Ed Process Int J | www.edupij.com
ISSN 2147-0901 | e-ISSN 2564-8020
Copyright © 2021 | ÜNİVERSİTEPARK

EDUCATIONAL PROCESS
INTERNATIONAL JOURNAL

RESEARCH ARTICLE

Exploring the emerging COVID-19 research trends and current status in the field of education: a bibliometric analysis and knowledge mapping

Turgut Karakose · **Murat Demirkol**

ARTICLE HISTORY
Received *March 3, 2021*
Accepted *May 7, 2021*
Published Online *May 19, 2021*

CORRESPONDENCE
Turgut Karakose
turgut.karakose@dpu.edu.tr
Department of Educational Sciences, Faculty of Education, Kutahya Dumlupinar University, Evliya Celebi Campus, 43100, Kutahya, Turkey.

AUTHOR DETAILS
Additional information about the authors is available at the end of the article.

How to cite: *Karakose, T., & Demirkol, M. (2021). Exploring the emerging COVID-19 research trends and current status in the field of education: a bibliometric analysis and knowledge mapping. Educational Process: international journal, 10(2): 7-27.*

OPEN ACCESS

This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0), where it is permissible to download and share the work provided it is properly cited.

ABSTRACT

Background/purpose – The current study aims to analyze the thematic structures and trends of scientific publications that examine the relationship between the COVID-19 pandemic and education, while presenting a roadmap for future research on this topic.

Materials/methods – The data were obtained from the Web of Science Core Collection (WoSCC) bibliographic database by identifying the publications that examine the relationship between the COVID-19 pandemic and education, then were analyzed using bibliometric methodology and content analysis. VOSviewer, GraphPad softwares, and visualization maps were used to analyze the data and to present the findings.

Results – The results of the study show that publications examining the relationship between the COVID-19 pandemic and education focused on "online education" and "teacher education," while the countries that contributed the most to publications on this issue were USA, United Kingdom, Canada, and Spain. It was determined that most publications preferred the "theoretical model" and the majority of the research data were obtained through "scale/interview forms." Furthermore, the findings of this study revealed that during the COVID-19 pandemic period, the editorial/refereeing processes of the articles submitted to academic journals were carried out very quickly and the articles were published unusually quickly.

Conclusion – This study indicated that the majority of scientific studies on COVID-19 are focused on the field of health, and that there is limited edition research on COVID-19-related education. To the best of the authors' knowledge, the current study is the first research article in the international literature to examine the thematic structures and trends of scientific publications on the relationship between solely education and COVID-19 through bibliometric and content analysis; and contributes to the knowledge base on COVID-19-related education by mapping the existing knowledge.

Keywords – COVID-19, coronavirus, pandemic, education, bibliometric analysis, visualization, content analysis, scientometric analysis, online learning, online teaching, distance learning.

To link to this article –https://dx.doi.org/10.22521/edupij.2021.102.1

1. INTRODUCTION

The novel coronavirus disease (2019-nCoV) was detected in Wuhan, in China's Hubei province, in December 2019, and was subsequently declared a global pandemic by the World Health Organization (WHO) in March 2020. In the period that followed, the unfolding pandemic led to an unprecedented crisis that threatened the global healthcare system. As a result, whilst the world struggled with the COVID-19 pandemic, the human race has also been introduced to a brand new way of life. Unprepared for much of the chaos caused by the pandemic, most people's lives have been directly affected in terms of their health as well as both economic and sociocultural aspects (Huang et al., 2020; Karakose, 2021; Karakose & Malkoc, 2021a; Qiu et al., 2020; World Health Organization, 2020).

Although COVID-19 has caused serious health problems and significant loss of human life, modern advances in technology has provided significant advantage in the prevention and treatment of the disease when compared to other large scale global pandemics in history (Moreno et al., 2020). Today, awareness of developments happens almost instantly through the power of mass media and social media, which, on the most part, has provided a great advantage in the fight against COVID-19. For example, individuals can communicate with their relatives by phone or via the Internet, many are also able to handle their work commitments remotely or from their home; thereby minimizing risks associated with the pandemic (Ferrel & Ryan, 2020; He & Harris, 2020). However, even though modern technological possibilities have facilitated and enabled a multifaceted fight against COVID-19 compared to similar crises of the past, the current pandemic has still caused unexpected and very serious difficulties to the lives of millions worldwide (Karakose & Malkoc, 2021b; Qiu et al., 2020; Torales et al., 2020).

It is indisputable that the COVID-19 pandemic has caused serious problems to education on a global scale, as well as to national healthcare systems and economies. As a result, local and national governments, and policymakers worldwide have had to work extraordinarily hard to solve the various problems encountered in not only healthcare and the economy, but also in education too. The COVID-19 pandemic has revealed the need for drastic changes in the organizational structures, curricula, and education policies of all schools and universities. From the early weeks of the pandemic, many countries were forced to suspend in-person learning and to shift the focus to various forms of online and hybrid education (Chick et al., 2020; Karakose, 2020; Viner et al., 2020). During the COVID-19 pandemic, many countries developed and implemented distance education programs in order to ensure that education was able to continue without significant interruption (Murphy, 2020; Tesar, 2020). As such; in addition to the many negative impacts of the COVID-19 pandemic, there have also been important opportunities presented. For example, Lee et al. (2021) stated that many people have developed skills in using digital devices in order to minimize the problems experienced by their children or students, and have thereby been better able to help and support them during what for many has been a unique education process.

Countries worldwide have fought the effects of COVID-19 whilst trying to ensure that important service areas such as education are maintained without significant interruption. Scientists have also responded to the current pandemic, which has impacted almost every aspect of human life, by carrying out various scientific research studies on the crisis. Correspondingly, international scientific journals have afforded increased coverage to studies on COVID-19, even publishing special issues, and many scientific publications focused on COVID-19 were produced worldwide within a very short time-span. When the scientific

studies conducted since December 2019 are examined, it can be seen that many international journals have published large numbers of academic articles regarding the COVID-19 pandemic, and a significant portion of these articles have also received numerous citations in what has been a relatively short space of time. Pericàs et al. (2020) stated that articles on COVID-19 have continued to increase in prestigious international scientific journals, especially from March 2020 onwards. This situation has provided important evidence regarding the powerful impact of COVID-19 on scientific studies conducted globally.

The number of worldwide scientific publications focused on COVID-19 is increasing on a daily basis. When the relevant literature is examined, it can be seen that different studies have been conducted at the international level on the pandemic' effect on education. However, a significant proportion of the studies published on COVID-19 were conducted in the field of health. Furthermore, whilst there have been some scientific studies published that have examined the pandemic's effect on education, there have been only a few. In this context, where studies examining the relationship between education and COVID-19 are considered, it is notable that different perspectives have emerged; focusing on topics such as developing new online resources, increasing the skills needed to use new technologies, providing free access to online resources, and developing alternative assessment and evaluation methods (Karakose, 2021; Karakose et al., 2021; Longhurst et al., 2020). From this perspective, determining the effects of the COVID-19 pandemic on education, as well as determining the current situation, has presented an important challenge for educational institutions worldwide. Therefore, the current study is considered important in terms of providing a roadmap for future research to examine the relationship between COVID-19 and education. Moreover, a large number of bibliometric studies have been conducted in support of research on the effects of COVID-19 (Furstenau et al., 2021), but no studies published during 2020 solely examined the relationship between the COVID-19 pandemic and education whilst presenting the thematic structures and trends of selected publications through scientometric analysis.

Consequently, the current study examined publications from journals indexed in the Web of Science Core Collection (WoSCC) database published between January 1 and December 31, 2020; more specifically, those that only examined the relationship between the COVID-19 pandemic and education. The top 100 most-cited publications were then analyzed in detail, with an effort to determine the thematic structures and trends. The purpose of the current study is to determine the thematic structures and trends of academic publications that examine the relationship between the COVID-19 pandemic and education, and to provide a roadmap for future studies on this subject. The sub-goals of this bibliometric study are:

Regarding the top 100 most-cited publications that only examined the relationship between the COVID-19 pandemic and education,

- What is the distribution in terms of the journals?
- What is the distribution in terms of the most contributive countries and institutions?
- What is the distribution in terms of topics and method employed?
- What is the distribution in terms of the population/sample/study groups used?
- What is the distribution in terms of the data collection tools and statistical techniques employed?
- What is the distribution in terms of time taken to publish in the journals?

