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The Effects of the Covid-19 Pandemic on Distance Education in Higher Education: A Bibliometric Analysis Study

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Abstract

This study aimed to examine the COVID-19 effect on distance education in higher education in the pre-COVID-19 pandemic (January to November 2019) and post-COVID-19 pandemic periods (December 2019 and January to December 2020). Two different meta-data sets, consisting of 580 articles for the pre-COVID-19 period and 746 for the post-COVID-19 period, obtained by querying the Web of Science database, were used for analysis. SciMAT and Vosviewer software were used for bibliometric analysis. Publications from the two different periods were compared according to keywords, words from abstracts, based on the criteria using co-occurrence and co-word analysis. The results of the keyword co-occurrence analysis show that the keywords "e-learning" and "online learning" were used more in the post-COVID-19 period compared to the pre-pandemic period. In the pre-pandemic period, the thematic trend of academic studies largely aligned with students and satisfaction. However, in the post-pandemic period, the research trend was mostly toward such themes as video lectures and web 2.0 technologies. The research results show that the impact of COVID-19 was reflected in the research published in the post-pandemic period, with the interest in e-learning and online learning increasing in higher education, alongside a trend towards investigating the delivery of instruction rather than conducting student-centered studies.

Key words*: COVID-19; distance education; e-learning; higher education; online learning; pandemic.*

Introduction

The COVID-19 pandemic brought social and economic life to a near standstill, causing significant changes in national economies, healthcare systems, educational institutions, and private and public markets. As the global economy crashed due to the rise of the pandemic, some countries saw their health systems collapse and detrimental effects in their education systems. UNESCO reported an estimate of 107 countries closing all schools due to the pandemic (United Nations Educational, Scientific and Cultural Organization, 2020). With schools closing in many parts of the world for periods of weeks to months, the normal course of educational activities changed significantly, and 94% of the total global student population was negatively affected by this situation (De Giusti, 2020). According to UNESCO's (2020) data, approximately 1.6 billion students of all grades have been adversely affected by the pandemic in more than 190 countries.

The COVID-19 pandemic also negatively affected higher education (UNESCO, 2020). For example, the National Universities Commission (NUC) in Nigeria closed all universities (Ezeri, 2020). Similarly, authorities in Malaysia decided to stop all learning and teaching activities, including those in online environments (Asia Pacific University of Technology & Innovation, 2020). However, Australia preferred to use alternative learning styles (ranging from synchronous to asynchronous to face-to-face) rather than closing higher education institutions entirely. Many universities in Egypt, Hong Kong and China have transitioned directly to online learning. When the education processes at Passau University in Germany were suspended, administrators there stated that oral exams should not be conducted via Skype, FaceTime or other digital means, as they had no legal basis.

The closure of schools precipitated an increasing interest and change movement towards emergency remote teaching (ERT) in the education paradigms of many countries (Bozkurt & Sharma, 2020; Di Pietro, 2020; Martinez, 2020). This change can be seen as a great distance education experiment, revealing what truly works and what does not (Zimmerman, 2020). Although ERT and distance education seem to be the same thing, there are actually key differences between the two (Bozkurt & Sharma, 2020; Bozkurt et al., 2020; Hodges et al., 2020). While distance education is an optional, planned activity based on theoretical and practical knowledge, ERT is compulsory "survival education" that uses all available resources, including offline and/or online tools, in times of crisis (Bozkurt et al., 2020). In addition, the main purpose of ERT is to minimize spatial distance to ensure the persistence of education. Contrarily, the main purpose of distance education is to minimize operational/psychological distance to facilitate the persistence of teaching and learning. During this pandemic, the misinterpreted nuances between these two terms have caused great confusion and, accordingly, a number of wrong steps in education. Therefore, it is necessary to evaluate and report the factors related to the use of distance education during the pandemic (Sukendro et al., 2020).

Since the beginning of the COVID-19 pandemic, researchers from around the world have published hundreds of articles each day, providing evaluations about how the pandemic has affected various fields, such as health, education, and the environment. Thus, scientific production related to COVID-19 has increased incrementally in various databases. One evaluation gauged the annual growth rate in publications during this time period at 12.4% (Yalçın & Şeker, 2020). For this reason, researchers are turning to bibliometric data to facilitate navigation in scientific databases and to identify and synthesize research findings (Casado-Aranda et al., 2020). Bibliometric data provides important strategic information for the evaluation and reporting of research results (Mohadab et al., 2020). In addition, a bibliometric approach may provide insights into scientific studies on distance education in higher education as a whole. When the currently available bibliometric analyses on the effects of COVID-19 are examined, it becomes apparent that the most popular field for published research in this area is medicine. For example, Yang et al. (2020) used bibliometry to analyze research on traditional Chinese medicine during the COVID-19 period to provide references for further research. Yu et al. (2020) analyzed the literature on COVID-19 published between 2019 and 2020 in the Web of Science database, providing an overview of the results, keywords, journals, authors, and number of citations. In addition, Casado-Aranda et al. (2020), in the first bibliometric study on COVID-19 and the environment, examined how the pandemic affected publications in environmental science. The results of this study set an agenda for future research by providing a starting point for academics in the field of environmental studies to assess the effects of COVID-19. Similarly, Sigala (2020) critically reviewed previous and emerging literature to help professionals and researchers better understand, manage, and evaluate both the tourism impacts and transformational appropriateness of COVID-19. Aristovnik et al. (2020) conducted a comprehensive bibliometric analysis of COVID-19 research in science and social science settings. Felice and Polymeni (2020) analyzed the intersections of the COVID-19 pandemic and machine learning using bibliometric analysis, explaining that such a study can improve the understanding and management of COVID-19 by providing references to publication outputs, countries, institutions, journals, keywords, funding, and citation counts.

Although the literature provides several examples of bibliometric analyses on COVID-19, no study has used such methods to examine the trends of distance education-related publications in the midst of COVID-19 and compare them with those of the pre-pandemic period. The present study provides the opportunity to observe the effects of COVID-19 on distance education studies by getting a "bird's eye view" of the state of this research, because bibliometric analysis has the potential to offer a very objective perspective on this issue. This study makes critical contributions to the literature by mapping information about the research field and guiding researchers by clarifying the connections between authors, publications, and other features of the field of study. The study findings can help researchers efficiently assess the previous

and current situation of education in the age of the COVID-19 and design new studies to fill key gaps. This study aims to examine COVID-19 effect on distance education in higher education in both before the COVID-19 pandemic (January to November 2019) and after (December 2019 and January–December 2020). Given the framework of this extraordinary situation, this study aimed to determine the trends of research on distance education in higher education within a one-year period. In this context, the following research questions framed our study (questions address both the pre-pandemic period of January to November 2019 and the post-pandemic periods of December 2019 and January–December 2020):

1) What are the most used keywords in publications on distance education in higher education?
   a) What is the distribution of keywords in publications according to journals on distance education in higher education?
2) What are the most used words in abstracts and thematic structures of publications on distance education in higher education?

Research methods

This study used bibliometric mapping analysis. Bibliometric analysis allows tracing the paths of the studies, researchers, institutions, and scientific flow related to the determined scientific subject (Martí-Parreño et al., 2016). Bibliometric studies allow the identification of trends by quantifying key characteristics of research in a particular field and evaluating the results (Kasemodel et al., 2016). The reasearch in the present study was conducted in three stages: 1) obtaining the data sets, 2) analyzing the data sets using VOSviewer, and 3) analyzing the data sets using SciMAT.

Research design

This study aimed to examine the COVID-19 effect on distance education in higher education in the pre-COVID-19 pandemic period (January to November 2019) and post-COVID-19 pandemic periods (December 2019 and January–December 2020). The keywords and databases were determined in light of this aim. First, the Web of Science (WoS) database was searched using the following queries:

[("higher education" OR "university*" OR "college" OR "undergrad*" OR "graduate" OR "postgrad*" OR "corporate training" OR "professional training" OR "adult education" OR "vocational education" OR "medical school*" OR "medical student*" OR "dental education")] ***AND*** [("online learning" OR "online teaching" OR "online education" OR "online course*" OR "open learning" OR "open and distance learning" OR "distance learning" OR "distance education" OR "elearning" OR "e-learning" OR "internet based learning" OR "internet based instruction" OR "internet based education" OR "virtual learning" OR "virtual education" OR "web based learning" OR "web based instruction" OR "web based education" OR "distance course*" OR "internet based course*" OR "web based course*" OR "web based class**" OR "internet based class*" OR "Online class*" OR "virtual class*" OR "online community" OR "Digital learning"

OR "Digital education" OR "Digital instruction" OR "Digital course*" OR "Virtual learning" OR "Virtual education" OR "Virtual instruction" OR "Digital class*" OR "learning management system" OR "LMS" OR "MOOC*" OR "Massive Open Online Course*")] ***NOT*** [("K-12" OR "kindergarten" OR "primary school" OR "middle school" OR "secondary school" OR "school" OR "high school" OR "reception" "R-12" "junior primary" OR "elementary school" OR "middle primary" OR "upper primary" OR "senior school")] in the abstract section, using the advanced search function. This search yielded a total of 20,043 papers published as of December 20th, 2020. Many of these initial search results were not related to the purpose of the study. For this reason, the search was refined using limitations regarding the year, publication type, language, index, and categories in the WoS database. According to the aims of this study, publication date was the most important limitation. Since this study aimed to compare papers published in the pre- and post-pandemic periods, two separate data sets were created according to the years.

