

# The Visualization of the Impact of Covid-19 On Education Field: A Bibliometric Study

**Laela Sagita<sup>1</sup> & Rully Charitas Indra Prahmana<sup>2</sup>**

<sup>1</sup>Universitas PGRI Yogyakarta, Yogyakarta, Indonesia

<sup>2</sup>Universitas Ahmad Dahlan, Yogyakarta, Indonesia

Correspondence email: [laelasagita@upy.ac.id](mailto:laelasagita@upy.ac.id), [rully.indra@mpmat.uad.ac.id](mailto:rully.indra@mpmat.uad.ac.id)

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## ABSTRAK

Pandemi COVID-19 membuat banyak peneliti dari berbagai bidang memberikan kontribusi sesuai dengan keahliannya. Salah satunya dalam bidang pendidikan. Bidang ini telah menghasilkan hasil penelitian dan dipublikasikan di jurnal bereputasi untuk meningkatkan keterbacaannya di masyarakat. Riset-riset yang dipublikasikan memberikan gambaran tentang tantangan kegiatan belajar mengajar selama pandemi dan solusi yang ditawarkan. Penelitian ini menyajikan hasil analisis menggunakan Bibliometrix R-Package pada 950 data yang bersumber dari database Scopus dalam periode tahun 1990-2022. Hasil analisis dan visualisasi menunjukkan kontributor di berbagai level, termasuk penulis, institusi, dan negara, sebagai peluang untuk membuka kolaborasi antara peneliti dan institusi. Selain itu, penelitian ini juga mengidentifikasi beberapa kata kunci yang dapat digunakan sebagai poin penting untuk menentukan kebaruan atau arah penelitian selanjutnya. Akhirnya, penelitian ini memberikan kontribusi sebagai peta jalan untuk peluang penelitian potensial dan implikasi yang signifikan bagi praktisi pendidikan masa depan, pembuat kebijakan, dan peneliti di lapangan.

**Kata kunci :** Bibliometrik; Bibliometrix R-Package; publikasi penelitian pendidikan

## ABSTRACT

The COVID-19 pandemic has made researchers from various fields make fundamental contributions according to their expertise. One of which is in the education field. The field has created research results and published them in reputable journals to increase the readability for the community. The published researches provide an overview of the challenges of teaching and learning activities during the pandemic and the solutions offered. This study presents the analysis results using the Bibliometrix R-Package on 950 data sourced from the Scopus database during the years 1990-2022. The analysis and visualization results show contributors at various levels, including authors, institutions, and countries, as opportunities to open collaboration between researchers and institutions. In addition, the study also identified several keywords that can be used as an essential point to determine the novelty or direction of future research. Finally, this study contributes as a roadmap to potential research opportunities and significant implications for future education practitioners, policymakers, and researchers in the field.

**Keywords:** Bibliometric; Bibliometrix R-Package; education publication research



## 1. INTRODUCTION

Covid-19 has an exponential rate of spreading data and information about it (Tupan & Rosiyan, 2021; El Mohadab, Bouikhalene & Safi, 2020). This information motivates the scientific community to collect, organize, process, and comprehensively distribute data and transmission with attractive data visualizations, so decision-makers can easily understand it (Homolak, Kodvanj & Virag, 2020; Zyoud & Zyoud, 2021). One of them is data visualization on the distribution of data and information related to the Covid-19 from a psychological perspective based on article data from a particular journal (Nuryana, Murshidi, & Rahman, 2021). Globally, the production of publications in various scientific databases occurs in multiple disciplines. The main purpose is to overcome this pandemic concerning education, medicine, health, socio-economic, psychological, and environmental dimensions.

The world of education has not escaped the impact of the COVID-19 pandemic, including the lockdown policies in several countries that have changed the face of education (Amro, 2021; AlTameemy & Alrefaee, 2021; Rosyada & Sundari, 2021). Elements of education policymakers, academics, teachers, parents, and students quickly adapt and innovate in the learning process (Rehm, Moukarzel & del Fresno, 2021; Kaden, 2020; Merrill, 2020).

This study is going to conduct a bibliometric analysis of data and information on the education dimension of the Covid-19. This analysis shows international publications' broad distribution from the schools' performance, teachers, and students during the pandemic. It presents new learning theories, learning barriers, data gaps, data overload, authors' distribution of publication themes, and scientific collaboration. These findings can be used as important information for future researchers to ensure the sustainability of research results through the pandemic, especially in education.