2. METHODOLOGY

2.1. Study Design

This study conducted a systematic review of the publications examining the relationship between the COVID-19 and education, and revealed their bibliometric profiles. Bibliometric analysis identifies research patterns of publications and also enables for in-depth content analysis (Diem & Wolter, 2013). In this context, the review was reported according to PRISMA guidelines (Moher et al., 2009). The PRISMA flow diagram showing the flow of search in identification and screening of sources for analysis was presented in Figure 1.

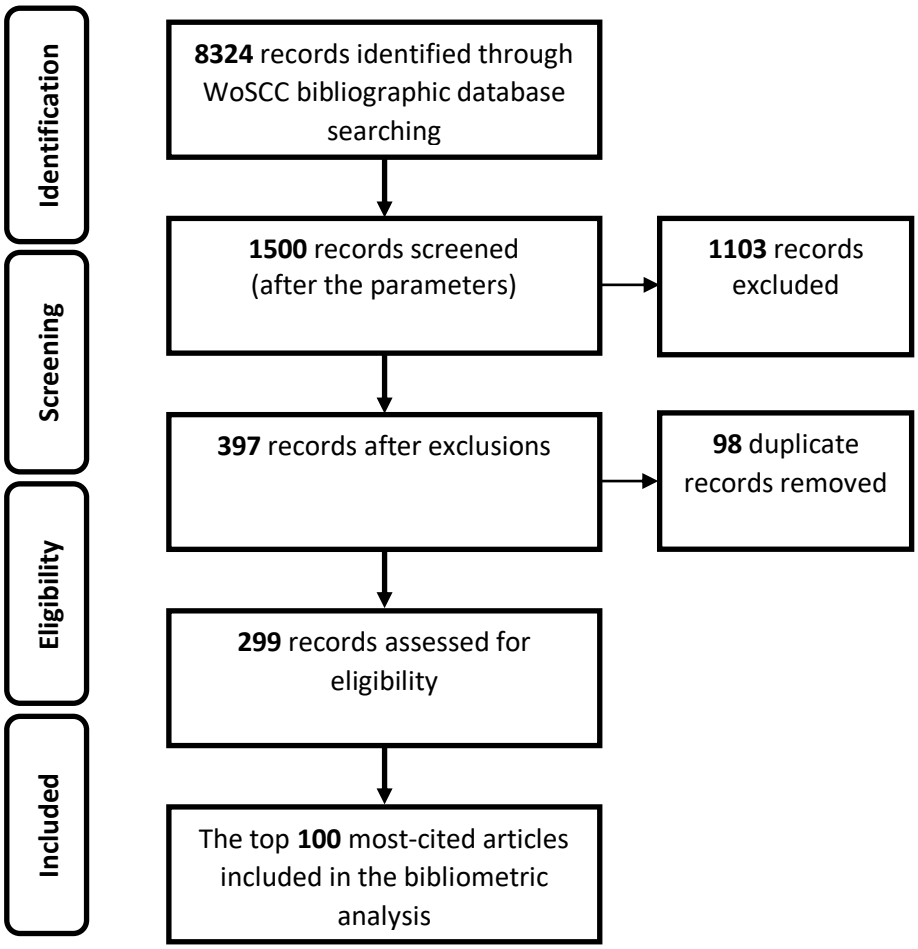

Figure 1. PRISMA flow diagram; **PRISMA**: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

2.2. Data search and identification

The Web of Science Core Collection (WoSCC) bibliographic database was reviewed in order to identify studies published between January 1 and December 31, 2020, that examined the relationship between the COVID-19 pandemic and education. The data were obtained from the WoSCC bibliographic database on February 14, 2021, by identifying the publications on COVID-19-related education. The WoSCC bibliographic database covers a large number of high-quality international scientific journals with the highest impact factor; providing detailed and reliable information about the articles, and is considered the primary database used in bibliometric research (Aggarwal et al., 2016; Zhai et al., 2017).

Since the WoS is the most comprehensive and globally accepted database of academic studies, only publications from journals indexed in the WoS database were included in the

current study. In order to identify the closest match to the aims of the study, the query equation for the Web of Science (WoS) was the following: TS=("COVID-19" OR "2019-nCoV" OR "COVID-19 pandemic" OR "SARS-CoV-2'') AND TS=("EDUCATION" OR "School" OR "Student" OR "Teacher" OR "Learning" OR "Teaching" OR "University" OR "Academician"). As such, these search criteria also constitute the limitations of the current study.

2.3. Data extraction

The publications indexed in the Web of Science Core Collection (WoSCC) bibliographic database related to the purpose of the current research were identified. Review articles, basic research articles, letters, editorials, etc. from the WoS database were all included within the scope of the current study.

The researchers independently determined the top 100 most-cited publications to be included in the current study's analysis in order to prevent errors considering the large number of articles subject to the study. Next, the dataset was finalized by cross-matching the researchers' lists, which each consisted of 100 articles. In addition, the same the researchers independently reviewed and evaluated the merged top 100 most-cited publications list so as to increase the reliability of the research and to further refine it as necessary. Differences in opinion were discussed until a consensus was reached among the researchers, and field experts were also consulted where necessary so as to ensure an agreement was reached.

2.4. Statistical analysis

Within the scope of the current research, the top 100 most-cited publications that only examined the relationship between the COVID-19 pandemic and education were scrutinized according to their topic, journal, contributive countries/institutions, method, population/sample/study group, data collection tool/s, statistical techniques, and time to reach publication. The data obtained from the Web of Science database were analyzed using a bibliometric methodology and content analysis.

Bibliometric analysis employs bibliometric theory to analyze relevant literature using a mathematical and statistical approach in order to analyze research undertaken in various scientific fields (Diem & Wolter, 2013; Zou, Yue, & Vu, 2018). In this context, VOSviewer software version 1.6.16 was used for the analysis of the several themes of the current research. VOSviewer (Van Eck & Waltman, 2010) is a software tool used for the visualized analysis of publications such as bibliographic matching, co-authorship, and co-citation. For the other themes of the current research, the data obtained in this study were analyzed according to content analysis (Yildirim & Simsek, 2013), categorical analysis of types (Corbin & Strauss, 2008; Tavsancil & Aslan, 2001), and frequency analysis techniques (Köhler & Stemmler, 1997); and then the findings then presented to include graphical and table representation. All of the obtained data were then transferred to Microsoft Excel for the purposes of sorting and calculation. Visualization maps were created using VOSviewer software, while graphs were created using (GraphPad Software, Inc., 2021), and Datawrapper (Aisch, 2018).

3. RESULTS AND DISCUSSION

Findings obtained from the analysis of publications examining the relationship between the COVID-19 pandemic and education are presented in the headings below under main themes: (i) journals; (ii) countries and institutions; (iii) thematic trends; (iv) methods; (v) population/sample/study group; (vi) data collection tools; and, (vii) publication time. The themes were determined according to the study of Attride-Stirling (2001), which explain the important points related to the research questions and represent the answers or meanings given to the research questions.

Figure 2 shows the graphical representation of the distribution of the top 100 most cited articles over the months, the total number of publications in those months, and the average citations per article.