Data set created from the search for the pre-COVID-19 pandemic period (January–November 2019)

The query described in this section was used to identify articles for the pre-pandemic period data set. The initial search examined only the abstract sections of papers, using the "advanced search" feature in WoS. Published articles related to distance education in higher education between "January and November in 2019" were included. This first search obtained a total of 1,936 articles. Next, the document type was filtered by "journal articles", and the number of publications decreased to 1,062. The third limitation was filtering by the English language, which reduced the total number of articles to 941. The "SSCI, SCI-EXPANDED, A&HCI and ESCI" indexes were selected in the database the fourth limitation, decreasing the number of articles to 927. Lastly, the search results were limited to the "education research" and "education scientific disciplines" categories, narrowing down the number of articles to 580. These 580 articles formed the first data set (Figure 1).

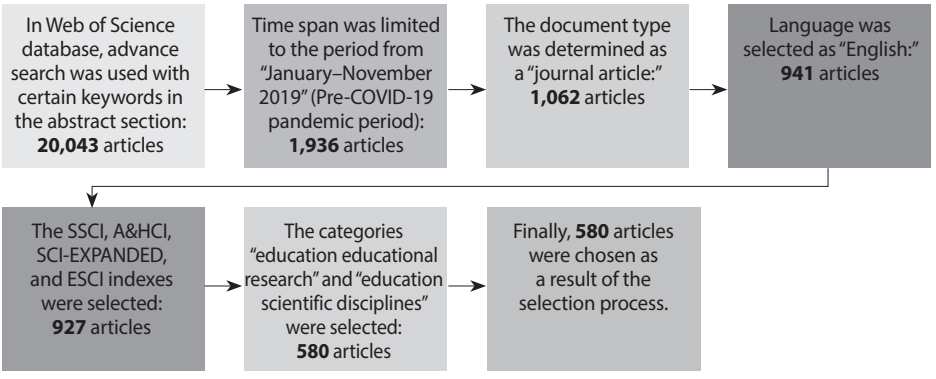

Figure 1. Article selection process for publications from the pre-pandemic period (first data set)

Data set created from the search for the post-COVID-19 pandemic periods (December 2019 and January–December 2020)

The query described in this section was used to identify articles for the post-pandemic period data set. The initial search examined only the abstract sections of papers, using the "advanced search" feature in WoS. Published articles related on distance education in higher education from the periods of "December 2019 and January-December in 2020" were included. This first search obtained a total of 1,547 articles. Next, the document type was filtered by "journal articles", and the number of publications decreased to 1,353. The third limitation was filtering by the English language, which reduced the total number of articles to 1,235. The "SSCI, SCI-EXPANDED, A&HCI and ESCI" indexes were selected in the database as the fourth limitation, decreasing the number of articles to 1,231. Lastly, the search results were limited to the "education educational research" and "education scientific disciplines" categories, narrowing down the number of articles to 746. These 746 articles formed the second data set (Figure 2).

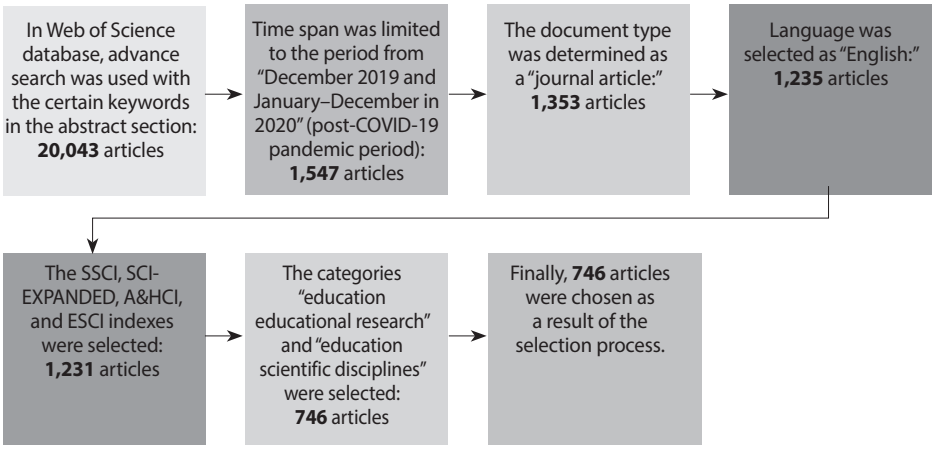

Figure 2. Article selection process for the post-COVID-19 pandemic period (second data set)

Data analysis

Using these data sets, patterns based on mathematical relationships were revealed through visualization methods based on bibliometric data. There are many programs available for bibliometric analysis; this research used VOSviewer and SciMAT for visualization mapping. The first step in the bibliometric analysis process involved creating the data sets for the study. Next, the full data sets were downloaded in the tab-delimited (Win) file format from the Web of Science database and the files were uploaded to the VOSviewer. Additionally, these data sets were downloaded in another file format from the Web of Science database and that file was uploaded to SciMAT. Finally, the bibliometric analysis was conducted in both programs.

The VOSviewer

VOSviewer is a software tool for constructing and visualizing bibliometric networks at the level of journals, researchers or individual publications (Van Eck & Waltman, 2017). In this study, the VOSviewer was used to construct network visualizations of keywords, words in abstracts, authors, publications, and journals between 2019 and 2020. Co-ccurence analysis was performed with VOSviewer to present the most used keywords and words in the article abstracts between 2019 and 2020. Co-occurrence analysis of keywords reveals the research area's development over time (Göksu, 2021; Zhao, 2017), and it can reflect research hotspots in different disciplines and fields (Li et. al., 2016).

SciMAT

SciMAT is an open-source program which incorporates methods, algorithms, and measures for all the steps in the general science mapping workflow, from preprocessing to the visualization of results (Cobo et al., 2012). As opposed to the VOSviewer tool, in SciMAT researchers can create strategic diagrams to reveal the thematic tendency for a specific period through co-word analyses. Cobo et al. (2012) explained that a strategic diagram contains four themes: "motor themes at upper right," "basic and transversal themes at lower right," "highly developed and isolated themes at upper left," and "emerging or declining themes at lower left." Thus, researchers should pay attention to the upper right and lower right regions of the strategic diagram to understand which themes come to the fore in studies during the period of interest. While the clusters in the upper right part of the diagram show the most basic study areas of the period under investigation, the clusters in the lower right show the areas that continue their development during the period (Cobo et al., 2012).

Harzing's Publish or Perish

Publish or Perish is a program that enables researchers to analyze academic citations from a variety of data sources, such as the Web of Science, Scopus and Google Scholar. Publish or Perish can analyze different metrics, including the h-index, from raw citations (Harzing, 2016). The researchers preferred Publish or Perish to analyze the h-index for the data obtained from the Web of Science for this study.

Research results

Most common keywords in publications and the distribution of keywords in publications according to journals on distance education in higher education

To construct the map of the most commonly used keywords and major thematic clusters, co-occurrence analysis was conducted using VOSviewer. Studies on the pre- (January to November in 2019) and post-COVID-19 pandemic periods (December 2019 and January–December 2020) are represented separately in the following figures.

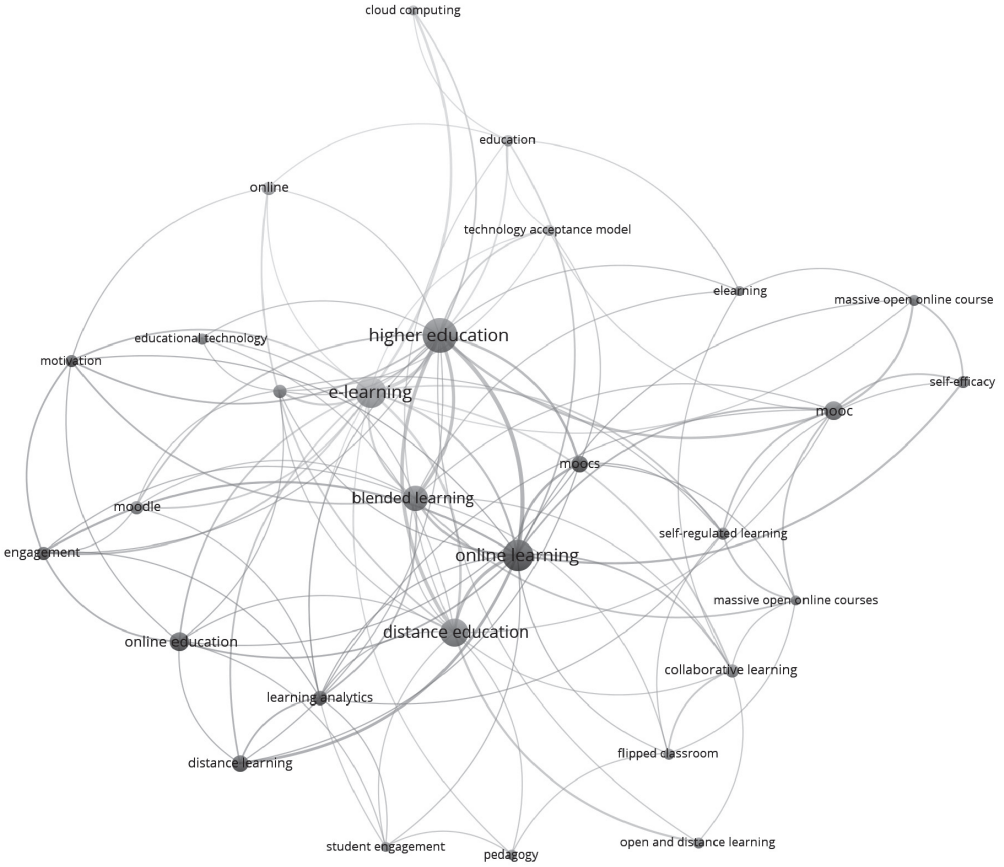

Figure 3. The network visualization map of co-occurrence of keywords for distance education in higher education from January to November 2019 (during the pre-COVID-19 pandemic period)

Note: Only keywords with seven or more occurrences were included (n=29).