The findings can enrich data and information for librarians, especially those part of the education field. We want to complement the results of what Tupan and Rosiyan (2021) have conducted. They used ViosViewer bibliometric analysis from the Scopus database with several keywords, namely, "*novel coronavirus*" or "*coronavirus 2019*" or "*covid 2019*" and "*covid 19*". They analyzed the amount of the data by each classification, such as publication year, publication source, institution, country, document type, and funding institution, and visualization of Covid-19 data based on keywords from the database. However, it is still general in discussing the domain of covid-19 in education. So, it cannot present how the pattern of educational development during the pandemic. Therefore, Therefore, the results of this study will describe the dimensions of education, especially in the aspect of learning activities during the pandemic. It is hoped that this paper will be useful for further research.

## 2. PREVIOUS FINDINGS

Tupan and Rosiyan (2021) identified the distribution of the Covid-19 data and information based on several data classifications by using VosViewer software. The highest productivity in producing publications is Huazhong University of Science and Technology, while China is the most productive country in producing data related to the coronavirus. Most of the data classification is based on the research theme, which is in the medical field. Furthermore, they found that most of the funding sponsors were provided by the National Science Foundation of China.

Bibliometric analysis using VOSViewer software in the environmental field was carried out by Zyoud and Zyoud (2021). In their study, they used 729 sources from the Scopus database with different proportions of document types, including papers with article types totaling 563

(77.2%), 7.7% or 56 being reviews, and the remaining 15% or 110 is a document classified as "other."

The publication of the impact of the Covid-19 using the bibliometrix package R-based Biblioshiny in the economic field was carried out by [Mahi et al. \(2021\)](#) with a total data used of 1,636 articles indexed in the WoS database. The most productive institution producing articles is the University of Michigan with 35 publications, followed by the University of Chicago with only one publication. While the most productive country is the United States. In contrast to the environmental and medical fields, China, with 122 publications placed in second place. However, the UK has superior results in collaborative publications compared to other top publishing countries. A ratio shows that almost one-third of all publications by British authors collaborate with Germany, Singapore, and Australia. [Mahi et al. \(2021\)](#) provided an analysis of future research in the field of Economics after being affected by the virus, focusing on finding the most cost-effective and control measures with fast and efficient policy implementation. Another study was conducted by [Nuryana, Murshidi, and Rahman \(2021\)](#). By using the R-based Biblioshiny app, their study determined research trends during the pandemic in the field of psychology. The paper found 576 articles with the classification of the most productive countries, namely China, followed by Australia, Bangladesh, and Japan accordingly.

In the field of education, [Karakose & Demirkol \(2021\)](#) analyzed the thematic structure and trends of scientific publications, particularly in the relationship between the Covid-19 and education, as well as presented a roadmap for future research on the topic. To answer this goal, [Karakose and Demirkol \(2021\)](#) use data from the Web of Science Core Collection (WoSCC) database and apply VOSviewer to visualize the results. The search method in the WoSCC database using keywords: 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"). The study found that the countries with the highest number of publications are the United States, the United Kingdom, Canada, and Spain accordingly.

Another point of view of this study compared to the four previously reviewed studies is that most of the publications in this field tend to use the "theoretical models" method. Most of the data used in the study use "interview forms." In addition, the findings show that the focus of the research is on "online education" and "teacher education." [Karakose and Demirkol \(2021\)](#) stated that this article is the first bibliometric analysis article at the international level to analyze the relationship trend between education and the pandemic. Researchers with knowledge in education seized this opportunity to complete the findings of the impact of the Covid-19 on the education area using bibliometric analysis. Researchers will analyze student performance during the Covid-19 pandemic by using the Bibliometrix package analysis using R-based developed by [Aria and Cuccurullo \(2017\)](#). The study used R-based bibliometrics because this Bibliometrix-package is well known for its completeness of features and is used in more and more publications (Firdaus et al., 2019; Linnenluecke et al., 2020).

