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# Hybrid learning trends in higher education post pandemic Covid 19: Scientometric mapping

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## Abstract

The study aimed to identify the keywords, authors, institutions and countries that were most influential in the implementation of hybrid learning in higher education during the Covid 19 pandemic, and to see future research trends related to the post-Covid 19 pandemic. This research uses bibliometric approach. The data collected is sourced from the Scopus database, starting from 2020 to 2022. Using ALL search ("*hybrid learning*" AND "*higher education*"), and obtained 1,110 research documents. Document sources came from 783 journal documents, 214 conference proceeding documents, 59 document book series, and 54 document books. The research results explained that seven sub-fields of research keywords were obtained, with the top 7 keywords namely students, e-learning, hybrid learning, covid-19, higher education, blended learning, teaching, learning systems, online learning. With the theme of this research consists of 3,132 authors, and produces 19 networks of collaborative writers. There is a network of 105 countries, and the top 7 countries are United States, China, Spain, United Kingdom, Australia, Malaysia, Saudi Arabia, Norway, Netherlands and Pakistan. The documents were also obtained by 2,212 organizations and 71 research organization networks, as well as 174 interconnected journals.

**Keywords:** Hybrid Learning; Higher Education; Post Covid 19; Scientometric

## 1. Introduction

The idea of electronic-based learning (e-learning) has existed since the 1950s, which describes comprehensive learning by utilizing technological advances. When technological advances developed rapidly in the 2000s, there was increasing attention to this electronic learning process, using hybrid-based learning, especially during the Covid 19 pandemic which attacked all countries, including Indonesia. Elementary education, secondary education, and higher education have adopted the important role of hybrid learning, even non-formal education has adopted it.

Hybrid learning provides a lot of access for students to meet their needs for various information, without any classroom limitations through the use of the internet (Hall & Villarreal, 2015; Helms, 2014). In addition, hybrid learning is able to combine multiple learning more comfortably, but learning must still be done, considering this is the key to the success of hybrid learning. When educational and technological assets merge into one, this will be something that is more useful for individuals with various ease and flexibility in learning.

The Covid 19 pandemic forced many activities to be restricted, especially educational activities. To limit the spread of the virus, educational institutions must switch to e-learning or hybrid learning using available educational platforms. Social distancing is very important and the Covid 19 pandemic has put an end to face-to-face education that has been carried out so far, thus having a negative impact on educational activities (Maatuk et al, 2022; Elberkawi et al, 2021).

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Social restrictions have encouraged distance education activities as an alternative to face-to-face education in various forms. Therefore, many levels of education have taken various best ways to deliver learning material remotely, involve students, and conduct assessments.

The concept of hybrid learning, although widely known, has not been fully explored (Keržič et al, 2019; Rasheed et al, 2020). Many countries have designed and implemented distance education systems during the Covid 19 pandemic to ensure that education can continue without interruption (Tesar, 2020; Jandrić, et al, 2020). Several opportunities and challenges related to hybrid learning, educational institutions, and Covid 19, have prompted a lot of research in this field. If you look at the various scientific studies that have been published during the Covid 19 pandemic, it is clear that many journals have published many academic articles on e-learning or hybrid learning (Karakose & Demirkol, 2021; Singh et al, 2021; Dhawan, 2020).

In addition, a large number of bibliometric studies have been carried out in this area. However, very few studies have focused entirely on the relationship between hybrid learning, higher education, and Covid 19 using scientometric or bibliometric analysis (Brika et al, 2021; Hasumi & Chiu, 2022; Mishra et al, 2021; Tlili et al, 2022; Hysa et al, 2022). This paper discusses bibliometric indicators for hybrid learning in the world of education during the Covid 19 pandemic, and is continued with network analysis to determine the most important sub-fields in this topic. To determine the trend of hybrid learning during Covid 19, the following problem formulation is proposed:

- Q1: What are the most important sub-fields of hybrid learning during the Covid 19 pandemic?
- Q2: Who are the most influential authors on the subject of hybrid learning during the Covid 19 pandemic?
- Q3: What countries and research institutions were referred the most for research on the subject of hybrid learning during the Covid 19 pandemic?
- Q4: What are the current research gaps and trends in the subject of hybrid learning in light of the Covid 19 pandemic?

The analysis was carried out to provide a broad and long-term perspective on the vocabulary of learning publications. This helps to recognize problems that arise in the field of hybrid learning. Newly published studies can increase knowledge and bridge knowledge gaps through findings about hybrid learning trends. This applies, in particular to all levels of education, because of the importance of knowing the latest information about distance learning and its methods. From this reason, this research is very important to analyze the volume of publications that have been made about the subject matter and to strengthen the knowledge base about what researchers have done and studied. This will be able to create new advances to improve education in the event of a future pandemic.