A total of 1,750 different keywords were used in 580 articles published about distance education in higher education from January to November 2019 (the pre-COVID-19 pandemic period). To better identify themes and clusters, the minimum number of occurrences of a keyword was adjusted to seven. According to the co-occurrence analysis, 29 keywords within five clusters met the criteria (Figure 3). As seen in Figure 3, the largest cluster, presented in red, included online learning, MOOC, online education, learning analytics, distance learning, engagement, and motivation as its most used keywords.

A total of 2,160 different keywords were used in 746 publications about distance education in higher education in December 2019 and January–December 2020 (during the post-pandemic period). To better identify themes and clusters, the minimum number of occurrences of a keyword was adjusted to seven. According to the co-occurrence

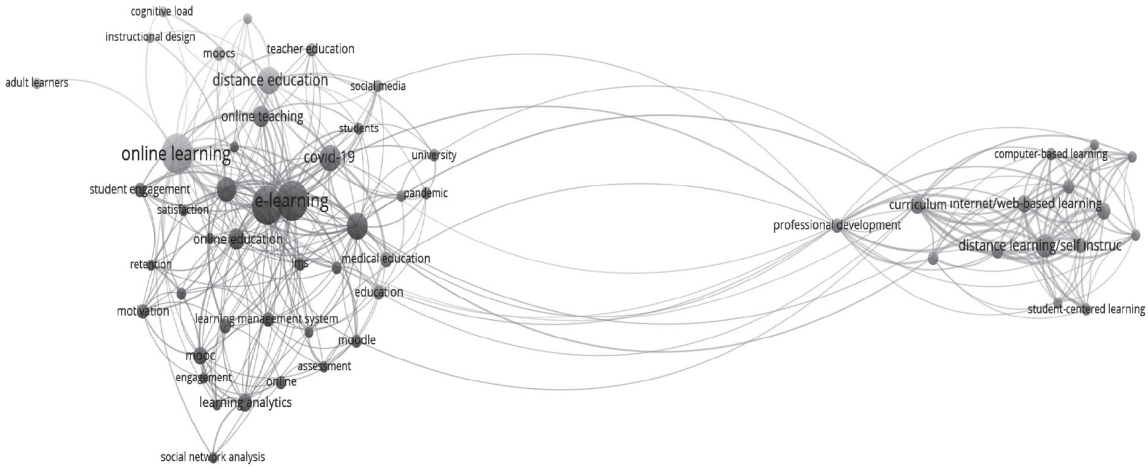

Figure 4. The network visualization map of co-occurrence of keywords regarding distance education in higher education in December 2019 and January–December 2020 (during the post-pandemic period)

Note: Only keywords with seven or more occurrences were included (n=57).

analysis, 57 keywords within five clusters met the criteria (Figure 4). As seen in Figure 4, the largest cluster, presented in red, comprised the following most commonly used keywords: e-learning, higher education, online education, learning analytics, MOOC, learning management system, Moodle, student engagement system, and motivation.

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Next, the most used keywords in articles on distance education in higher education from the pre-pandemic period (January to November 2019) were examined through the co-occurrence analysis (see Figure 3). This stage of the analysis also examined which journals used these keywords the most. The findings are presented in Table 1. In 2019, "higher education" was the most used keyword, frequently appearing in *Education and Information Technologies* and the *Social Sciences, Humanities and Education Journal*. Moreover, the second most common keyword, "e-learning," was used in five different journals (IJETL, EIT, ITSE, ILE and TOJDE).

Table 1

Top keywords used by article authors from January to November 2019 (during the pre-pandemic period)

Authors' Keywords	Occurrences	Total Link Strength	The Most Mentioned Journals
Higher Education	69	58	EIT (8), SHE (4)
E-Learning	57	46	IJETL (10), EIT (8), ITSE (5), ILE (4), TOJDE (4)
Online Learning	56	53	OL (6), ILE (4)
Distance Education	47	33	IRRODL (11), TOJDE (9)
Blended Learning	38	28	BMCME (4)
Online Education	23	12	-
MOOC	21	19	IJETL (8)
Distance Learning	17	12	JIME (4)

Note: Only keywords with seven or more occurrences were included in the list (n=29).

* EIT=Education and Information Technologies, SHE=Social Sciences, Humanities and Education Journal, ITSE=Interactive Technology and Smart Education, IRRODL=International Review of Research in Open and Distributed Learning, BMCME=BMC Medical Education, ILE=Interactive Learning Environments, IJETL=International Journal of Emerging Technologies in Learning, TOJDE=Turkish Online Journal of Distance Education, OL=Online Learning, JIME=Journal of Interactive Media Education

- This search demonstrated that the specified keyword was not mentioned in any journal four or more times.

Table 2

Top keywords used by article authors in December 2019 and January–December 2020 (during the post-pandemic period)

Authors' Keywords	Occurrences	Total Link Strength	The Most Mentioned Journals
E-learning	93	85	EIT (16), IJETL (15), BMCME (5), ES (4)
Online Learning	92	95	OL (14), ETRD (8), OP (5), CE (4), EJEL (4), TT(4)
Higher Education	88	96	EIT (13), IJETHE (4)
Distance Education	44	40	TOJDE (11), EIT (5)
COVID-19	42	49	BMBE(7), ES(5), RRPEM(4)
Distance Learning	41	50	JCE (33)
Blended Learning	36	37	EIT (4)
Distance Learning/ Self-Instruction	32	101	JCE (26)

Note: Only keywords with seven or more occurrences were included in the list (n=57).

* EIT=Education and Information Technologies, IJETL=International Journal of Emerging Technologies in Learning, BMCME=BMC Medical Education, ES=Education Sciences, OL=Online Learning, RRPEM=Revista Romaneasca Pentru Educatie Multidimensionala, CE=Computers & Education, ETRD=Educational Technology Research and Development, EJEL=Electronic Journal of E-Learning, OP=Open Praxis, TT=TechTrends, TOJDE=Turkish Online Journal of Distance Education, IJETHE=International Journal of Educational Technology in Higher Education, BMBE=Biochemistry and Molecular Biology Education, JCE=Journal of Chemical Education,

- This search demonstrated that the specified keyword was not mentioned in any journal four or more times.

The most commonly used keywords in articles on distance education in higher education from the post-pandemic period (December 2019 and January–December 2020) were examined through co-occurrence analysis (see Figure 4). This stage of

analysis also examined which journals used these keywords the most. The findings are presented in Table 2. In 2020, "e-learning" was the most used keyword, frequently appearing in five journals (EIT, IJETL, BMCME and ES). The second most commonly used keyword, "online learning," appeared in six journals (OL, ETRD, OP, CE, EJEL and TT)

Most used words in abstracts and thematic structures of publications on distance education in higher education

The co-word analysis was used to identify the major thematic clusters across the data sets. The pre-pandemic (January to November 2019) and post-pandemic (December 2019 and January–December 2020) time periods were analyzed separately. The co-word analysis was conducted using SciMAT software, by creating strategic diagrams to represent the thematic structure of trends from both periods. The strategic diagrams for the 2019 and 2020 periods are presented below as Figures 5 and 6, respectively.

Figure 5. The strategic diagram for the pre-pandemic period

The strategic diagram for the pre-pandemic period (January to November 2019) is shown in Figure 5. Five motor themes - "satisfaction," "students," "e-learning," "models," and "determinants" - were located in the upper right quadrant of the diagram, while almost no clusters can be seen in the lower right quadrant. This demonstrates that the researchers in this area paid more attention to these themes than the others depicted in Figure 5. Table 3 presents detailed quantitative data about nodes and clusters from the pre-pandemic period strategic diagram.

Table 3
The nodes of the clusters in the strategic diagram for the pre-pandemic period

Rank	Cluster	Documents	h-index	Citations	Words
1	Satisfaction	77	8	248	Moodle, online, higher education, performance, technology, satisfaction, outcomes, self-efficacy, technology acceptance, management, adult learners, predictors
2	Students	75	8	248	students, environment, motivation, classroom, perceptions, teacher, system, massive online open courses, blended learning, engagement, design, faculty
3	E-learning	43	6	133	e-learning, attitudes, learning-management system, education, university, strategies, self-regulated learning, cloud computing, gamification, information, integration, McLean model
4	Online-learning	42	4	80	Online learning, online courses, distance education, achievement, distance learning, community, success, collaborative learning, cognitive load, social presence, health, mobile learning
5	Models	40	7	200	models, behaviour, challenge, impact, adoption, user-acceptance, framework, college, implementation, language, scale, usage
6	Determinants	23	7	124	behavioural intention, acceptance, information technology, technology-acceptance model, continuance-intention, extension, determinants, perceived ease, college-students, efficacy, online teaching, validation
7	Courses	18	4	45	MOOCs, online education, participation, skills, courses, perspectives, flipped classroom, persistence, gender, time, readiness, trends
8	Pedagogy	15	3	25	competences, ICT, quality, instructional design, pedagogy, student engagement, Facebook, support, media, pedagogical content knowledge, principles, feedback
9	Experience	11	3	20	sciences, experience, knowledge, learners, retention, medical education, instruction, academic achievement, age
10	Educational data-mining	3	1	4	Learning analytics, educational data-mining, academic performance
11	Open-and distance learning	3	1	2	distance, open and distance education, context, open universities
12	Educational technology	2	1	2	Educational technology, professional development, usability

Table 3 indicates that psychometric variables related to learners were used more by researchers as keywords during the pre-pandemic period than various e-learning tools, models or designs.