### 3. METHODS

This study is a systematic review by revealing the bibliometric profile of the Covid-19 in the education field using the Scopus database, the largest database in the world ([Li et al., 2010](#)). The bibliometric analysis identifies publication research patterns and allows in-depth and objective content analysis ([Ellegaard & Wallin, 2015](#); [Diem & Wolter, 2013](#)). Bibliometric analysis works by analyzing differences in frameworks, tools, and methods in groups of scientific publications in a database ([Akhavan et al., 2016](#)). It aims to obtain publication trends

and evaluate the impact of scientific journals, studies, and researchers in specific fields (Ponce & Lozano, 2010). This research uses the bibliometric study based on Zupic and Ater (2015) which is presented below.

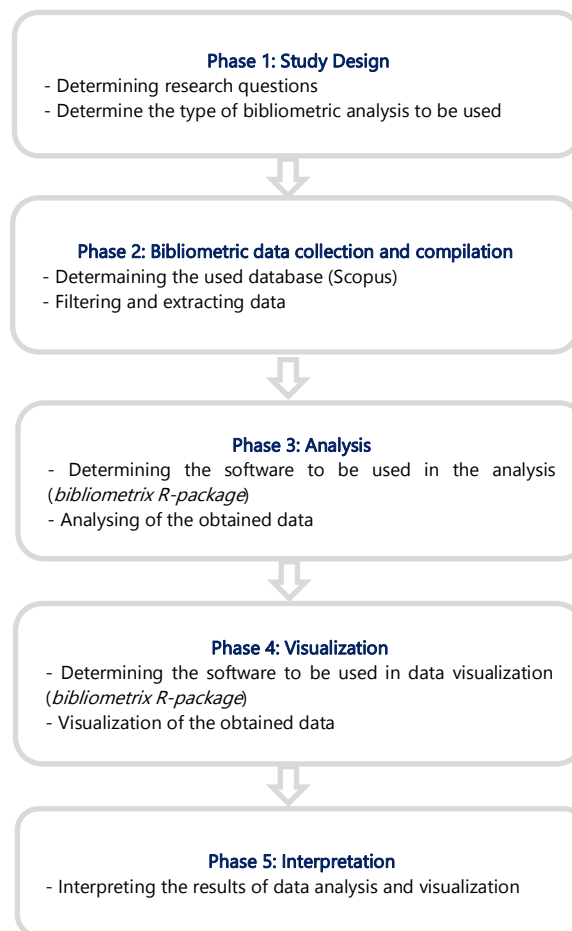


Figure 1. The stages of bibliometric studies

The keywords used in collecting article data from the Scopus database are (TITLE-ABS-KEY (student AND performance) AND TITLE-ABS-KEY (pandemic) OR TITLE-ABS-KEY (covid)) which were accessed on October 8, 2021. We found 950 documents with details on article (675), book (5), book chapter (7), conference paper (189), conference review (25), data paper (2), editorial (4), letter (8), note (6), review (28), and short survey (1).

#### 4. RESULTS AND FINDINGS ANALYSIS

##### *Trends in Publication and Key Information*

The data used in this study is ranging from 1990 to 2022. Figure 2 shows that several articles have been set to be published in 2022. Thus, in the analysis, we present comprehensive publication information for 32 years. The paper presented is the article related to the H1N1 Influenza virus pandemic (Merrill et al., 1990; Centers for Disease Control and Prevention, 2009; May et al., 2010; Shiflet & Shiflet, 2011; Alonso & McCormick, 2012; Koharchik et al., 2012; Pourabbasi et al., 2012; Thoroughman et al., 2013; Greci et al., 2013; Acosta et al., 2014; Mwamwenda, 2014). Surely, keyword searches that are more relevant to the H1N1 virus

pandemic will get more results. This can be used as a prediction that the sustainability of publications about the Covid-19 is still very long. The publication related to the subject shown in Figure 2, which began in 2020 about the quality of E-Learning during the pandemic from the perspective of university students (Sankar et al., 2020).

