, R. K., Rehman, S. U., Ashiq, M., Siddique, N., & Ahmad, S. (2021). Bibliometric analysis of coronavirus disease (COVID-19) literature published in Web of Science 2019–2020. *Journal of family & community medicine*, 28(1), 1.

Lou, J., Tian, S. J., Niu, S. M., Kang, X. Q., Lian, H. X., Zhang, L. X., & Zhang, J. J. (2020). Coronavirus disease 2019: a bibliometric analysis and review. *Eur Rev Med Pharmacol Sci*, *24*(6), 3411-21.

Mustapha, I., Van, N. T., Shahverdi, M., Qureshi, M. I., & Khan, N. (2021, July 31). Effectiveness of digital technology in education during COVID-19 Pandemic. A bibliometric analysis. Retrieved from https://uis.brage.unit.no/uisxmlui/bitstream/handle/11250/2982095/document%2B%25282%2529.pdf?sequence=1

Ndibalema, P. (2022). The global research trends on the growth of remote learning in higher education institutions:

A bibliometric analysis. *International Journal of Technology in Education and Science (IJTES), 6*(2), 218-236

Patralekh, M. K., Iyengar, K. P., Jain, V. K., & Vaishya, R. (2021). Bibliometric analysis of COVID-19-related publications in Indian orthopedic journals. *Journal of clinical orthopedics and trauma*, 22, 101608.

Verma, S., & Gustafsson, A. (2020). Investigating the emerging COVID-19 research trends in the field of business and management: A bibliometric analysis approach. *Journal of Business Research, 118*, 253-261.

Zhang, L., Carter Jr, R. A., Qian, X., Yang, S., Rujimora, J., & Wen, S. (2022). Academia's responses to crisis: A bibliometric analysis of literature on online learning in higher education during COVID-19. *British Journal of Educational Technology*, *53*(3), 620-646.

Wang, P., & Tian, D. (2021). Bibliometric analysis of global scientific research on COVID-19. *Journal of Biosafety and Biosecurity*, *3*(1), 4-9.

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