In recent years, there has been an increase in research interest in fields related to hybrid learning, technology acceptance models, interactive learning environments and digital-based learning, namely Siripongdee, et al (2020); de Moura et al. (2020); Oprea (2014); Nylund & Lanz (2020); Pal & Vanijja (2020); Serban and Loan (2020). A large amount of literature has been written and published on hybrid learning bibliometric analysis, such as Bozkurt's research (2022); Shen & Ho (2020); Omar, et al (2021); Chen, et al (2021).

This study aims to identify the most critical areas (key words) of hybrid learning. The contribution of this study is that no controlled studies have compared differences in models to determine the most critical research areas in hybrid learning and the most influential authors, institutions, and countries. In addition, to look at the hybrid learning framework and future research trends related to the post-Covid 19 pandemic. This study makes an important contribution to the analysis of current hybrid learning models and networks in higher education during the post-Covid 19 pandemic.

## 2. Material and methods

This study uses a bibliometric approach. The data collected was retrieved through a search engine with the topic of hybrid learning in tertiary institutions during the Covid 19 pandemic, using the Scopus database on November 10, 2022. The following search terms were used: ALL (*"hybrid learning"* AND *"higher education"*), in all types from 2020 to 2022, and obtained 1,110 research documents (6 documents in 2023, 470 documents in 2022, 386 documents in 2021, and 248 documents in 2020). Source documents come from 783 journal documents, conference proceeding 214 documents, book series 59 documents, and book 54 documents.

This bibliometric study data represents the entire research on "hybrid learning in higher education" in the Scopus database. The reason for choosing this database compared to others was due to several considerations, namely because

Scopus data in the field of scientometrics has grown significantly. Scopus is much more than a database of academic papers. Many informational purposes are supported by selected, organized and balanced databases, including complete citation links and enhanced metadata (Baas et al., 2020). The Scopus database includes high quality research namely Science Citation Index Expanded (SCI-Expanded), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (A&HCI), Emerging Sources Citation Index (ESCI) (Mongeon & Paul-Hus, 2016; Chadegani et al., 2013).

According to the method and approach of bibliometric analysis (Zupic & Čater, 2015), this research relies on co-occurrence indicators (co-words) to find out the main keywords that were the focus of previous research as well as indicators of co-authorship, publications, and citations to find leading authors, organizations, and countries on the topic. E-learning in higher education. Following the methodology of compiling bibliometric studies in management and organization, described by Zupic & Čater ( 2015), a bibliometric analysis was carried out by completing the following steps: research design, research questions, and selection of an analytical approach (co-occurrence, publications, citations , and co-authorship); compilation, selection, and screening of bibliometric data, analysis (selecting appropriate bibliometric software, cleaning data, and generating networks); visualization, and interpretation.

A bibliometric analysis was performed to design a hybrid learning network and determine the most frequently used keywords and the most cited authors, organizations and countries to explain new and recent trends in this topic. This can be achieved depending on different software. Cite Space transforms the concept of a research domain into a mapping function between research boundaries and an intellectual and effective basis for information visualization (Chen, 2016). This research uses VOSviewer software, which is used to design networks and is a powerful function for co-incidence analysis and citation analysis (Van Eck & Waltman, 2017).

## 3. Results

### 3.1. Keyword Frequency

Figure 1 shows seven sub-areas (clusters) for hybrid learning research in tertiary institutions during the Covid 19 pandemic. First, the red cluster shows searches related to the following: education, curriculum, pandemic, human, virtual learning, SARS-COV, Indonesia, epidemiology, education, distance, cross-sectional study, educational measurement, article, controlled study, questionnaire, critical thinking. Second, the green cluster displays related searches: distance education, mooc, teaching and learning, technology education, distance-learning, colleges and universities, case studies. Third, the blue navy cluster shows related disbursements: higher education, learning outcomes, moocs, innovation, social media, knowledge building, knowledge, university sector.