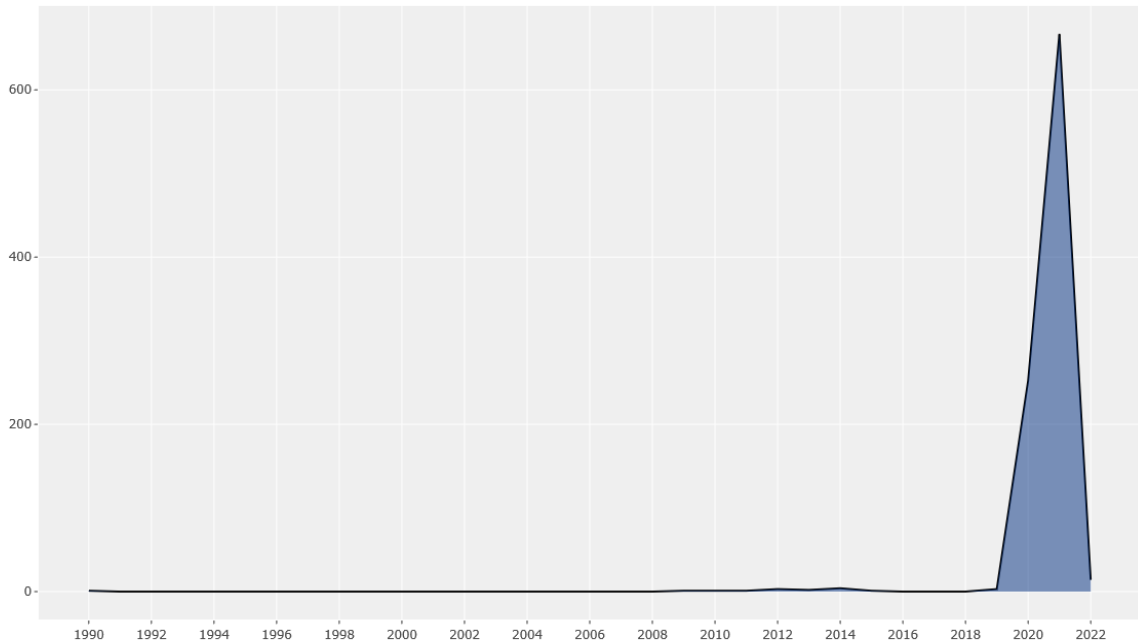


Figure 2. Annual Scientific Production Chart related to student’s performance during the pandemic era from 1990 to 2022

The rapid increase in publications in education shows that this research has stimulated great interest in the scientific community. Of the total 950 documents, not only in the form of scientific articles in journals, but also book documents, book chapters, conference papers, conference reviews, data papers, editorials, letters, notes, reviews, and short surveys the most proportion being scientific articles as presented in Table 1.

Table 1. The total of publications by the document types related to student’s performance

Document types	Total
Article	675
Book	5
Book Chapter	7
Conference Paper	189
Conference Review	25
Data Paper	2
Editorial	4
Letter	8
Note	6

**Three-Field Plot Analyses are Performed: The Author, Author's Country, and Keywords**

Figure 3 presents a data visualization using a three-field plot that describes the correlation of 20 data with groupings based on three data elements, namely author (AU), country of author (AU\_CO), and keywords (DE). This visualization gives an idea about the overall active contribution of a country in publishing the Covid-19 in the field of education.