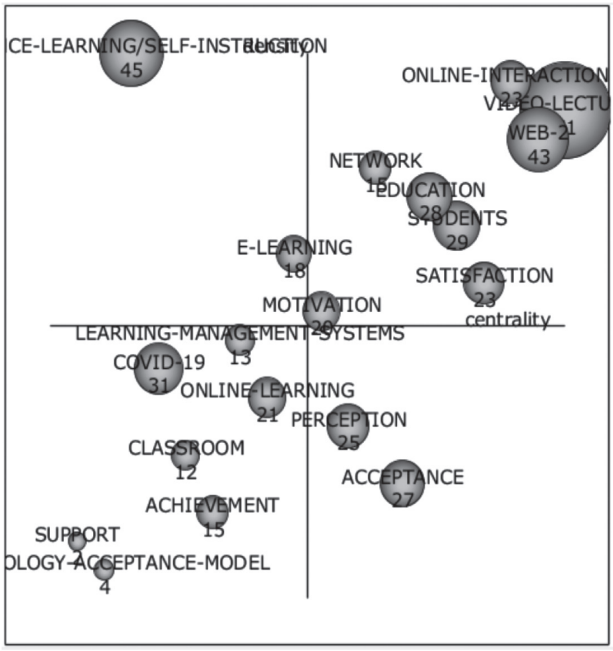

Figure 6. The strategic diagram for the post-pandemic period

The strategic diagram for the post-pandemic period (December 2019 and January–December 2020) is shown in Figure 6. Seven motor themes, i.e. "video lectures," "web-2," "students," "education," "online interaction," "satisfaction," and "network" were located in the upper right quadrant of the strategic diagram. Moreover, the two developing themes of "acceptance" and "perception" were located in the lower right quadrant. This demonstrates that the researchers in this area paid more attention to these themes than the others depicted in Figure 6. Table 4 presents detailed quantitative data about nodes and clusters from the strategic diagram for the post-pandemic period.

Table 4 indicates that technologies, tools, design models, learning/teaching design with e-learning, and delivery of learning were used more by researchers as keywords during the post-pandemic period than psychometric variables related to learners. The "acceptance" and "perception" themes in the lower right quadrant of the strategic diagram show that the themes related to the psychometric properties of learners were developing themes during this period.

Table 4
The nodes of the clusters in the strategic diagram for the post-pandemic period

Rank	Cluster	Documents	h-index	Citations	Words
1	Video-lectures	71	4	56	impact, MOOC, design, video lectures, online, performance, engagement, quality, instruction, cognitive load, interaction, media

Rank	Cluster	Documents	h-index	Citations	Words
2	Distance learning / Self-instruction	45	2	14	Distance learning/self-instruction, internet/web-based learning, first-year undergraduate/general, second-year undergraduate, laboratory instruction, general-public, computer-based learning, general-public, student-centered learning, upper-division undergraduate, collaborative/ cooperative learning, testing/ assessment, interdisciplinary/ multidisciplinary
3	Web 2.0	43	2	18	attitudes, system, resources, web-2, platform, ICT, teachers, higher education, technology, knowledge, curriculum, framework
4	COVID-19	31	2	23	COVID-19, science, formative assessment, higher education institution, distance learning, online teaching, student engagement, medical education, pedagogy, pandemic, assessment, engineering education
5	Students	29	4	37	students, environment, intention, Kahoot, meta analysis, accent, rating, synchronous learning, computer self-efficacy, continuance, social network analysis, anxiety
6	Education	28	2	21	Instructional designers, simulations, videos, gender differences, behaviour, lectures, virtual classrooms, virtual patients, education, Facebook, augmented reality, teaching
7	Acceptance	27	1	10	learners, virtual learning environments, university, acceptance, information technology, success, usage, mobile learning, COVID-19 pandemic, integration, management, virtual reality
8	Perception	25	2	9	perception, learning environments, pre-service teachers, experiences, structural equation model, structural equation modelling, core, student evaluation, feedback, teacher education, adult learners, intrinsic motivation

Rank	Cluster	Documents	h-index	Citations	Words
9	Online interaction	23	1	8	model, online interactions, flipped classrooms, behavioural intention, self-regulated learning, user-acceptance, outcomes, professional development, determinants, technology acceptance, face-to-face, antecedents
10	Satisfaction	23	3	28	e-learning, utaut, scale, satisfaction, social presence, instructional design, validity, context, reliability, usability, mathematics, procrastination
11	E-learning	18	2	14	e-learning, learning outcome, decision tree, Moodle, health, educational data mining, association, electronic resources, learning materials, continuance intention, gamification, quality assurance.
12	Achievement	15	2	12	skill, college, VLE, achievement, learning analysis, self-efficacy, community, student satisfaction, patterns, multimedia-based-learning, learning

Discussion and conclusion

The COVID-19 pandemic that started in Wuhan, China in December 2019 has since spread all over the world. At the World Health Organization's urging, schools were closed in many countries, and distance education was implemented to reduce the pandemic's spread (WHO, 2020). According to UNESCO's data, schools were closed in 188 countries as of 7 April 2020, which affected 92% of the global student population (Ertuğ, 2020). Many countries have continued distance education due to the COVID-19 pandemic, which has affected millions for more than a year, as of February 2021. Given this situation, the present research sought to examine the studies on distance education at the higher education level both pre- and post-COVID-19 pandemic. The study also aimed to identify the effect of COVID-19 on distance education in higher education both during and within a year after such an extraordinary situation. Based on these goals, the studies published in the pre- and post-pandemic period were compared and interpreted through bibliometric analysis.

This study first sought to answer the research question on *the most used keywords in publications on distance education in higher education between January and November 2019 (during the pre-pandemic period), and in December 2019 and January to December 2020 (during the post-pandemic period).* The co-occurrence analysis conducted based on this research question indicated that "higher education," "e-learning," "online learning," and "distance education" were the most popular keywords in both 2019

and 2020, although the ranking of these keywords changed over time. The keyword "e-learning" was used at least four times in five different journals (IJETL, EATL, ITSE, ILE and TOJDE) for a total of 31 instances in 2019, while it was used at least four times in four different journals (EAIT, IJETL, BMCME and ES) for a total of 40 instances in 2020 (see Tables 1 and 2). Moreover, the keyword "online learning" was also used at least four times in two different journals for a total of ten instances in 2019, and 39 times in six different journals in 2020 (see Tables 1 and 2). Moore (1990, p. xv) defines distance education as "all arrangements that provide education to people participating in planned learning, different from the place and time of the instructor or instructors, through printed or electronic communication media." The term "distance education" is a more comprehensive concept involving e-learning and online learning. Bates (2005) states that while e-learning involves any telecommunications tool or computer-based learning, online learning uses the internet in particular (Bağrıaçık-Yılmaz & Karataş, 2020).

While e-learning achieved a growth of 15.4% in educational institutions before COVID-19, it has increased by 60% after the pandemic (Alqahtani & Rajkhan, 2020). This result is consistent with our research findings. Studies on distance education in higher education show that the most used keyword in 2019 was "higher education," while in 2020 it was "e-learning." Even the educational institutions that did not invest in e-learning or improve their existing infrastructure, due to past prejudices, have compulsorily switched to e-learning after the COVID-19 pandemic (Telli & Altun, 2020). For this reason, this compulsory distance education situation has been called "emergency remote education" in the literature (Gewin 2020; Keskin & Derya, 2020; Lau et al., 2020). While emergency distance education is seen as a necessity, distance education conducted before COVID-19 was seen as an option (Bozkurt, 2020). Another important finding of the present study is that although the COVID-19 keyword was not used in the search (see the methods section of this article), during the data set stage, it appeared as the fifth most common keyword in 2020 according to the analysis results (see Figure 2). While this situation shows the impact of COVID-19 on distance education, it also explains that studies on the COVID-19 pandemic's effects on higher education focus on distance education.

Second, this study sought an answer to the question on *what the most used words were in the abstracts and thematic structures of the publications on distance education in higher education between January and November 2019 (during the pre-pandemic period) and December 2019 and January–December 2020 (during the post-pandemic period).* To answer this research question, a co-word analysis was performed using SciMAT. In 2019, researchers showed more interest in various psychometric variables related to distance learners (see Figure 5 and Table 3), rather than in variables such as distance learning tools, education models, and teaching models. In 2020, however, researchers mostly focused on the media and technologies used in the delivery of instruction, video courses, technology-supported courses, distance learning tools such as human-computer interaction, and issues around instructional design, rather than various

psychometric variables related to distance learners (see Figure 6 and Table 4). Studies in the field show that after the 2000s, distance education research turned towards technology-related studies rather than pedagogical studies (Bozkurt et al., 2015; Zawacki-Richter & Naidu, 2016). The results of this study are partially consistent with the findings of Bozkurt et al. (2015) and Zawacki-Richter and Naidu (2016). However, although some studies explored variables related to technology during the pre-pandemic period, research trends that focused on learners came to the fore at this time (see Figure 5 and Table 3). Moreover, the fact that distance education before the pandemic was mostly voluntary may explain the results of the pre-pandemic period as the success of distance education is directly related to the learners' willingness and the acceptance of the various used technologies and processes (Almaiah & Alismaiel, 2019). For this reason, the presence of student-oriented studies can be explained by the desire to increase learner satisfaction.

In conclusion, the present study examined how the COVID-19 pandemic affected distance education in higher education. The change in published articles over the course of the two years before and after the COVID-19 pandemic was analyzed and discussed, providing significant results. Remarkably, there were fewer studies about distance education in higher education (580) published during the pre-pandemic period than those carried out during the post-pandemic period (746), in line with the specified limitations. The studies about distance education in higher education both pre- and post-pandemic focused on the keywords of "higher education," "e-learning," "online learning," and "distance education." In fact, although the COVID-19 keyword was not used in the search process during the data set creation phase, according to the analysis results, it appeared as the fifth most common keyword in 2020. While studies were carried out on students' motivation and self-regulation skills during the pre-pandemic period, there was a trend towards studies related to the learning environment, media, and delivery of instruction after the pandemic.