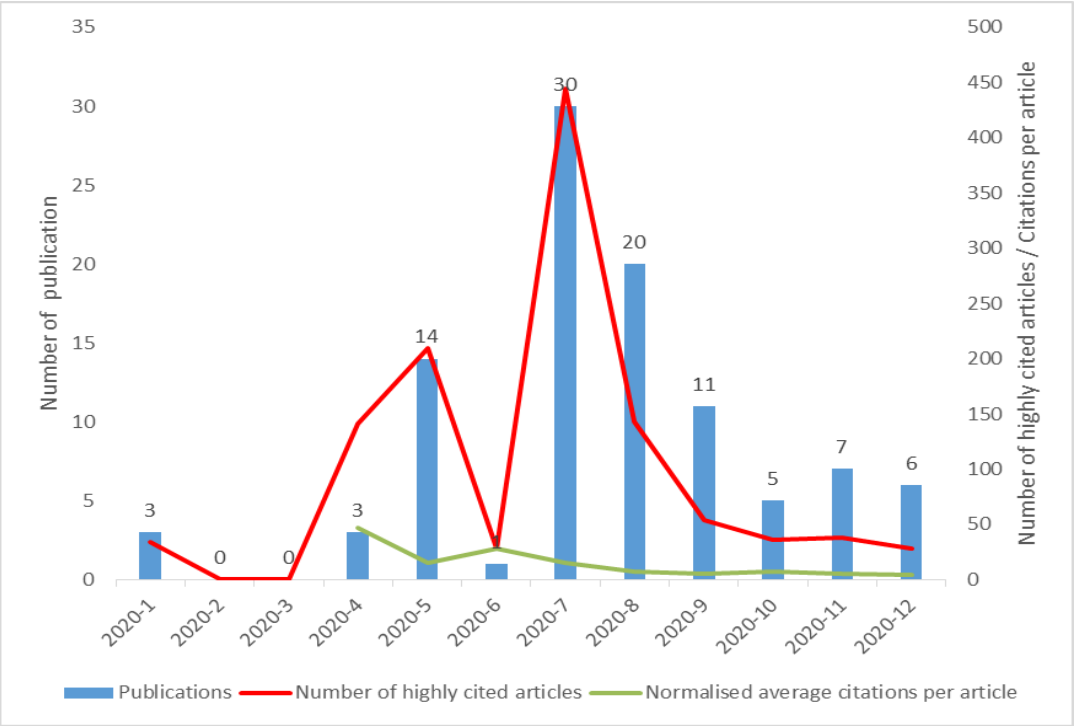

Figure 2. The descriptive characteristics of the top 100 most-cited publications

When Figure is 2 examined, it is seen that the number of publications on COVID-19-related education reached the highest level in 2020 / 7th month; however, it can be stated that the publications made gradually decreased in the following months. When the citations made from the articles are examined, it is observed that the number of citations increases or decreases in parallel with the number of publications. According to this data, it is possible to say that the interest of both researchers and journals in the studies on COVID-19-related education will gradually increase.

The first of the main themes within the scope of this study is the "countries and institutions" that contributed the most to publications examining the relationship between COVID-19 and education.

3.1. Theme 1: Analysis of most contributive countries and institutions with the most publications on education relationship with COVID-19

As the main theme within the scope of the current research, the "countries and institutions" that contributed the most to publications examining the relationship between COVID-19 and education were analyzed, and the findings obtained presented separately in Table 1, Figure 3 (countries) and Figure 4 (institutions).

Table 1. Number of publications by country based on the 100 most-cited publications

Rank	Country	Number of publications	Number of citations	Citation density
1	USA	33	549	16.64
2	United Kingdom	14	222	15.86
3	Canada	13	126	9.69
4	Spain	12	72	6.00
5	Singapore	7	109	15.57
6	Australia	6	112	18.67
7	Portugal	5	43	8.60
8	Saudi Arabia	4	32	8.00
9	Sweden	4	28	7.00
10	New Zealand	3	61	20.33
11	Scotland	3	51	17.00
12	Ireland	3	51	17.00
13	Italy	3	26	8.67

Note: Countries that contributed to at least three publications are included in the Table 1.

When Table 1 is examined, it can be determined that among the authors of the top 100 most-cited publications, the researchers hailed from different countries. Furthermore, the five countries with the most researchers who contributed to the publications were the USA ($f = 33$), United Kingdom ($f = 14$), Canada ($f = 13$), Spain ($f = 12$), and Singapore ($f = 7$). Additionally, researchers from more than one country participated in some of the studies.

Figure 3 shows the co-occurrence network of most contributive countries. In this context, while scientists in the USA worked with researchers from 36 different countries, this was followed by United Kingdom with 31 countries and Spain with 23 countries. The study also revealed that researchers from the remaining 15 countries (South Africa, Argentina, Turkey et al.) had not conducted any studies with researchers from different countries.

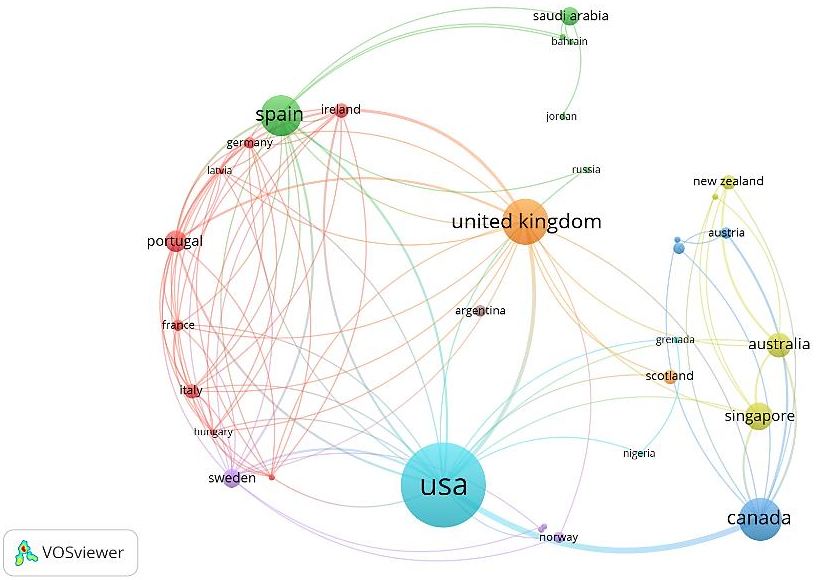

Figure 3. Co-occurrence network of most contributive countries

The findings of the current research further revealed that scientists in the USA published more articles than researchers in other countries. It is an important finding that many publications were soured from the USA during the COVID-19 period. According to Lee and Haupt (2020), the countries that produced the highest number of articles worldwide during 2020 were China, the USA, Italy, United Kingdom, and India, respectively. Martinez-Perez, Alvarez-Peregrina, Villa-Collar, and Sánchez-Tena (2020) emphasized that the countries producing the highest number of articles were the USA, China, and Italy. Furthermore, it was found that within the scope of the current study, scientists from the USA published studies together with researchers from 36 other countries. From this point of view, USA may be said to be one of the countries that receives the most "brain drain" (Adeyemi, Joel, Ebenezer, & Attah, 2018; Vega-Muñoz, Gónzalez-Gómez-del-Miño, & Espinosa-Cristia, 2021). However, this finding may be a result of scientists who are resident in the USA also working alongside many visiting foreign researchers, who in turn work with colleagues from their country of origin as well as other countries.

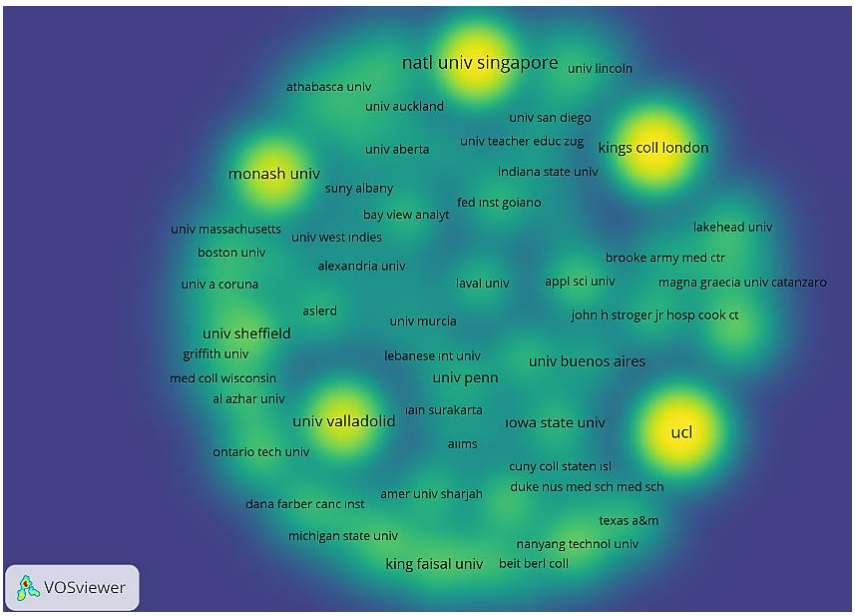

Figure 4. Density visualization map of the most contributive institutions

When Figure 4 is examined, it can be seen that among the top 100 most-cited publications, there were researchers from 191 different universities and higher education institutions. Furthermore, the institutions with the highest number of publishing researchers were shown to be, in order, the National University of Singapore (*f* = 5), UCL-London's Global University (*f* = 4), Monash University (*f* = 3), and University Valladolid (*f* = 3). Since the total of contributions from all institutions is 191 (the total number of publications analyzed in this study is 100), this data indicates cooperation between contributive institutions worldwide is very low.