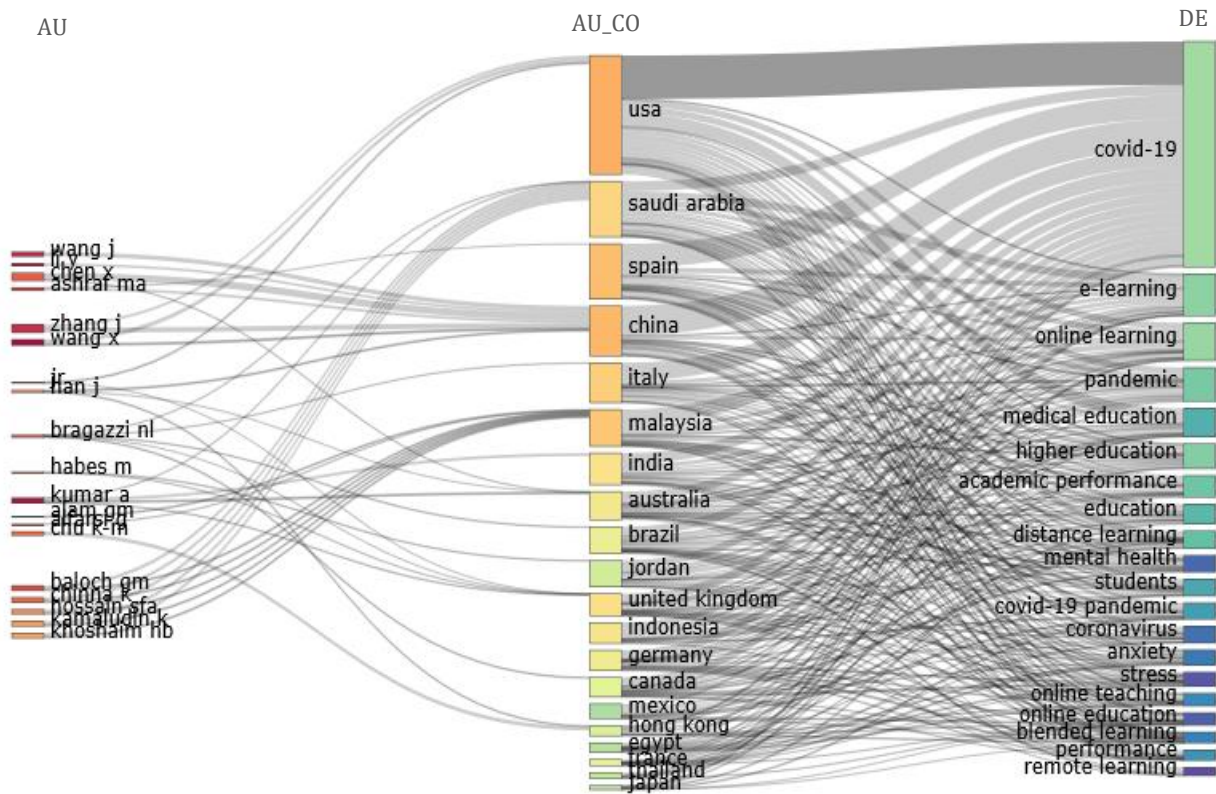


Figure 3. Three-field plot analysis related to student's performance during the pandemic era from 1990 to 2022 based on Author, Country, and keywords

The three data elements have different square sizes. This describes the number of various articles linked by gray lines. The focus of the analysis in the middle is the country of the author (AU\_CO), which connects the author (AU) and the used keywords (DE). The USA is a country that has a significant contribution to publications with outgoing flow count correlated on almost all keywords, followed by medical education and then online learning. Interestingly, all these articles were produced by three authors. Saudi Arabia, Spain, and Italy have almost the same square size and correlate with the Covid-19 keywords followed by online learning. While China has a smaller square size than the USA but has an even distribution on almost all keywords (DE) and has an incoming flow count from the author's data element (AU), which is larger than the USA.

### The Author's Contribution

It is found a total of 3738 authors published 950 documents in this study. Each author has a different contribution that can be measured by how many other articles use that author's ideas.