No bibliometric examination can provide a complete picture of the development and current state of the study area. This study is no exception; therefore, its findings are limited to its scope. The most important limitation of this study involves the process of creating its data sets. Based on our research findings and limitations, the trends in scholarship from 2019 to 2021 can be examined for a better understanding of the impact of the pandemic. Using bibliometric analysis data presented in this paper, researchers can understand the changing scholarly landscape in the wake of the COVID-19 pandemic and use this knowledge to explore the research gaps and conduct further studies on the subject. Expanding this work by using alternative databases (e.g., Scopus, ERIC, PsyInfo, PubMed) and including additional publication types (e.g., book chapters, conference papers) should also be considered. In addition, given that the pandemic affects all educational institutions, research trends can be revealed at different education levels (e.g., K-12, preschool, lifelong learning). There are still gaps in this literature that require more in-depth research.

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Učinci COVID-19 pandemije na obrazovanje na daljinu u visokom obrazovanju: bibliometrijsko istraživanje

Sažetak

Ovo istraživanje imalo je za cilj ispitati učinke COVID-19 pandemije na obrazovanje na daljinu u području visokoga obrazovanja u periodu prije COVID-19 pandemije (od siječnja do studenoga 2019.) i poslijepandemijskom razdoblju (prosinac 2019. i od siječnaj do prosinca 2020.). Za analizu korištena su dva niza metapodataka koji su obuhvatili 580 radova iz predpandemijskoga perioda i 746 radova iz razdoblja nakon pandemije izazvane Covid-19 virusom, a dobiveni su pretraživanjem Web of Science baze podataka. SciMAT i Vosviewer programi korišteni su za provođenje bibliometrijske analize. Uspoređene su publikacije iz dva spomenuta razdoblja u odnosu na ključne riječi i riječi iz sažetaka, prema kriterijima zasnovanim na analizi zajedničkih riječi i njihova istodobnoga pojavljivanja. Rezultati istovremenoga pojavljivanja ključnih riječi pokazuju da su riječi „e-učenje" i „online učenje" više korištene u poslijepandemijskom nego u predpandemijskom razdoblju, u kojemu su se teme istraživanja u velikoj mjeri odnosile na studente i zadovoljstvo. Ipak, u postpandemijskom razdoblju sklonost istraživača većinom se odnosila na teme poput videopredavanja i mrežne 2.0 tehnologije. Rezultati istraživanja pokazuju da je učinak pandemije COVID-19 vidljiv u istraživanjima objavljenima u poslijepandemijskom razdoblju, s porastom interesa za e-učenje i online učenje u visokom obrazovanju te većom sklonosti istraživanju osiguravanja poučavanja nego tema vezanih za studente.

Ključne riječi: *COVID-19 pandemija, e-učenje, obrazovanje na daljinu, online učenje, visoko obrazovanje.*

Uvod

Pandemija COVID-19 dovela je društveni i ekonomski život gotovo do potpunoga zastoja, uzrokujući značajne promjene u nacionalnim ekonomijama, zdravstvenim sustavima, obrazovnim institucijama te privatnim i javnim tržištima. Paralelno s propadanjem globalne ekonomije zbog zamaha pandemije, neke su zemlje svjedočile urušavanju vlastitih zdravstvenih sustava i štetnim posljedicama pandemije na njihov obrazovni sustav. Prema izvješću UNESCO-a približno je 107 zemalja zatvorilo sve

škole zbog pandemije (Organizacija ujedinjenih naroda za obrazovanje, znanost i kulturu, 2020). Uz zatvaranje škola u mnogim dijelovima svijeta na višemjesečne periode, normalan tijek obrazovnih aktivnosti značajno se promijenio, a ta je situacija negativno utjecala na 94 % ukupne globalne populacije učenika (De Giusti, 2020). Prema podatcima UNESCO-a (2020) približno 1,6 milijardi učenika svih razreda iskusilo je štetne utjecaje pandemije u više od 190 zemalja.

Pandemija COVID-19 također je negativno utjecala na visoko obrazovanje (UNESCO, 2020). Na primjer, Nacionalna sveučilišna komisija (NUC) u Nigeriji zatvorila je sva sveučilišta (Ezeri, 2020). Slično tome, vlasti u Maleziji odlučile su obustaviti sve aktivnosti učenja i poučavanja, uključujući one u *online* okruženjima (Azijsko-pacifičko sveučilište za tehnologiju i inovacije, 2020). Ipak, Australija je radije koristila alternativne stilove učenja (u rasponu od sinkronoga, preko asinkronoga, do nastave licem-u-lice) prije nego potpuno zatvaranje institucija visokoga obrazovanja. Mnoga sveučilišta u Egiptu, Hong Kongu i Kini direktno su prešla na *online* učenje. Kada je obustavljeno obrazovanje na Sveučilištu Passau u Njemačkoj, administratori su izjavili da usmeni ispiti ne bi trebali biti organizirani putem Skypea, Face Timea ili drugih digitalnih sredstava jer nemaju zakonsku osnovu.

Zatvaranje škola ubrzalo je rastući interes i pokret promjene prema izvanrednom obrazovanju na daljinu (ERT) u obrazovnim paradigmama mnogih zemalja (Bozkurt i Sharma, 2020; Di Pietro, 2020; Martinez, 2020). Ova promjena može se promatrati kao veliki eksperiment obrazovanja na daljinu, otkrivajući što zaista funkcionira, a što ne (Zimmerman, 2020). Iako se može činiti da su ERT i obrazovanje na daljinu ista stvar, između njih, u stvari, postoje ključne razlike (Bozkurt i Sharma, 2020; Bozkurt i sur., 2020; Hodges i sur., 2020). Dok je obrazovanje na daljinu opcionalna, planirana aktivnost zasnovana na teorijskom i praktičnom znanju, izvanredno obrazovanje na daljinu (ERT) je obavezno „obrazovanje preživljavanja" koje koristi sva dostupna sredstva, uključujući *offline* i/ili *online* alate, u kriznim vremenima (Bozkurt i sur., 2020). Osim toga, glavna je svrha ERT-a smanjivanje prostorne udaljenosti kako bi se osigurala postojanost obrazovanja. Suprotno tome, glavna je svrha obrazovanja na daljinu smanjivanje operativne/psihološke udaljenosti kako bi se omogućila postojanost poučavanja i učenja. Tijekom ove pandemije krivo tumačene nijanse razlike između ova dva pojma uzrokovale su veliku zbunjenost i, prema tome, određeni broj krivih koraka u obrazovanju. Stoga je nužno evaluirati obrazovanje na daljinu u vremenu pandemije i navesti čimbenike povezane za njegovu upotrebu (Sukendro i sur., 2020).

Od početka COVID-19 pandemije istraživači širom svijeta svakodnevno su objavljivali stotine radova, dajući prikaz načina na koji je pandemija utjecala na razna područja, poput zdravstva, obrazovanja i okoline. Na taj se način korpus znanstvenih studija o COVID-19 pandemiji u raznim bazama podataka značajno povećao. Jedna procjena pokazuje da je godišnji rast znanstvenih publikacija tijekom ovoga perioda 12,4 % (Yalçın i Şeker, 2020). Zbog toga se istraživači okreću bibliometrijskim podatcima kako bi omogućili snalaženje u znanstvenim bazama podatka te utvrdili i sintetizirali

rezultate istraživanja (Casado-Aranda i sur., 2020). Bibliometrijski podatci pružaju važnu stratešku informaciju za evaluaciju i izvještavanje rezultata istraživanja (Mohadab i sur., 2020). Osim toga, bibiliometrijski pristup može pružiti uvid u znanstvene studije o obrazovanju na daljinu u visokom obrazovanju kao cjelini. Kada se ispitaju trenutačno dostupne bibliometrijske analize o učincima COVID-19 pandemije, postaje očito da je najpopularnije polje za objavljena bibliometrijska istraživanja medicina. Na primjer, Yang i suradnici (2020) koristili su bibliometrijski pristup kako bi analizirali tradicionalnu kinesku medicinu tijekom COVID-19 perioda s ciljem osiguravanja referenci za buduća istraživanja. Yu i suradnici (2020) analizirali su literaturu o pandemiji COVID-19 objavljenu između 2019. i 2020. godine u WoS bazi podataka, dajući pregled rezultata, ključnih riječi, časopisa, autora i brojne citate. Osim toga, u prvom bibliometrijskom istraživanju COVID-19 pandemije i okoline, Casado-Aranda i suradnici (2020) ispitali su utjecaj pandemije na publikacije u području znanosti o okolišu. Rezultati ove studije programiraju buduća istraživanja pružajući polazište za akademike u polju istraživanja okoline da procijene učinke COVID-19 pandemije. Slično tome, Sigala (2020) je dao kritički pregled prijašnje i trenutačne literature kako bi pomogao stručnjacima i istraživačima da bolje razumiju, upravljaju i evaluiraju učinke COVID-19 pandemije na turizam i mogućnosti njihove transformacije. Aristovnik i suradnici (2020) proveli su opsežnu bibliometrijsku analizu istraživanja COVID-19 pandemije u znanstvenom okruženju i okruženju društvenih znanosti. Felice i Polymeni (2020) analizirali su sjecišta COVID-19 pandemije i strojnoga učenja koristeći bibliometrijsku analizu te objasnili da takvo istraživanje može poboljšati razumijevanje i upravljanje COVID-19 pandemijom, pružajući reference koje obuhvaćaju stvaranje publikacija, zemlje, institucije, časopise, ključne riječi, financiranje i broj citata.