The second of the main themes within the scope of this study is the "journals," which publish the articles that examined the relationship between COVID-19 and education.

3.2. Theme 2: Analysis of the journals which publish the articles that examined the relationship between COVID-19 and education.

Table 2 shows the distribution of the journals which publish the articles that examined the relationship between COVID-19 and education.

Table 2. Distribution of the journals that published the top 100 most-cited articles

Rank	Journal name	Based on 100 most cited articles TP	TC	CPP	Based all publications in the journal Journal Impact Factor™(JIF)*
1	Medical Education	9	95	10.60	4.57
2	Anatomical Sciences Education	7	160	22.86	3.76
3	Journal of Education for Teaching	7	61	8.71	1.48
4	Medical Teacher	6	61	10.17	2.65
5	European Journal of Teacher Education	5	30	6.00	2.25
6	Journal of Chemical Education	5	49	9.80	1.39
7	Revista Internacional de Educacion para la Justicia Social	5	26	5.20	-
8	Academic Medicine	3	34	11.33	5.35
9	Education Sciences	3	15	5.00	-
10	European Journal of Dental Education	3	30	10.00	1.05
11	Medical Education Online	3	38	12.67	1.97
12	BMC Medical Education	2	19	9.50	1.83
13	Education in the Knowledge Society	2	19	9.50	-
14	Frontiers in Psychology	2	15	7.50	2.07
15	Journal of Professional Capital and Community	2	8	4.00	0.82
17	International Journal of Early Childhood	2	6	3.00	-

Notes: TP= Total publication; TC= Total citations; CPP= Citation per publication; Journals that published at least two articles are included in the Table 2; *Figure for 2019 provided by Clarivate Analytics Journal Citation Reports (JCR)

Accordingly, it is possible to say that a significant portion of the articles were published in journals in the medical field, and the others were published in journals focused on education and psychology. The journals with the most articles published; Medical Education (*f=9*), Anatomical Sciences Education (*f=7*), Journal of Education for Teaching (*f=7*), and Medical Teacher (*f=6*). In addition, the data in Table 2 revealed that the journals that published the top 100 cited articles had a high impact factor. However, since the four most cited journals are included in the WoS-Emerging Sources Citation Index (ESCI), and these journals do not have any impact factors.

3.3. Theme 3: Analysis of thematic trends of publications on education relationship with COVID-19

Within the scope of the current research, the top 100 most-cited publications were analyzed in terms of topic distribution (the most frequently used keywords), and these "thematic trends" are presented in Figure 5.

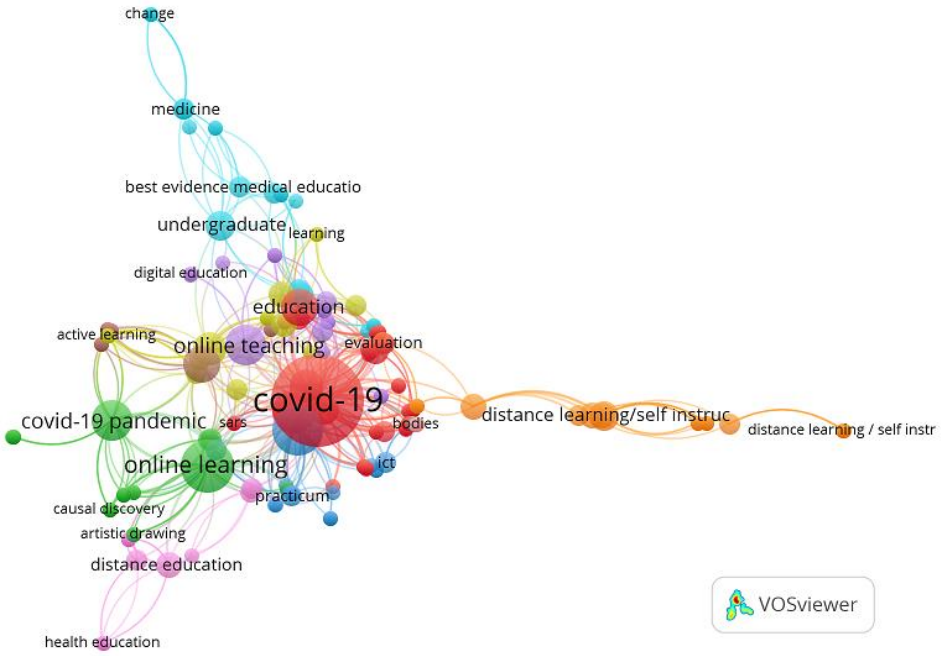

Figure 5. Co-occurrence network of research themes of the top 100 most-cited publications

According to Figure 5, the most frequently used keywords in the top 100 most-cited publications, excluding "COVID-19" and "education," were "Online learning (*f* = 12), teacher education (*f* = 11), online teaching (*f* = 7), and distance learning (*f* = 6)." Analysis of these 100 articles determined that the keyword "Online Learning" was frequently used together with one or more of the keywords "teacher education, distance education, online teaching, and online education"; "Teacher Education" with the keywords "Online teaching, online education, and online learning"; "Online Teaching" with the keywords "teacher education, higher education, undergraduate, online learning and medical education"; and "Distance Learning" was frequently used together with one or more of the keywords "medical education, assessment, and online education."

When the distribution of the top 100 most-cited publications within the scope of the study was analyzed in terms of the "subject (frequently used keywords)" of research, it was determined that the publications examining the relationship between COVID-19 and education were focused on "online education" and "teacher education." Education plays a critical role in the awareness of a country's citizens (Forouhari et al., 2010; Karakose & Kocabas, 2006; Roeser & Peck, 2009), the total development of a country (Agbedahin, 2019; Chabbott & Ramirez, 2000; McGrath, 2018), and also the competitiveness of one country with other countries (Hodgson & Spours, 2019; Karakose, Kocabas, & Yesilyurt, 2014; Musselin, 2018). Therefore, individual countries exert maximum efforts in order to conduct educational services with minimal interruption even during times of crises such as military conflict or health crises such as the current pandemic. During the early COVID-19 period, face-to-face education was largely suspended in almost all countries due to the high risk of disease transmission and the severe course of the disease experienced by some individuals

(Agarwal & Kaushik, 2020; Moorhouse, 2020). This situation led both national authorities and educational institutions to search for different solutions, with distance education having emerged as the key alternative, and which predominantly became compulsory in many instances as the only viable option. However, scientists have not remained indifferent to this issue, and a significant volume of research studies have been conducted in relation to the COVID-19 pandemic from various perspectives.

Therefore, with the introduction of distance education made compulsory, it became inevitable that different research studies would be conducted on numerous issues such as the advantages, disadvantages, limitations, and applications of online/distance education. Scientists have been shown to prefer similar keywords and terms whilst studying in this field; for example, publications generally used the concepts of "online learning, online education, distance education, distance learning," sometimes even interchangeably. Furthermore, the term "teacher education" was one of the most frequently used concepts. From this point of view, it may be stated that one of the service groups that plays the most important role in the distance education process are the teachers (Papadakis, 2018). In this sense, in order for students to benefit optimally from distance education, teachers should possess a high level of competence in this field. Within the scope of the current study, it may be said that the publications on teacher education tend to develop teachers' capacities while examining their readiness levels and competencies. Moreover, the fact that one of the prominent concepts revealed in the current study's data analysis was "medical education" may be explained as COVID-19 having affected those working in the healthcare profession the most.