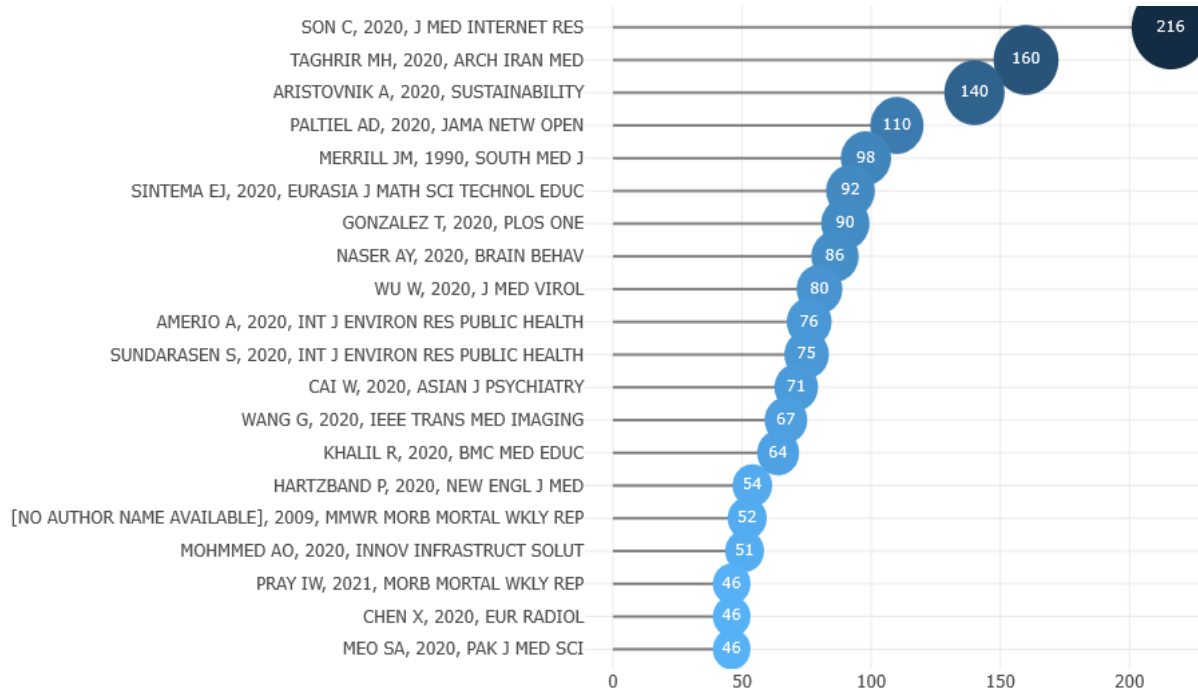


Figure 4. The author's contribution related to student's performance during pandemic era from 1990 to 2022

Figure 4 shows 20 authors with the highest number of citations with a minimum limit of 50 citations. The highest number of citations produced by Changwon Son discussed the effects of the Covid-19 on students' mental health in the United States based on the results of an interview study (Son et al., 2020). It was followed by Mohammad Hossein Taghrir, with 160 citations. Aleksander Aristovnik occupies the third position from Slovenia with citations that are not much different, namely 140. Aristovnik et al. (2020) found the impact of the COVID-19 pandemic on the lives of college students. The publication of A. David Paltiel, along with two other researchers, was in fourth place with 98 citations. The research conducted was to determine screening standards for students on the SARS-CoV-2 virus to deal with online lecture preparation at universities in the United States (Paltiel et al., 2020). Of the four authors with citations above 100, all of them are affiliated with medicine/health.

In addition to the number of citations from each author, Bibliometrix-R packaged provides data about collaborations carried out by researchers. Figure 5 presents a visualization of the proportion of Single Country Publications (SCP) and Multiple Country Publications (MCP) from each author's country of origin. The USA has the highest number of publications with 97 articles consisting of 89 SCPs and the same number of MCPs as Italy with eight articles. Regarding the number of articles originating from China, it is in second place with half the number of articles originating from the USA with 36 SCP and 12 MCP in detail. This data is fascinating because China has the most significant number of authors who collaborate with other countries.

In contrast, a high SCP value can be used as a guide for collaboration. The USA is followed by China, which has the highest number of SCPs. This condition is directly proportional to the number of MCPs—followed by Spain (27), Malaysia and India (26), the UK, and Saudi Arabia.

With 16 SCPs above Australia (14) and Germany (14), Indonesia is an opportunity to open cooperation with other countries. This data can be used by researchers who will collaborate not only across disciplines but also across countries to increase Indonesia's role at the international level.