Iako se u literaturi može pronaći nekoliko primjera bibliometrijskih analiza teme COVID-19, ni jedno istraživanje do sada nije koristilo takve metode kako bi ispitalo trendove publikacija o obrazovanju na daljinu usred pandemije i usporedilo ih s onima u razdoblju prije bolesti izazvane COVID-10 virusom. Ova studija daje priliku promatranja učinaka COVID-19 pandemije na istraživanja obrazovanja na daljinu koristeći ptičju perspektivu za promatranje stanja u istraživanju ove teme jer bibliometrijska analiza pruža vrlo objektivnu perspektivu ovoga pitanja. Ovo istraživanje daje vrlo važne doprinose literaturi locirajući informacije o istraživačkom području i vodeći istraživače putem objašnjavanja veze između autora, publikacija i drugih obilježja ovoga istraživačkog područja. Rezultati ove studije mogu pomoći istraživačima pri učinkovitoj procjeni prijašnjega i trenutačnoga stanja obrazovanja u dobu COVID-19 pandemije i osmišljavanju novih studija s ciljem ispunjavanja ključnih praznina. Ovo istraživanje nastoji ispitati učinke COVID-19 pandemije na obrazovanja na daljinu u području visokoga obrazovanja u periodu prije (od siječnja do studenoga 2019.) i nakon COVID-19 pandemije (prosinac 2019. i od siječnja do prosinca 2020.). S obzirom na ovu izvanrednu situaciju, cilj studije bio je utvrditi trendove u istraživanju obrazovanja na daljinu u visokom obrazovanju unutar jednogodišnjega perioda. U tom kontekstu

postavljena su sljedeća istraživačka pitanja (kako o predpandemijskom razdoblju od siječnja do studenoga 2019. godine, tako i u poslijepandemijskim razdobljima - prosinac 2019. i od siječnja do prosinca 2020. godine):

1) Koje su najčešće korištene riječi u publikacijama o obrazovanju na daljinu u području visokoga obrazovanja?
   a) Kakva je raspodjela ključnih riječi u publikacijama prema časopisima o obrazovanju na daljinu u području visokoga obrazovanja?
2) Koje su najviše korištene riječi u sažetcima i tematske strukture publikacija o obrazovanju na daljinu u području visokoga obrazovanja?

Istraživačke metode

U ovom istraživanju upotrijebljena je metoda bibliometrijske analize koja omogućuje praćenje puteva studija, istraživača, institucija i znanstvenoga tijeka vezanoga za određenu znanstvenu temu (Martí-Parreño i sur., 2016). Bibliometrijska istraživanja omogućuju utvrđivanje trendova kroz kvantificiranje ključnih svojstava istraživanja u određenom polju i evaluaciju rezultata (Kasemodel i sur., 2016). Istraživanje je provedeno u tri stadija: 1) prikupljanje skupina podataka, 2) analiziranje skupina podataka upotrebom VOSviewer programa i 3) analiziranje skupina podataka upotrebom SciMAT programa.

Dizajn istraživanja

U istraživanju se nastojalo ispitati učinak COVID-19 pandemije na obrazovanje na daljinu u području visokoga obrazovanja u periodu prije COVID-19 pandemije (od siječnja do studenoga 2019.) i periodima nakon pandemije (prosinac 2019. i od siječnja do prosinca 2020.). Ključne riječi i baze podataka određene su prema tome cilju. Prvo je pretraživana baza podataka Web of Science (WoS), prema sljedećim upitima:

[(„visoko obrazovanje" ILI „sveučilište*" ILI „fakultet" ILI „student*" ILI „apsolvent" ILI „poslijediplomski student*" ILI „korporativno obrazovanje" ili „stručno usavršavanje" ILI „obrazovanje za odrasle" ILI „strukovno obrazovanje" ILI „medicinska škola*" ILI „student medicine*" ILI „stomatološko obrazovanje")] ***I*** [(„online učenje" ILI „online poučavanje" ILI „online obrazovanje" ILI „online nastava*" ILI „otvoreno učenje" ILI „otvoreno učenje i učenje na daljinu" ILI „učenje na daljinu" ILI „obrazovanje na daljinu" ILI „eučenje" ILI „e-učenje" ILI „internetsko učenje" ILI „internetsko poučavanje" ILI „internetsko obrazovanje" ILI „virtualno učenje" ILI „virtualno obrazovanje" ILI „mrežno učenje" ILI „mrežna poduka" ILI „mrežno obrazovanje" ILI „kolegij na daljinu*" ILI „internetski kolegij*" ILI „mrežni kolegij*" ILI „mrežna nastava**" ILI „internetska nastava*" ILI „online nastava*" ILI „virtualna nastava*" ILI „online zajednica" ILI „Digitalno učenje" ILI „Digitalno obrazovanje" ILI „Digitalno poučavanje" ILI „Digitalni kolegij*" ILI „Virtualno učenje" ILI „Virtualno obrazovanje" ILI „Virtualno poučavanje" ILI „Digitalna nastava*" ILI „sustav upravljanja učenjem" ILI „LMS" ILI „MOOC*" OR „Masivni otvoreni online tečaj*")] ***NE*** [(„K-12" ILI „vrtić" ILI „osnovna škola" (primary school) ILI „niža srednja škola" ILI „srednja škola"

(secondary school) ILI „škola" ILI „srednja škola" (high school) ILI „recepcija" „R-12" "niža osnovna" ILI „osnovna škola" ILI „srednja osnovna" ILI „viša osnovna" ILI „viši razredi" (senior school)], u dijelu sažetka, koristeći naprednu funkciju pretraživanja. Ovom pretragom pronađeno je ukupno 20 043 radova objavljenih od 20. prosinca 2020. godine. Mnogi od tih početnih rezultata pretraživanja nisu bili povezani sa svrhom ovoga istraživanja. Iz toga razloga izmijenili smo pretragu ograničavajući godinu, vrstu izdanja, jezik, indeks i kategorije u WoS bazi podataka. Prema ciljevima ove studije, datum izdanja bio je najvažnije ograničenje. Budući da je cilj ovoga istraživanja bio usporediti radove objavljene u periodu prije i poslije pandemije, stvorena su dvije skupine podataka prema godinama.

Skupina podataka iz pretraživanja za period prije pandemije COVID-19 (od siječnja do studenoga 2019.)

Upit opisan u ovom dijelu korišten je kako bi se utvrdili radovi za skupinu podataka prije pandemije. Inicijalna pretraga putem značajke naprednoga pretraživanja u WoS-u odnosila se samo na sažetke radova. Uključeni su objavljeni radovi povezani s temom obrazovanja na daljinu u visokom obrazovanju objavljeni u periodu između siječnja i studenoga 2019. godine. Prvim pretraživanjem pronašlo se ukupno 1936 radova. Nakon toga se pristupilo filtriranju vrste dokumenata prema kriteriju „radovi u časopisima", nakon čega je broj publikacija opao na 1062. Treći korišteni filtar bio je engleski jezik, što je dodatno smanjilo ukupan broj radova na 941. SSCI, SCI-EXPANDED, A&HCI i ESCI indeksi odabrani su u bazi podataka kao četvrto ograničenje, što je smanjilo broj radova na 927. Posljednje, rezultati pretraživanja filtrirani su prema kategorijama „istraživanje obrazovanja" i „obrazovne znanstvene discipline", što je dodatno smanjilo broj radova na 580. Tih 580 radova čine prvu skupinu podataka (Slika 1).

Slika 1.

Skupina podataka stvorena pretraživanjem za periode poslije COVID-19 pandemije (prosinac 2019. i od siječnja do prosinca 2020.)

Pretraživanje opisano u ovom dijelu korišteno je kako bi se odredili znanstveni radovi za postpandemijski skup podataka. Inicijalna pretraga ispitivala je samo sažetke radova, koristeći značajku „napredno pretraživanje„ u WoS-u. Uključeni su objavljene studije o obrazovanju na daljinu u visokom obrazovanju iz perioda prosinac 2019. i siječanj do prosinac 2020. Prvo pretraživanje obuhvatilo je ukupno 1547 radova. Nakon toga, rezultati su filtrirani vrstom dokumenta kao „studije u časopisima" i broj publikacija opao je na 1353. Treći kriterij bio je engleski jezik, što je dodatno smanjilo ukupan broj radova na 1235. Indeksi SSCI, SCI-EXPANDED, A&HCI i ESCI nadalje su odabrani u bazi podataka kao četvrto ograničenje, reducirajući broj radova na 1231. Naposljetku, rezultati pretraživanja ograničeni su na kategorije „istraživanje obrazovanja" i „obrazovne znanstvene discipline", sužavajući broj studija na 746. Tih 746 radova činilo je drugi skup podataka (Slika 2).

Slika 2.

Analiza podataka

Koristeći navedene skupine podataka, otkriveni su uzorci zasnovani na matematičkim odnosima kroz metode vizualizacije utemeljene na bibliometrijskim podatcima. Mnogi su dostupni programi za bibliometrijsku analizu: u ovom istraživanju korišten je VOSviewer i SciMAT za vizualizaciju i mapiranje. Prvi korak procesa bibliometrijske analize uključio je stvaranje skupina podataka za istraživanje. Nakon toga, skupine punih podataka preuzete su u *tab-delimited* (Win) datotečnom formatu iz Web of Science baze podataka i postavljene u VOSviewer. Osim toga, ove skupine podataka preuzete su u drugom obliku datoteka iz Web of Science baze podataka i ta datoteka postavljena je u SciMAT. Naposljetku, bibliometrijska analiza provedena je u oba programa.