3.4. Theme 4: Analysis of trends of methods in publications on education relationship with COVID-19

As the main theme within the scope of the current research, the "methods" used in the top 100 most-cited publications were analyzed, and the findings presented separately in Table 3 (methods).

Table 3. The number of publications and citations by the type of publication

Type of publication	Number of publications	Number of citations	Citation density
Theoretical studies*	59	694	11.76
Empirical quantitative studies	17	319	18.76
Empirical qualitative studies	23	114	4.96
Mixed method	1	8	8.00

*Theoretical studies include literature review, systematic review, and meta-analysis

When Table 3 is examined, it can be seen that four different methods were used in the top 100 most-cited publications. The obtained data showed that 59 of the top 100 most-cited publications presented theory-based research, whilst 23 of the studies were qualitative, 17 were quantitative, and one was conducted as a mixed-method study.

Analysis of the "methods/research models" used in the top 100 most-cited publications showed that the combined sum of studies conducted according to qualitative, quantitative, and mixed methods was less than the number of theoretical studies. However, some of the 59 studies that qualified as theoretical in the current study included personal views and perspectives of the author(s), and did not include qualitative, quantitative, or mixed

methods in the scientific research paradigms, and no other information was provided regarding the method applied in the studies. Although most of the publications in question were theoretical, it is, however, quite difficult to state that the publications were actually theorizing, criticizing, or developing types of research studies. As known, the COVID-19 pandemic caught much of the world unprepared (Jena, 2020; Sakib et al., 2021). At the onset of the pandemic, many scientists submitted articles to international scientific journals that only contained their personal and professional viewpoints on the COVID-19 pandemic, but lacked evidence of any qualitative and quantitative research having been conducted, and many of these studies were published unusually quickly. While an expansive review of the literature stood out in some of the theoretical studies, this was not so for many other studies. In fact, some of the theoretical studies contained only a few references, and there were even articles published by journals in the WoS database without any references at all having been cited by the authors.

The fact that the number of studies based on a theoretical design were significantly more than the others may be related to the methods employed by the researchers in their studies. Whilst the whole world was caught unprepared for the COVID-19 pandemic and did not initially know how to react to the unfolding crisis, scientists were seen to have quickly shared their views on what needed to be done and how during the pandemic on various platforms. Considering the widespread and varied difficulties brought on by COVID-19, it may be considered normal and logical that the first studies to be conducted were largely based on theoretical review.

3.5. Theme 5: Analysis of population/sample/study group in publications on education relationship with COVID-19

As the fifth main theme in the current study, the "population/sample/study group" with which the top 100 most-cited publications were conducted were analyzed, and the findings presented separately in Figure 6 (location of study population) and Figure 7 (sample/study group distribution).

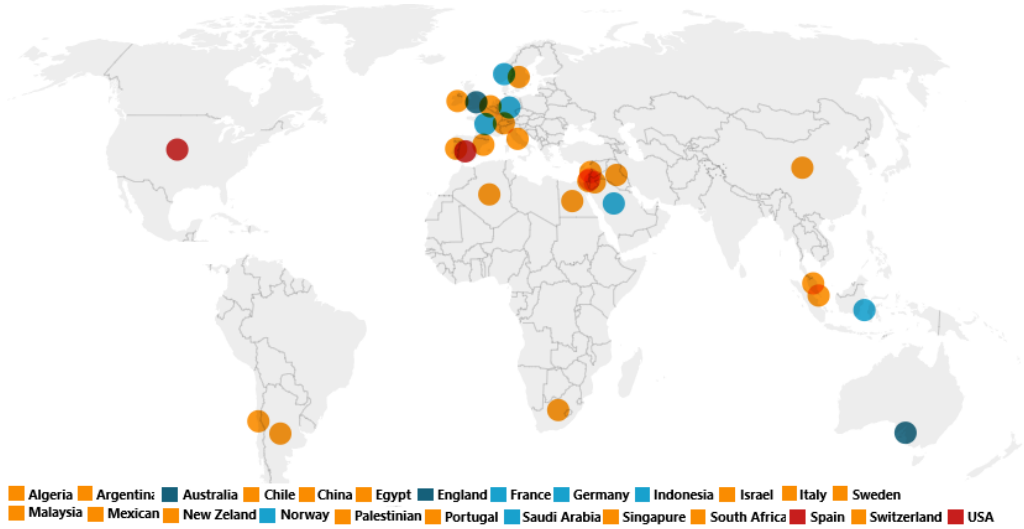

Figure 6. Global distribution of study population in the top 100 most-cited publications

Figure 6 shows the distribution of countries that comprised the study population of the top 100 most-cited articles examined within the scope of the current research. In this context, the countries in which study populations were formed the most were the USA (*f* = 8), Spain (*f* = 5), United Kingdom (*f* = 4), and Austria (*f* = 3). Generally speaking, it may be said that the top 100 most-cited studies were conducted in a total of 30 different countries.

The findings obtained in the current study from analysis of the population in which the studies were conducted in the reviewed publications reveal that the data were collected from populations in 30 different countries. In some publications, the data were collected from only one country, while in other studies the research data were obtained from more than one. Within the scope of the current study, data were collected in 40 of the 100 articles analyzed, and the countries where the most data were collected were respectively: the USA, Spain, and United Kingdom. Figure 8 shows the sample/study group distribution of the top 100 most-cited articles examined within the scope of the current research.

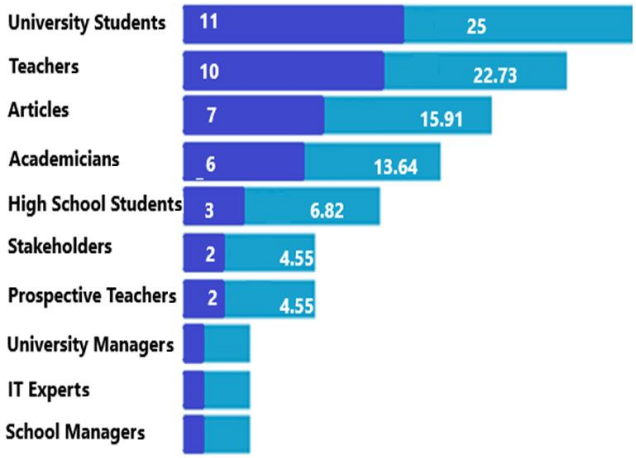

Figure 7. Distribution of research sample/study group in the top 100 most-cited publications

According to the findings depicted in Figure 7, it can be seen that university students ($f = 11$) were included in the research samples the most, followed by teachers ($f = 10$), articles ($f = 7$), and academicians ($f = 6$). When the studies within the scope of the current research are evaluated as a whole, it may be stated that a total of 10 different sample types were preferred.

When the sample/study group in which the data were collected was examined, it was determined that data were collected from nine different samples/study groups; with data in 10 studies collected from teachers, seven studies' data were from articles, six from academics, and three from high school students. The reason why the most data were obtained from teachers may be due to many countries having newly and suddenly adopted distance education; hence it was logical that scientific studies would assess the readiness and competencies of educators regarding their delivery of distance education.

As widely known, prior to COVID-19, the realization of education and training services through digital channels, e-books, and e-learning environments were frequently highlighted by scientists, and discussions took place as to whether online education could be considered a viable alternative to formal face-to-face classroom-based education (Chen et al., 2020; Palvia et al., 2018; Paudel, 2021; Sun, Tang, & Zuo, 2020).

However, with the unexpected and sudden emergence of the COVID-19 pandemic, countries were left with no choice between the delivery of online and in-person education. Throughout this difficult period, many educational institutions worldwide were soon forced to close their doors, and many countries took the necessary decision to switch to immediately switch over to online education (Karakose, 2021). Considering all of these findings, it may be said that it was inevitable that solutions would be developed in response to the pandemic crisis through determining the perceptions of both teachers and students in educational studies during the COVID-19 period.