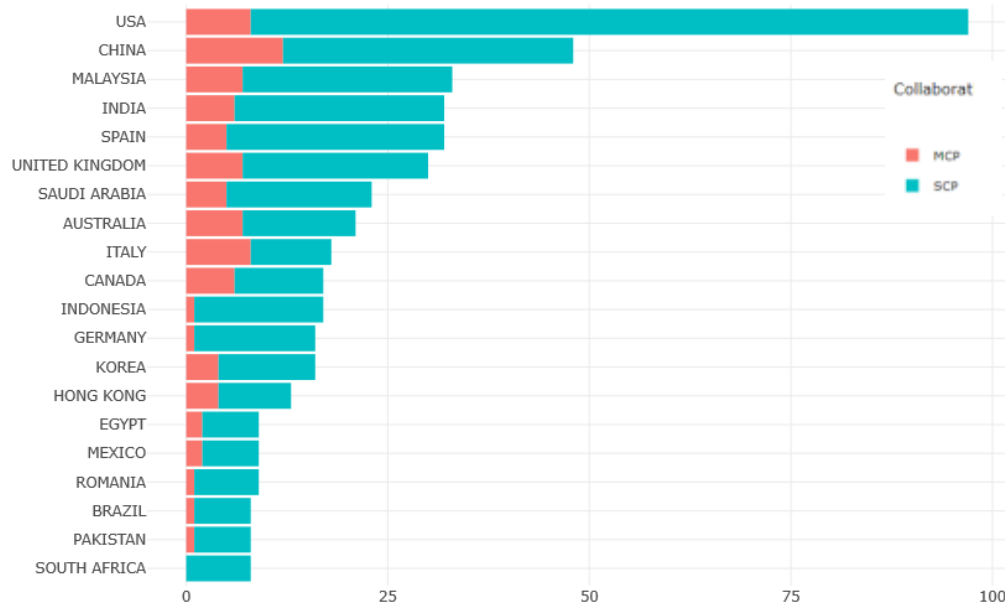


Figure 5. Corresponding Author's Country related to student's performance during pandemic era from 1990 to 2022

### ***The Most Frequent Keywords and Future Research based on the Journal's Aim and Scope***

The study uses the most frequently used keywords to find out the trend of publications over a certain period. Keywords facilitate the search for articles that match the research field (McDonnell, 2010). With the accuracy of using a keyword, researchers can quickly find topics that are currently popular (Nuryana et al., 2021).

Figure 6 is a data visualization of the author's keywords from 950 documents. Ten keywords can be seen clearly, including online learning, higher education, e-learning, pandemic, distance learning, medical education, covid-19 pandemic, academic performance, education, and student. These keywords correspond to the keywords that appear the most in the three-field plot visualization with correlations between the author, the author's country, and keywords, as shown in Figure 3, including COVID-19, e-learning, online learning, medical education, academic performance, higher education, and distance learning. It can indicate that the research theme on these five keywords is a research theme that is currently popular in this era.





Figure 6. The Most Frequent Keywords related to student's performance during pandemic era from 1990 to 2022

The output of the superiority of the Bibliometrix R-Package that is not available in other bibliometric applications is the strategic diagram presented in quadrant form. [Cobo et al. \(2011\)](#) divide four quadrants with different meanings, as illustrated in Figure 7.