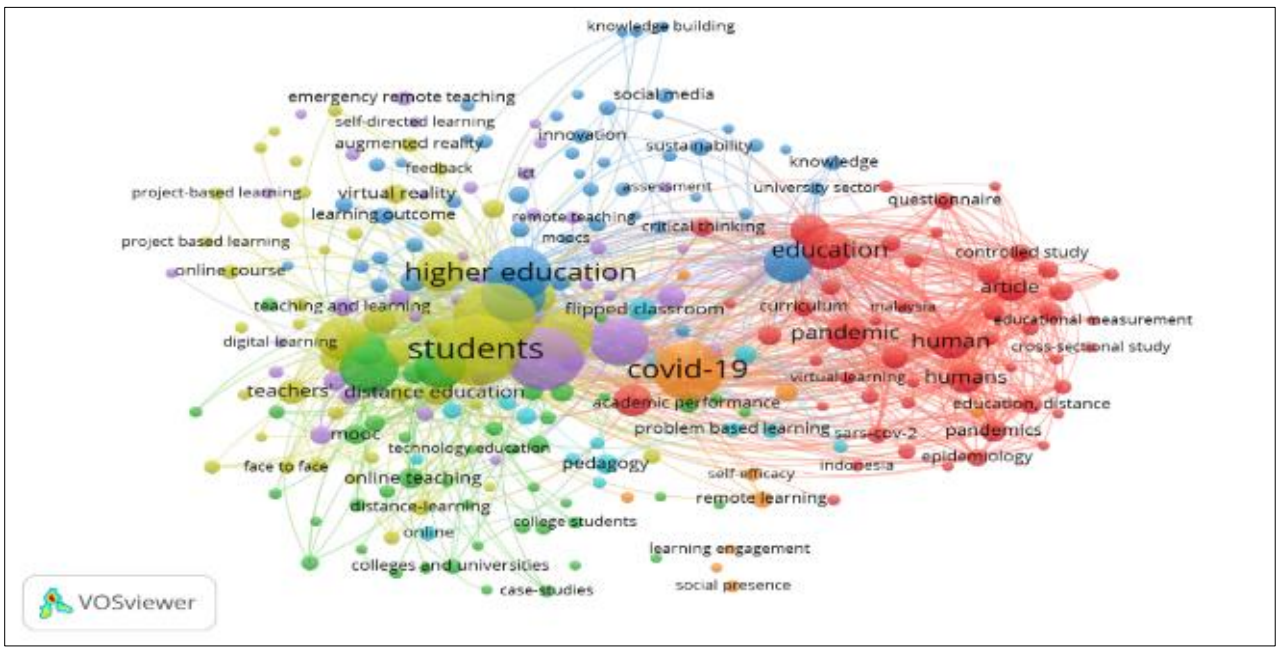


**Figure 1** The Most Frequent Keywords That Have Been Repeated More Than 5

Fourth, the yellow cluster is related to students, online courses, project-based learning, virtual reality, feedback, augmented reality, emergency remote teaching, teachers distance education, face to face, distance learning. Fifth, cluster violet shows searches related to remote teaching, ICT, self-directed learning, emergency remote teaching. Sixth, the light blue cluster indicates disbursement related to flipped classroom, pedagogy, problem-based learning, online. Finally, the orange cluster displays tracking Covid 19, self-efficacy, remote learning, learning engagement, social presence.

The following shows the number of keywords used for hybrid learning research in tertiary institutions during the Covid 19 pandemic, with occurrences above 100 and the top 9 total link strengths as shown in Table 1. Researchers can also take this subfield as a topic for research in hybrid learning. that shape the latest research trends. At the same time, many studies use different terms to express the same meaning, namely blended learning (Bozkurt, 2022; Gecer & Dag, 2012; McCarthy, 2016; Abdelrahman & Irby, 2016)

**Table 1** Top 9 Keywords in Hybrid Learning Research in Higher Education

| No | Keyword | Occasions | Total Link Strength |
|---|---|---|---|
| 1 | Students | 224 | 1596 |
| 2 | E-learning | 216 | 1475 |
| 3 | Hybrid Learning | 185 | 1018 |
| 4 | Covid-19 | 156 | 969 |
| 5 | Higher Education | 132 | 617 |
| 6 | Blended Learning | 129 | 607 |
| 7 | teaching | 109 | 935 |
| 8 | Learning systems | 109 | 778 |
| 9 | Online learning | 109 | 530 |

Source: Vosviewer Output (2022)

### 3.2. Author References

By using the Vosviewer function module for co-authorship visualization, the pattern of author cooperation in this hybrid learning is analyzed. Based on 1,110 research documents from the Scopus database published by 3,132 authors, a collaborative network of authors on hybrid learning in higher education during the Covid pandemic was considered, as shown in Figure 2, which shows that there were research partnerships between several authors. Co-authorship is affiliation and country, namely: Wang Y, Xu J, Yu L, Zhang Y, Li X, Li Y, Han J, Li Q, Li Z, Ashraf MA, Liu J, Tlili A, Huang R, Burgos D, Shi Y, Yang J, Wang Z, Wang S, Li J, and Li L. As for the rest, they have separate and individual publications.