3.6. Theme 6: Analysis of data collection tools/statistical techniques in publications on education relationship with COVID-19

As the main theme of the current study, the "data collection tools and statistical techniques" employed in the top 100 most-cited publications were analyzed in detail, and the findings presented separately in Figure 8 (data collection tools) and Figure 9 (statistical techniques).

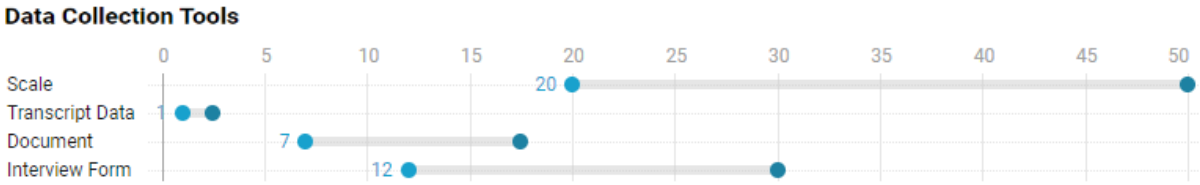

Figure 8. Distribution of data collection tools in the top 100 most-cited publications

From analysis of the top 100 most-cited publications, it was determined that scales (*f = 20*) were the most used in the studies, followed by interview forms (*f* = 12), documents (*f = 7*), and transcript data (*f = 1*). However, since 10 of the 100 studies were purely narrative, it was determined that no data collection tool was employed in those studies.

The findings regarding the distribution of statistical techniques used in the top 100 most-cited publications within the scope of the current research are presented in Figure 9.

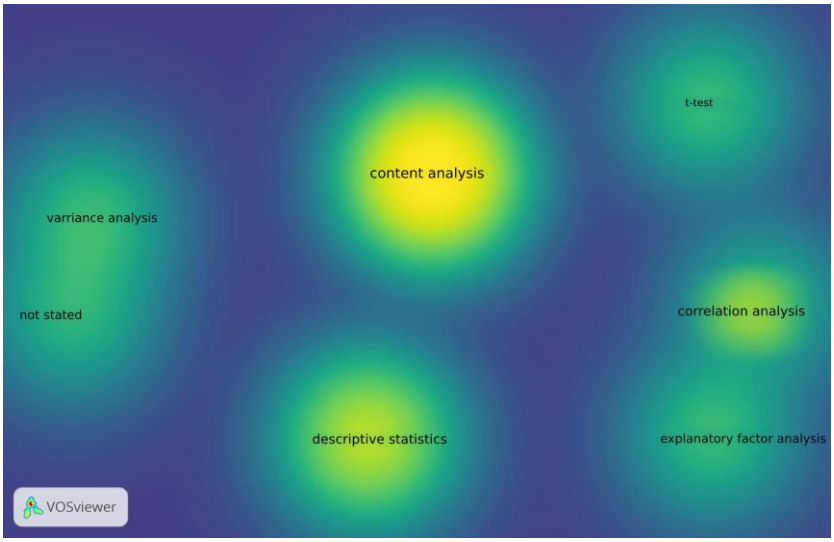

Figure 9. Density visualization map of statistical techniques in the most-cited publications

According to the analysis findings regarding the statistical techniques used in the top 100 most-cited articles, excluding theory-based studies, were content analysis (*f* = 23), followed by descriptive statistics (*f* = 12), and correlation analysis (*f* = 6). As a result of the analysis, it was determined that a total of seven different statistical techniques were used in the non-theoretical studies.

As a result of the current study's analysis of the data collection tools and statistical techniques employed in the examined 100 publications, it was seen that only 40 of the 100 studies had actually gathered research data, and that 60 of the articles had been prepared solely on a theoretical basis. It was then determined that most of the collected data were obtained through questionnaires/scales and interview forms. In addition, it can be said that the majority of the data obtained within the scope of the current research were analyzed through content analysis and descriptive statistics.

3.7. Theme 7: Analysis of time taken to publish in publications on education relationship with COVID-19

For the seventh main theme within the scope of the current research, the "publication time" for the most-cited publications, i.e., the time taken between an article submitted for review and actual publication by the journal, were analyzed, and the findings are presented in Figure 10. For this theme, the time elapsed (in days) between the dates when studies were sent to the respective journals and the actual date of publication was determined.

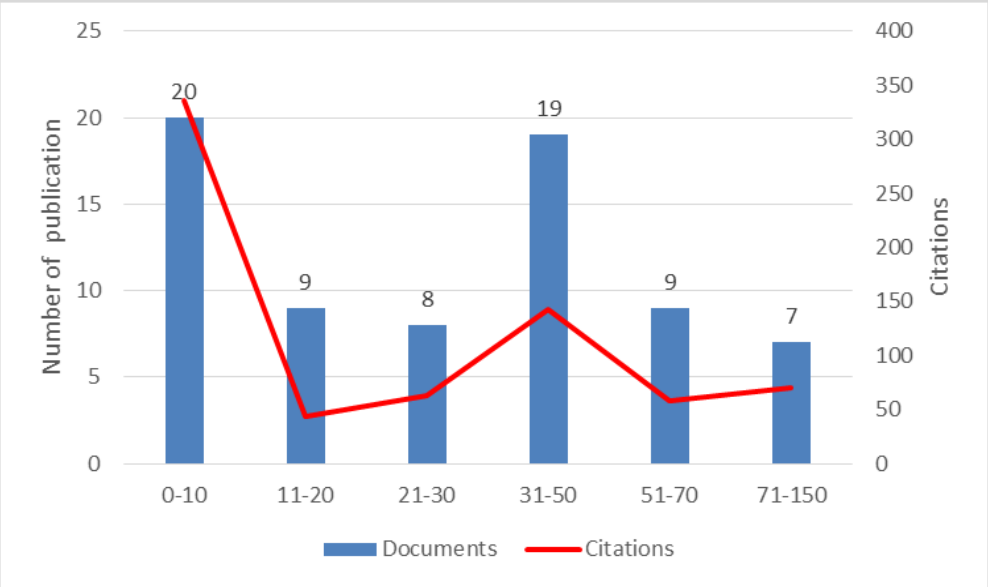

Figure 10. Distribution of publication times in the most-cited publications

According to the findings illustrated in Figure 10, the time taken for the editorial and peer-review process leading to actual publication of the studies for the most-cited publications had a fastest rate of 1-10 days (*f* = 20), while others were published in 31-50 days (*f*= 19). Looking at the 72 articles within the scope of the current study whose publication dates were actually specified, the average publication time was determined as being 12 days. However, review and publication information was not available for a significant number of the articles published in the journals, in this context the number of articles without a date of submission can be expressed as (*f* = 28).

The time taken for submitted articles to be reviewed and published in the case of the top 100 most-cited publications was analyzed as part of the current study. The analysis revealed that no such information was retrievable for 28 of the 100 examined articles. However, it was seen that 20 articles were published within just 10 days, whilst a further 19 articles took between 31 and 50 days, and the longest time from review to publication was 150 days. These findings show that during the COVID-19 pandemic, articles submitted to international academic journals were published very much quicker than is considered standard practice. With editorial reviews on submitted articles prior to the COVID-19 pandemic having taken much longer than revealed by the current study, it may be said that academic journals implemented rapid editorial and review processes during the pandemic, leading to faster publication times and associated faster downstream citations of the published articles.

4. CONCLUSION

This study investigated the thematic structures and trends of the top 100 most-cited publications indexed in the Web of Science Core Collection (WoSCC) bibliographic database that specifically examined the relationship between the COVID-19 pandemic and education. Moreover, a large number of bibliometric studies have been conducted on the effects of COVID-19, but no studies published so far have only examined the relationship between the COVID-19 pandemic and education through bibliometric analysis. In this context, the current study is the first research article in the international literature to examine the thematic structures and trends of scientific publications on the relationship between solely education and COVID-19 through bibliometric and content analysis.

The education crisis caused by the COVID-19 pandemic has profoundly affected millions of students and educators worldwide. From this perspective, determining the effects of the COVID-19 pandemic on education, as well as the current situation, is important for educational institutions around the world. Therefore, it has become necessary for educational institutions to take measures in order to minimize the effects of the pandemic on education by enacting a faster reflex to the COVID-19 crisis.