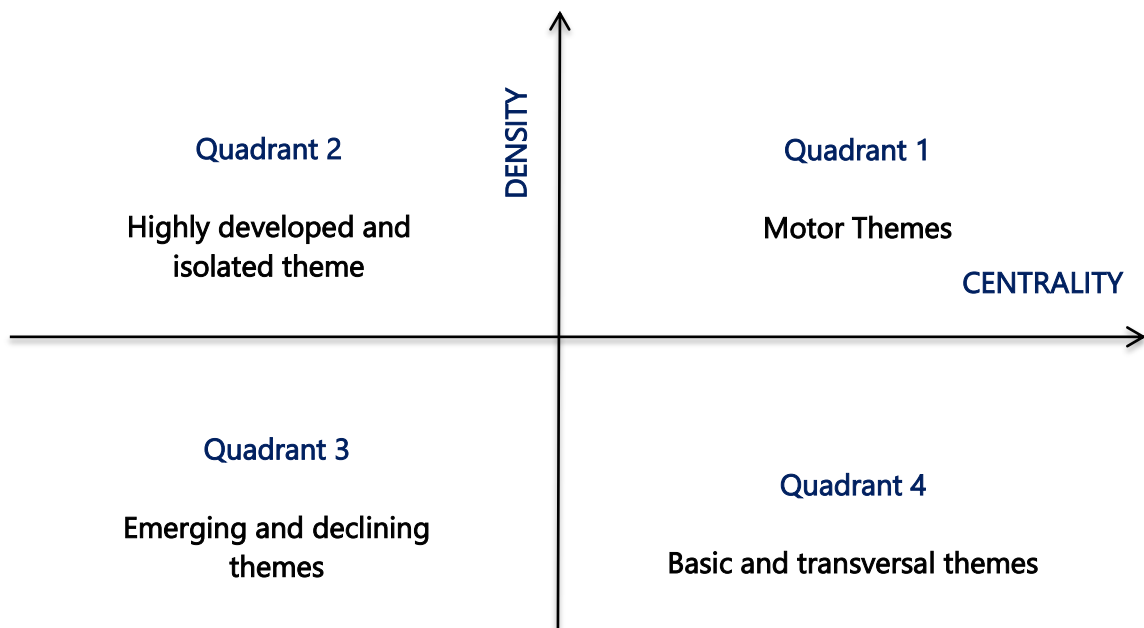


Figure 7. Thematic map strategic diagram with 4 quadrants

Quadrant 1 (top right) is the motor team that describes the research themes that drive the study theme. Quadrant 2 (top left) means that the themes in this quadrant do not influence the theme of the study. Quadrant 3 (bottom left) shows the research theme in quadrant 3 has two meanings, namely declining or emerging. Meanwhile, quadrant 4 (bottom right) is the research theme which is the theme that influences the article.

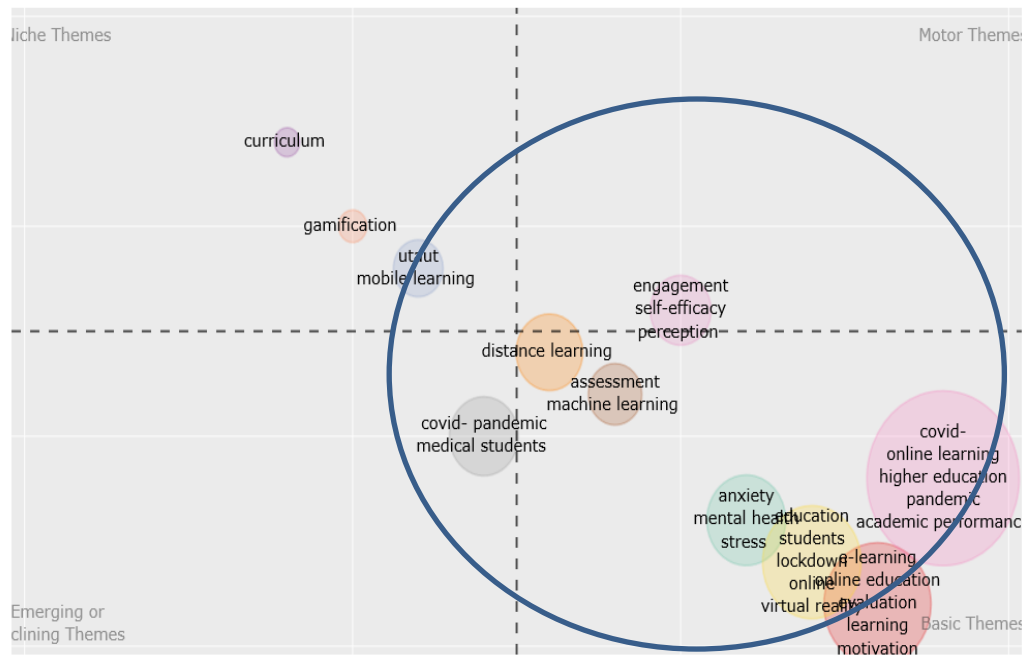


Figure 8. Thematic Map Analysis

The thematic strategic map in this publication is presented in Figure 8, with the themes in the blue circle as theme trends that can be developed. Although quadrant one has a low density, there are only three themes, namely engagement, self-efficacy, and perception as motor themes. The themes in quadrant one mean externally related and conceptually related to themes in other quadrants. Covid-pandemic and medical students in quadrant 3 in this study act as emerging themes. These results are supported by the data presented in Figure 3 and Figure 6.

## 5. CONCLUSION

The results of this study can be used by further researchers who have a roadmap with the themes of learning technology, learning design, and educational psychology, as well as evaluation and assessment. We divided the results of this study into two clusters, namely internal and external students, by considering the density and centrality theme. The internal cluster consists of anxiety, mental health, stress, motivation, and academic performance. Meanwhile, the external cluster consists of online learning, virtual reality, assessment, machine learning, and distance learning. The relevance of this theme is allegedly going to be a theme that has a high chance of being researched during the pandemic.

In addition, the opportunity for collaboration between countries is also very high, especially in the era of digital communication. The Single Country Publications (SCP) and Multiple Country Publications (MCP) data presented here might help researchers who want to engage cooperation between countries related to significant themes according to the keywords visualized in this study. This condition is in line with the government's program to increase the number of international standard universities or word class universities, where one of the indicators is the existence of international collaboration between countries in each research.

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