VOSviewer

VOSviewer je program za izgradnju i vizualizaciju bibliometrijskih mreža na razinama časopisa, istraživača ili pojedinačnih publikacija (Van Eck i Waltman, 2017). U ovoj studiji VOSviewer upotrijebljen je kako bi se izgradila mreža vizualizacije ključnih riječi, riječi u sažetcima, autora, publikacija i časopisa u 2019. i 2020. godini. Analiza istovremenoga pojavljivanja izvedena je upotrebom VOSviewera kako bi se predstavile najčešće korištene ključne riječi u sažetcima studija iz 2019. i 2020. godine. Analiza istovremenoga pojavljivanja ključnih riječi otkriva razvoj područja istraživanja tijekom vremena (Göksu, 2021; Zhao, 2017), i može odražavati ključne točke istraživanja u raznim disciplinama i područjima (Li i sur., 2016).

SciMAT

SciMAT je program otvorenoga koda koji uključuje metode, algoritme i mjere za sve korake u općem tijeku znanstvenoga lociranja, od predprocesiranja do vizualizacije rezultata (Cobo i sur, 2012). Za razliku od VOSviewera, u SciMAT istraživačima pruža mogućnost izrade strateških dijagrama s ciljem otkrivanja tematskih sklonosti u određenom periodu kroz analizu zajedničkih riječi. Cobo i suradnici (2012) objasnili su da strateški dijagram sadrži četiri teme: „pokretačke teme gore desno," „osnovne i transverzalne teme dolje desno," „visoko razvijene i izolirane teme gore lijevo," i „teme koje se pojavljuju ili sve manje javljaju dolje lijevo." Stoga, istraživači bi trebali obratiti pozornost na gornji desni i donji desni dio strateškoga dijagrama kako bi razumjeli koje teme dolaze u prednji plan u studijama tijekom određenoga perioda. Dok grozdovi u gornjem desnom dijelu dijagrama pokazuju najosnovnija područja istraživanja za period koji se ispituje, grupe u donjem desnom dijelu pokazuju područja koja nastavljaju svoj razvoj tijekom proučavanoga perioda (Cobo i sur., 2012).

Harzingov Publish or Perish

Publish or Perish je program koji omogućava istraživačima da analiziraju akademske citate iz raznolikih izvora podataka, poput Web of Science, Scopus i Google Scholara. Publish or Perish ima mogućnost analize različitih metrijskih podataka, uključujući

h-indeks, iz sirovih citata (Harzing, 2016). Istraživači u ovoj studiji koristili su Publish or Perish program za analizu h-indeksa za podatke dobivene iz Web of Science baze podataka.

Rezultati istraživanja

Najčešće korištene ključne riječi u publikacijama i distribucija ključnih riječi u publikacijama prema časopisima o obrazovanju na daljinu u visokom obrazovanju

Kako bi se konstruirala mapa najviše korištenih ključnih riječi i glavnih tematskih skupina, provedena je analiza istovremenoga pojavljivanja u programu VOSviewer. Studije o predpandemijskom (od siječnja do studenoga 2019.) i poslijepandemijskom razdoblju (prosinac 2019. i od siječnja do prosinca 2020.) predstavljene su odvojeno na slikama koje slijede.

Slika 3.

Ukupno je 1750 različitih ključnih riječi bilo upotrijebljeno u publikacijama o temi obrazovanja na daljinu u visokom obrazovanju u razdoblju od siječnja do studenoga 2019. godine (predpandemijski period). Kako bi se bolje utvrdile teme i skupine, utvrđen je kriterij prema kojemu se određena ključna riječ trebala pojaviti minimalno sedam puta. Prema analizi istodobnoga pojavljivanja 29 ključnih riječi unutar pet grozdova podataka zadovoljilo je kriterije (Slika 3). Kako se vidi iz Slike 3, najveći skup, predstavljen crvenom bojom, sadrži *online* učenje, MOOC (masovni otvoreni *online* tečaj), *online* obrazovanje, analitiku učenja, učenje na daljinu, angažman i motivaciju kao najčešće korištene ključne riječi.

Slika 4.

Ukupno 2160 ključnih riječi se pojavljuju u 746 publikacija o obrazovanju na daljinu u visokom obrazovanju u prosincu 2019. i razdoblju od siječnja do prosinca 2020. godine (tijekom poslijepandemijskoga perioda). Kako bi bolje utvrdili teme i skupine, minimalni broj pojavljivanja ključnih riječi promijenjen je na sedam. Prema analizi istovremenoga pojavljivanja 57 ključnih riječi unutar pet skupina podataka zadovoljilo je kriterije (Slika 4). Kako se vidi iz Slike 4, veća nakupina, predstavljena crvenom bojom, sadrži sljedeće najviše korištene ključne riječi: e-učenje, visoko obrazovanje, *online* obrazovanje, analitika učenja, MOOC, LMS (sustav za upravljanje učenjem), Moodle, sustav angažiranja učenika i motivacija.

Tablica 1.

Sljedeće, najviše korištene ključne riječi u radovima o temi obrazovanja na daljinu u visokom obrazovanju u razdoblju prije pandemije (od siječnja do studenoga 2019. godine) bile su ispitane analizom istovremenoga pojavljivanja (Slika 3). U ovom stadiju analize također se ispitalo u kojim su časopisima najčešće spominjane te ključne riječi.

Rezultati su prikazani u Tablici 1. „Visoko obrazovanje" najčešće je korištena riječ u 2019. godini i često se pojavljuje u časopisima *Education and Information Technologies* i *Social Sciences, Humanities and Education Journal*. Osim toga, druga najčešće spominjana riječ, „e-učenje", korištena je u pet različitih časopisa (IJETL, EIT, ITSE, ILE i TOJDE).

Tablica 2.

Najčešće korištene riječi u radovima o temi obrazovanja na daljinu u visokom obrazovanju iz poslijepandemijskoga perioda (prosinac 2019. i od siječnja do prosinca 2020.) ispitane su upotrebom analize istovremenoga pojavljivanja (Slika 4). U ovoj fazi analize također je ispitano u kojim su se časopisima najčešće pojavljivale te ključne riječi. Rezultati su predstavljeni u Tablici 2. 2020. godine „e-učenje" bilo je najviše korištena ključna riječ, koja se često pojavljivala u pet časopisa (EIT, IJETL, BMCME i ES). Druga po redu najčešće korištena ključna riječ, „*online* učenje", pojavila se u šest časopisa (OL, ETRD, OP, CE, EJEL i TT)

Najčešće korištene riječi u sažetcima i tematskim strukturama publikacija o obrazovanju na daljinu u visokom obrazovanju

Analiza zajedničkih riječi upotrijebljena je za utvrđivanje glavnih tematskih skupina u grupama podataka. Predpandemijsko (od siječnja do studenoga 2019. godine) i poslijepandemijsko razdoblje (prosinac 2019. i od siječnja do prosinca 2020. godine) analizirani su odvojeno. Analiza zajedničkih riječi provedena je upotrebom SciMAT programa, stvaranjem strateških dijagrama koji predstavljaju tematsku strukturu trendova iz oba razdoblja. Strateški dijagrami za razdoblja 2019. i 2020. godine predstavljeni su u nastavku, na slikama 5 i 6, tim redom.

Slika 5.

Strateški dijagram za predpandemijsko razdoblje (od siječnja do studenoga 2019.) prikazan je na Slici 5. Pet pokretačkih tema – „zadovoljstvo", „student", „e-učenje", „modeli" i „odrednice" –smještene su u gornjem desnom kvadrantu dijagrama, dok se gotovo ni jedna skupina ne zamjećuje u donjem desnom kvadrantu. To pokazuje da su istraživači u ovom području više pažnje pridavali tim temama nego ostalima prikazanima na Slici 5. Tablica 3 prikazuje detaljne kvalitativne podatke o sjecištima i skupinama strateškoga dijagrama predpandemijskoga razdoblja.

Tablica 3.

Podatci predstavljeni u Tablici 3 pokazuju da su istraživači kao ključne riječi tijekom predpandemijskoga perioda više koristili psihometrijske varijable povezane s učenicima nego razne alate e-učenja, modele ili dizajne.

Slika 6. Strateški dijagram za poslijepandemijsko razdoblje

Strateški dijagram za poslijepandemijsko razdoblje (prosinac 2019. i od siječnja do prosinca 2020.) prikazan je na Slici 6. Sedam pokretačkih tema, tj. „videopredavanja",

„web-2", „student", „obrazovanje", „*online* interakcija", „zadovoljstvo" i „mreža" locirane su u gornjem desnom kvadrantu strateškoga dijagrama. Štoviše, dvije teme u razvoju, „prihvaćanje" i „percepcija" smještene su u donjem desnom kvadrantu. Ovo pokazuje da su istraživači u ovome području davali više pažnje tim temama nego drugima prikazanima na Slici 6. U Tablici 4 predstavljeni su detaljni kvalitativni podatci o sjecištima i skupinama iz strateškoga dijagrama poslijepandemijskoga perioda.

Tablica 4.

Podatci u Tablici 4 pokazuju da su tijekom poslijepandemijskoga razdoblja, više od psihometrijskih varijabli koje se odnose na učenike, bile korištene sljedeće ključne riječi: tehnologije, alati, modeli dizajna, učenje i poučavanje uz e-učenje i ostvarivanje učenja. Teme „prihvaćanje" i „percepcija" u donjem desnom kvadrantu strateškoga dijagrama pokazuju da su teme vezane za psihometrijska svojstva učenika tijekom ovoga perioda bile teme u razvoju.