In conclusion, the findings of this study revealed that the majority of scientific studies on COVID-19 are focused on the field of health, and that there is limited edition research on COVID-19-related education. In this context, national governments, educational and research organizations should encourage possible research on the effects of COVID-19 pandemic on education, and must take measures quickly so as to minimize the negative effects of the pandemic on global education.

LIMITATIONS AND FUTURE RESEARCH

Although the current research revealed important findings from analyzing articles from the WoSCC bibliographic database that only examined the relationship between COVID-19 and education, it does, however, have certain limitations. The articles within the scope of this study were analyzed by taking into account the top 100 most-cited publications in the WoSCC bibliographic database that examined the relationship between the COVID-19 pandemic and education. However, in order to evaluate the effects of COVID-19 on education in a more comprehensive way, it may be necessary to conduct more extensive research that includes international research databases other than WoSCC bibliographic database. Furthermore, it may be recommended to also conduct additional studies with mixed methods in addition to the qualitative or quantitative research approach in order to fully examine the relationship between COVID-19 and education.

DECLARATIONS

Author Contributions Both authors contributed equally to the current research, and they read and approved the final published version of the article.

Conflicts of Interest The authors declared no conflict of interest.

Ethical Approval No ethical approval was sought as the article does not present any study of human or animal subjects.

Funding None.

Data Availability Statement Data sharing is not applicable as no new data were created or analyzed in the presented study.

Acknowledgments None.

REFERENCES

Adeyemi, R. A., Joel, A., Ebenezer, J. T., & Attah, E. Y. (2018). The effect of brain drain on the economic development of developing countries: evidence from selected African countries. *Journal of Health and Social Issues*, *7*(2), 66-76.

Agarwal, S., & Kaushik, J. S. (2020). Student's perception of online learning during COVID pandemic. *The Indian Journal of Pediatrics*, *87*, 554-554. https://doi.org/10.1007/s12098-020-03327-7

Agbedahin, A. V. (2019). Sustainable development, education for sustainable development, and the 2030 agenda for sustainable development: emergence, efficacy, eminence, and future. *Sustainable Development*, *27*(4), 669-680. https://doi.org/10.1002/sd.1931

Aggarwal, A., Lewison, G., Idir, S., Peters, M., Aldigee, C., Boerckel, W.,…Sullivan, R. (2016). The state of lung cancer research: a global analysis. *Journal of Thoracic Oncology, 11*(7), 1040-1050. https://doi.org/10.1016/j.jtho.2016.03.010

Aisch, G. (2018, February 5). Datawrapper now checks your colors, so you don't have to [Blog post]. *Datawrapper*. Retrieved from https://blog.datawrapper.de/colorblind-check/

Attride-Stirling, J. (2001). Thematic networks: an analytic tool for qualitative research. *Qualitative Research*, *1*(3), 385-405. https://doi.org/10.1177%2F146879410100100307

Berg, B. L., & Lune, H. (2015). Qualitative research methods in the social sciences. (H. Aydin, Trans./Ed.). Konya, Turkey: Egitim Yayincilik.

Chabbott, C., & Ramirez, F. O. (2000). Development and education. In M. T. Hallinan (Ed.), *Handbook of the Sociology of Education* (pp. 163-187). Boston, MA: Springer. https://doi.org/10.1007/0-387-36424-2_8

Chen, T., Peng, L., Yin, X., Rong, J., Yang, J., & Cong, G. (2020). Analysis of user satisfaction with online education platforms in China during the COVID-19 pandemic. *Healthcare, 8*(3), 200. https://doi.org/10.3390/healthcare8030200

Chick, R. C., Clifton, G. T., Peace, K. M., Propper, B. W., Hale, D. F., Alseidi, A. A., & Vreeland, T. J. (2020). Using technology to maintain the education of residents during the COVID-19 pandemic. *Journal of Surgical Education*, *77*(4), 729-732. https://doi.org/10.1016/j.jsurg.2020.03.018

Corbin, J. M., & Strauss, A. (2008). *Basics of qualitative research: techniques and procedures for developing grounded theory* (3rd ed.). Thousand Oaks, CA: Sage.

Diem, A., & Wolter, S. C. (2013). The use of bibliometrics to measure research performance in education sciences. *Research in Higher Education*, *54* (1), 86-114.

Ferrel, M. N., & Ryan, J. J. (2020). The impact of COVID-19 on medical education. *Cureus, 12*(3), e7492. https://dx.doi.org/10.7759%2Fcureus.7492

Forouhari, S., Khajehei, M., Moattari, M., Mohit, M., Rad, M. S., & Ghaem, H. (2010). The effect of education and awareness on the quality-of-life in postmenopausal women. *Indian Journal of Community Medicine*, *35*(1), 109-114. https://dx.doi.org/10.7759%2Fcureus.7492

Furstenau, L. B., Rabaioli, B., Sott, M. K., Cossul, D., Bender, M. S., Farina, E. M. J. D. M.,…Bragazzi, N. L. (2021). A bibliometric network analysis of coronavirus during the first eight months of COVID-19 in 2020. *International Journal of Environmental Research and Public Health, 18*(3), 952. https://doi.org/10.3390/ijerph18030952

GraphPad Prism [Computer software]. La Jolla, CA: GraphPad Software, Inc. Retrieved from http://www.graphpad.com/scientific-software/prism/.

He, H., & Harris, L. (2020). The impact of Covid-19 pandemic on corporate social responsibility and marketing philosophy. *Journal of Business Research*, *116*, 176-182. https://doi.org/10.1016/j.jbusres.2020.05.030

Hodgson, A., & Spours, K. (2019). Further education in England: at the crossroads between a national, competitive sector and a locally collaborative system? *Journal of Education and Work*, *32*(3), 224-237. https://doi.org/10.1080/13639080.2019.1596231

Huang, C., Wang, Y., Li, X., Ren, L., Xhao, J., Hu, Y,…Cao, B. (2020). Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet, 395*(10223), 497-506. https://doi.org/10.1016/S0140-6736(20)30183-5

Jena, P. K. (2020). Impact of pandemic COVID-19 on education in India. *International Journal of Current Research*, *12*(7), 12582-12586. http://journalcra.com/article/impact-pandemic-covid-19-education-india

Karakose, T. (2020). Global Education in the shadow of the novel coronavirus: reflections on the impact of COVID-19 outbreak on education systems. *Educational Process: International Journal, 9*(4), 201-204. https://doi.org/10.22521/edupij.2020.94.1

Karakose, T. (2021). The impact of the COVID-19 epidemic on higher education: Opportunities and implications for policy and practice. *Educational Process: International Journal, 10*(1), 7-12. https://doi.org/10.22521/edupij.2021.101.1

Karakose, T., & Kocabas, I. (2006). Ozel ve devlet okullarinda ogretmenlerin beklentilerinin is doyumu ve motivasyon uzerine etkileri. *Journal of Theory and Practice in Education, 2*(1), 3-14. https://dergipark.org.tr/en/pub/eku/issue/5441/73869

Karakose, T., Kocabas, I., & Yesilyurt, H. (2014). A quantitative study of school administrators' work-life balance and job satisfaction in public schools. *Pakistan Journal of Statistics, 30*(6), 1231-1241. https://www.researchgate.net/publication/289002648_A_quantitative_study_of_school_administrators'_work-life_balance_and_job_satisfaction_in_public_schools

Karakose, T., & Malkoc, N. (2021a). Psychological impact of the COVID-19 pandemic on medical doctors in Turkey. *Social Behavior and Personality, 49*(1), e9890. https://doi.org/10.2224/sbp.9890

Karakose, T., & Malkoc, N. (2021b). Behavioral and interpersonal effects of the COVID-19 epidemic on frontline physicians working in Emergency Departments (EDs) and Intensive Care Units (ICUs). *Acta Medica Mediterranea, 37*, 437-444. https://doi.org/10.19193/0393-6384_2021_1_68

Karakose, T., Yirci, R., Basyigit, H., & Kucukcakir, A. (2021). Investigation of associations between the effects of COVID-19 fear on school administrators and nutrition and problematic eating behaviors. *Progress in Nutrition, 23*(2): e2021187, [OnlineFirst]. https://doi.org/10.23751/pn.v23i2.11656

Köhler, T., & Stemmler, M. (1997). Normative versus impassive configure frequency analysis in personality research -their use discussed in a reanalysis of data on situation- bound anxiety. *European Journal of Personality, 11*(1), 69-79. https://doi.org/10.1002%2F%28SICI%291099-0984%28199703%2911%3A1%3C69%3A%3AAID-PER277%3E3.0.CO%3B2-G

Lee, J. J., & Haupt, J. P. (2020). Scientific globalism during a global crisis: research collaboration and open access publications on COVID-19. *Higher Education*. Advance Online Publication. https://doi.org/10.1007/s10734-020-00589-0

Lee, S. J., Ward, K. P., Chang, O. D., & Downing, K. M. (2021). Parenting activities and the transition to home-based education during the COVID-19 pandemic. *Children and Youth Services Review*, *122*, Article 105585. https://doi.org/10.1016/j.childyouth.2020.105585

Longhurst, G. J., Stone, D. M., Dulohery, K., Scully, D., Campbell, T., & Smith, C. F. (2020). Strength, weakness, opportunity, threat (SWOT) analysis of the adaptations to anatomical education in the United Kingdom and Republic of Ireland in response to the Covid-19 pandemic. *Anatomical Sciences Education, 13*(3), 301-311. https://doi.org/10.1002/ase.1967

Martinez-Perez, C., Alvarez-Peregrina, C., Villa-Collar, C., & Sánchez-Tena, M. Á. (2020). Citation network analysis of the novel coronavirus disease 2019 (COVID-19). *International Journal of Environmental Research and Public Health, 17*(20), Article 7690. https://doi.org/10.3390/ijerph17207690

McGrath, S. (2018). *Education and development*. Abingdon, United Kingdom: Routledge.

Moorhouse, B. L. (2020). Adaptations to a face-to-face initial teacher education course 'forced' online due to the COVID-19 pandemic. *Journal of Education for Teaching*, *46*(4), 609-611. https://doi.org/10.1080/02607476.2020.1755205

Moher, D., A. Liberati, J. Tetzlaff, & Altman, D. G. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *Annals of Internal Medicine, 151*(4): 264–269. https://doi.org/10.7326/0003-4819-151-4-200908180-00135

Moreno, C., Wykes, T., Galderisi, S., Nordentoft, M., Crossley, N., Jones, N., ... & Arango, C. (2020). How mental health care should change as a consequence of the COVID-19 pandemic. *The Lancet Psychiatry, 7*(9), 813-824. https://doi.org/10.1016/S2215-0366(20)30307-2

Murphy, M. P. (2020). COVID-19 and emergency eLearning: consequences of the securitization of higher education for post-pandemic pedagogy. *Contemporary Security Policy*, *41*(3), 492-505. https://doi.org/10.1080/13523260.2020.1761749

Musselin, C. (2018). New forms of competition in higher education. *Socio-Economic Review*, *16*(3), 657-683. https://doi.org/10.1093/ser/mwy033

Palvia, S., Aeron, P., Gupta, P., Mahapatra, D., Parida, R., Rosner, R., & Sindhi, S. (2018). Online education: worldwide status, challenges, trends, and implications. *Journal of Global Information Technology Management, 21*(4), 233-241. https://doi.org/10.1080/1097198X.2018.1542262

Papadakis, S. (2018). Evaluating pre-service teachers' acceptance of mobile devices with regards to their age and gender: a case study in Greece. *International Journal of Mobile Learning and Organisation*, *12*(4), 336-352. https://doi.org/10.1504/IJMLO.2018.095130

Paudel, P. (2021). Online education: benefits, challenges and strategies during and after COVID-19 in higher education. *International Journal on Studies in Education*, *3*(2), 70-85. https://doi.org/10.46328/ijonse.32

Pericàs, J. M., Arenas, A., Torrallardona-Murphy, O., Valero, H., & Nicolás, D. (2020). Published evidence on COVID-19 in top ranked journals: A descriptive study. *European Journal of Internal Medicine, 79*, 120-122. https://doi.org/10.1016/j.ejim.2020.07.005

Qiu, J., Shen, B., Zhao, M., Wang, Z., Xie, B., & Xu, Y. (2020). A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications

and policy recommendations. *General Psychiatry*, *33*(2), Article e100213. https://dx.doi.org/10.1136%2Fgpsych-2020-100213

Roeser, R. W., & Peck, S. C. (2009). An education in awareness: Self, motivation, and self-regulated learning in contemplative perspective. *Educational Psychologist*, *44*(2), 119-136. https://doi.org/10.1080/00461520902832376

Sakib, N., Akter, T., Zohra, F., Bhuiyan, A. I., Mamun, M. A., & Griffiths, M. D. (2021). Fear of COVID-19 and depression: a comparative study among the general population and healthcare professionals during COVID-19 pandemic crisis in Bangladesh. *International Journal of Mental Health and Addiction*. Advance Online Publication. https://doi.org/10.1007/s11469-020-00477-9

Sun, L., Tang, Y., & Zuo, W. (2020). Coronavirus pushes education online. *Nature Materials*, *19*(6), 687-687. https://doi.org/10.1038/s41563-020-0678-8

Tavsancil, E., & Aslan, A. E. (2001). Content analysis and application examples for verbal, written and other materials. Istanbul, Turkey: Epsilon.

Tesar, M. (2020). Towards a post-Covid-19 "New Normality?": physical and social distancing, the move to online and higher education. *Policy Future in Education, 18*(5), 556-559. https://doi.org/10.1177%2F1478210320935671

Torales, J., O'Higgins, M., Castaldelli-Maia, J. M., & Ventriglio, A. (2020). The outbreak of COVID-19 coronavirus and its impact on global mental health. *International Journal of Social Psychiatry*, *66*(4), 317-320. https://doi.org/10.1177%2F0020764020915212

Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics, 84*, 523-538. https://doi.org/10.1007/s11192-009-0146-3

Vega-Muñoz, A., Gónzalez-Gómez-del-Miño, P., & Espinosa-Cristia, J. F. (2021). Recognizing new trends in brain drain studies in the framework of global sustainability. *Sustainability*, *13*(6), Article 3195. https://doi.org/10.3390/su13063195

Viner, R. M., Russell, S. J., Croker, H., Packer, J., Ward, J., Stansfield, C.,...Booy, R. (2020). School closure and management practices during coronavirus outbreaks including COVID-19: a rapid systematic review. *The Lancet Child & Adolescent Health*, *4*(5), 397-404. https://doi.org/10.1016/S2352-4642(20)30095-X

World Health Organization. (2020). *Naming the coronavirus disease (COVID-19) and the virus that causes it.* https://bit.ly/31krd75

Yildirim, A., & Simsek, H. (2013). *Qualitative research methods in the social sciences*. Ankara, Turkey: Seckin.

Zhai, X., Cui, J., Shao, J., Wang, Q., Chen, X., Wei, X.,…Li, M. (2017). Global research trends in spinal ultrasound: a systematic bibliometric analysis. BMJ Open, 7(10), Article e015317. http://dx.doi.org/10.1136/bmjopen-2016-015317

Zou, X., Yue, W. L., & Vu, H. L. (2018). Visualization and analysis of mapping knowledge domain of road safety studies. *Accident Analysis & Prevention, 118*, 131-145. https://doi.org/10.1016/j.aap.2018.06.010

ABOUT THE CONTRIBUTORS

Turgut Karakose, PhD, is Professor of Educational Administration in the Kutahya Dumlupinar University (Turkey). His main research interests include educational leadership and administration, reputation management, school administration, psychology, and human behavior. He has published extensively in the major international journals and also authored books and chapters on education/management.
E-mail: turgut.karakose@dpu.edu.tr
ORCID ID: https://orcid.org/0000-0003-0346-8154

Murat Demirkol is Lecturer at the Vocational High School at Firat University (Turkey). His main fields of study are mentoring, educational leadership and administration, school administration and classroom management.
E-mail: mdkol@hotmail.com
ORCID ID: https://orcid.org/0000-0003-3108-3219