Rasprava i zaključak

Bolest uzrokovana COVID-19 virusom, koja je počela u Wuhanu u Kini u prosincu 2019. godine, od tada se proširila po cijelom svijetu. Na poticaj Svjetske zdravstvene organizacije zatvorene su škole u mnogim zemljama i počelo se prakticirati obrazovanje na daljinu kako bi se smanjilo širenje epidemije (WHO, 2020). Prema podatcima UNESCO-a škole su zatvorene u 188 zemalja od 7. travnja 2020., čime je obuhvaćeno 92 % globalne populacije učenika (Ertuğ, 2020). Od veljače 2021. godine mnoge zemlje i dalje nastavljaju obrazovanje na daljinu zbog pandemije COVID-19, što je utjecalo na milijune učenika tijekom više od godine dana. S obzirom na navedenu situaciju, ovo istraživanje nastojalo je ispitati studije o obrazovanju na daljinu na razini visokoga obrazovanja prije i poslije pandemije COVID-19. Istraživanjem se također nastojalo utvrditi utjecaj COVID-19 pandemije na obrazovanje na daljinu u području visokoga obrazovanja tijekom godine nakon te izvanredne situacije. Na osnovi tih ciljeva, studije objavljene prije i poslije pandemije uspoređene su i protumačene putem bibliometrijske analize.

Ovo istraživanje prvo je nastojalo odgovoriti na istraživačko pitanje o *najviše korištenim ključnim riječima u publikacijama o obrazovanju na daljinu u visokom obrazovanju između siječnja i studenoga 2019. godine (tijekom predpandemijskoga perioda) i u prosincu 2019. i od siječnja do prosinca 2020. (tijekom poslijepandemijskog perioda).* Analiza istovremenoga pojavljivanja provedena na osnovi ovoga istraživačkog pitanja ukazivala je na to da su „visoko obrazovanje", „e-učenje", „*online* učenje", i „obrazovanje na daljinu" bile najpopularnije ključne riječi i u 2019. i 2020. godini, iako se njihov poredak mijenjao tijekom vremena. Ključna riječ „e-učenje" bila je korištena najmanje četiri puta u raznim časopisima (IJETL, EATL, ITSE, ILE I TOJDE), ukupno 31 put 2019. godine, a najmanje četiri puta u četiri različita časopisa (EAIT, IJETL, BMCME i ES) u ukupno 40 navrata u 2020. godini (vidi Tablice 1 i 2). Osim

toga, ključna riječ „*online* učenje" također je upotrijebljena četiri puta u dva različita časopisa ukupno deset puta 2019. godine i 39 puta u šest različitih časopisa 2020. godine (vidi Tablice 1 i 2). Moore (1990, str. xv) definira obrazovanje na daljinu kao „sve dogovore koji omogućuju obrazovanje ljudima koji sudjeluju u planiranom učenju na mjestu različitom od onoga gdje je učitelj ili učitelji, putem tiskanih ili elektroničkih komunikacijskih medija". Pojam „obrazovanje na daljinu" je sveobuhvatniji koncept koji uključuje e-učenje i *online* učenje. Bates (2005) navodi da dok e-učenje obuhvaća sve telekomunikacijska sredstva ili računalno učenje, *online* učenje odvija se posebno putem interneta (Bağrıaçık-Yılmaz & Karataş, 2020).

Dok je e-učenje postiglo rast od 15,4 % u obrazovnim institucijama prije COVID-19 pandemije, povećalo se za 60 % nakon pandemije (Alqahtani i Rajkhan, 2020). Ovaj je rezultat u skladu s našim rezultatima istraživanja. Studije o obrazovanju na daljinu u visokom obrazovanju pokazuju da je najviše korištena ključna riječ u 2019. godini bila „visoko obrazovanje", dok je u 2020. godini to bilo „e-učenje". Čak su i obrazovne institucije koje nisu uložile u e-učenje ili poboljšale postojeću infrastrukturu, zbog prošlih predrasuda, obavezno prešle na e-učenje nakon COVID-19 pandemije (Telli i Altun, 2020). Zbog toga je situacija obaveznoga obrazovanja na daljinu prozvana „izvanredno obrazovanje na daljinu" u literaturi (Gewin 2020; Keskin i Derya, 2020; Lau i sur., 2020). Dok se izvanredno obrazovanje na daljinu promatra kao nužnost, obrazovanje na daljinu prije COVID-19 pandemije promatralo se kao opcija (Bozkurt, 2020). Još jedan važan nalaz ove studije je da iako ključna riječ COVID-19 nije korištena u pretraživanju (vidi poglavlje Metode ovoga rada) tijekom stvaranja skupina podataka, pojavila se kao peta najčešće korištena ključna riječ u 2020. godini prema rezultatima analize (vidi Sliku 2). Ova situacija pokazuje utjecaj COVID-19 na obrazovanje na daljinu i također objašnjava da se istraživanja utjecaja COVID-19 pandemije na visoko obrazovanje fokusiraju na obrazovanje na daljinu.

Drugo, u istraživanju se također tražio odgovor na pitanje o tome *koje su najčešće upotrijebljene riječi u sažetcima i tematskim strukturama objavljenih radova o obrazovanju na daljinu u visokom obrazovanju između siječnja i studenoga 2019. (predpandemijski period) i u prosincu 2019. te od siječnja do prosinca 2020. (poslijepandemijski period).* Kako bismo odgovorili na ovo istraživačko pitanje, proveli smo analizu zajedničkih riječi upotrebom SciMAT programa. 2019. godine istraživački su pokazali veći interes za psihometrijske varijable povezane za učenike na daljinu (vidi Sliku 5 i Tablicu 3) nego za varijable poput sredstava učenja na daljinu, obrazovanih modela i modela poučavanja. U 2020. godini, pak, istraživači su se najviše fokusirali na medije i tehnologije korištene u osiguravanju pouke, videokolegije, tehnološki podržane kolegije, alate učenja na daljinu, poput interakcije čovjek-računalo, i pitanja dizajna nastave prije nego na razne psihometrijske varijable povezane za učenike na daljinu (vidi Sliku 6 i Tablicu 4). Proučavanje ovoga područja pokazuje da se nakon 2000. godine fokus istraživanja pomaknuo s pedagoških tema na teme tehnologije (Bozkurt i sur., 2015; Zawacki-Richter i Naidu, 2016). Rezultati ove studije djelomično su sukladni s rezultatima

Bozkurta i suradnika (2015) i Zawacki-Richtera i Naidua (2016). Ipak, iako su neke studije istraživale varijable povezane s tehnologijom tijekom predpandemijskoga perioda, istraživački trendovi s fokusom na učenike u to su vrijeme došli u prednji plan (vidi Sliku 5 i Tablicu 3). Štoviše, činjenica da je obrazovanje na daljinu prije pandemije bilo najviše dobrovoljno može objasniti rezultate u predpandemijskom periodu budući da je uspjeh obrazovanja na daljinu direktno povezan s voljnosti učenika da prihvate razne korištene tehnologije i procese (Almaiah i Alismaiel, 2019). Zbog toga se prisutnost istraživanja usredotočenih na učenika može objasniti željom za povećavanjem zadovoljstva učenika.

Zaključno, ova studija ispitala je način na koji je pandemija COVID-19 utjecala na obrazovanje na daljinu u visokom obrazovanju. Promjenu u objavljenim radovima tijekom dvije godine prije i nakon pandemije COVID-19 analiziralo se i o njoj se raspravljalo, što je polučilo značajne rezultate. Osobito, bilo je manje studija o obrazovanju na daljinu u visokom obrazovanju (580) objavljenih tijekom predpandemijskoga perioda nego onih provedenih tijekom poslijepandemijskoga razdoblja (746), sukladno navedenim ograničenjima. Studije o obrazovanju na daljinu u visokom obrazovanju oboje prije i nakon pandemije fokusirale su se na ključne riječi „visoko obrazovanje", „e-učenje", „*online* učenje" i „obrazovanje na daljinu". U stvari, iako ključna riječ COVID-19 nije upotrijebljena u procesu pretraživanja tijekom faze oblikovanja skupina podataka, prema analizi rezultata ona se pojavljuje kao peta najčešće korištena ključna riječ 2020. godine. Usporedo s provođenjem istraživanja motivacije studenata i samoregulacijskih vještina tijekom predpandemijskoga razdoblja, zamjetan je trend istraživanja okoline učenja, medija i osiguravanja obrazovanja nakon pandemije.

Ni jedno bibliometrijsko istraživanje ne može dati sliku razvoja i trenutačnoga stanja ovoga područja znanstvenoga interesa, pa tako ni ovo istraživanje, čiji su rezultati ograničeni njegovim opsegom. Najvažnije je ograničenje ove studije proces stvaranja grupa podataka. Na osnovi rezultata našega istraživanja i njegovih ograničenja, trendovi u području znanstvenoga istraživanja iz 2019. i 2020. godine mogu se ispitati s ciljem boljega razumijevanja utjecaja pandemije. Uz pomoć bibliometrijske analize predstavljene u ovom radu, istraživači mogu razumjeti promjenjivi znanstveni krajolik tijekom pandemije COVID-19 i upotrijebiti to znanje kako bi ispitali manjkavosti postojećih istraživanja i proveli buduća o ovome pitanju. Također treba razmotriti proširivanje ovoga rada upotrebom alternativnih baza podataka (npr. Scopus, ERIC, PsyInfo, PubMed) i uključivanjem dodatnih vrsta publikacija (npr. poglavlja knjiga, radovi s konferencija). Osim toga, s obzirom na to da pandemija utječe na sve obrazovne institucije, budući istraživački trendovi mogu obuhvatiti različite razine obrazovanja (npr. K-12, vrtić, cjeloživotno obrazovanje). U ovom korpusu znanja još uvijek postoje praznine koje zahtijevaju sveobuhvatnije istraživanje.