The threshold is set at 3 to know the most famous author when the data is prepared for the co-authoring map. As a result, it was found that 63 items in the network are connected to each other. Author collaboration analysis helps us to understand the current research status and its level. Experts from various types of fields in the context of knowledge exchange can play an important role in developing their respective fields. The number of publications of a particular author with other authors is also important. Each node in the network represents one author, and the size varies with the number of publications. Figure 2 shows four different colors and each color represents a group the author belongs to, which refers to the default grouping method setting in Vosviewer. Each line represents a collaborative relationship between authors, and wider lines indicate a strong relationship. Table 2 shows the top 10 consist of stronger co-authorship with respect to the productive authors of the documents.

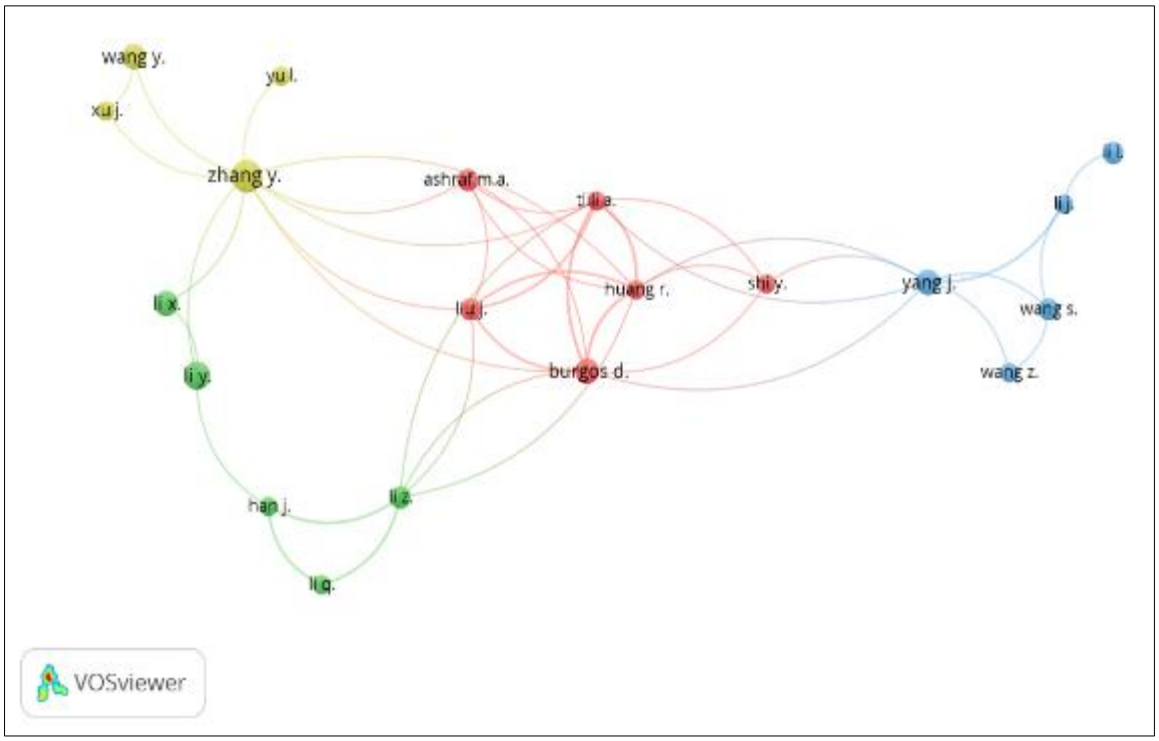


**Figure 2** Network of Hybrid Learning Research Writers

**Table 2** Top 10 Hybrid Learning Research Network Co-Authorship

| No | Author | Documents | Citations | Total Link Strength |
|---|---|---|---|---|
| 1 | Makhachashvili R | 5 | 9 | 5 |
| 2 | Semenist I | 5 | 9 | 5 |
| 3 | Zhang Y | 8 | 17 | 4 |
| 4 | Burgos D | 5 | 22 | 2 |
| 5 | Li X | 5 | 18 | 2 |
| 6 | Li Y | 6 | 14 | 2 |
| 7 | Wang Y | 5 | 18 | 1 |
| 8 | Y | 5 | 12 | 1 |
| 9 | Arnab S | 5 | 4 | 0 |
| 10 | Hod Y | 5 | 21 | 0 |

Source: Vosviewer Output (2022)

### 3.3. State Network

Scientometric analysis carried out in hybrid learning in tertiary institutions during the Covid 19 pandemic based on state cooperation shows that 105 countries have published research articles. Of the 53 countries have less than 5 article documents. United States (US) is the most active and contributing country of all, apart from international cooperation. Likewise, China, Spain, United Kingdom (UK) and Australia are the top 5 countries with high contribution. Figure 3 shows an overlay image of 105 countries where Malaysia, Saudi Arabia, Norway, Netherlands Pakistan, India, Canada, Brazil, Indonesia, Thailand and the Philippines have the most recent publications (Blue 2021.0 to Yellow 2021.6).

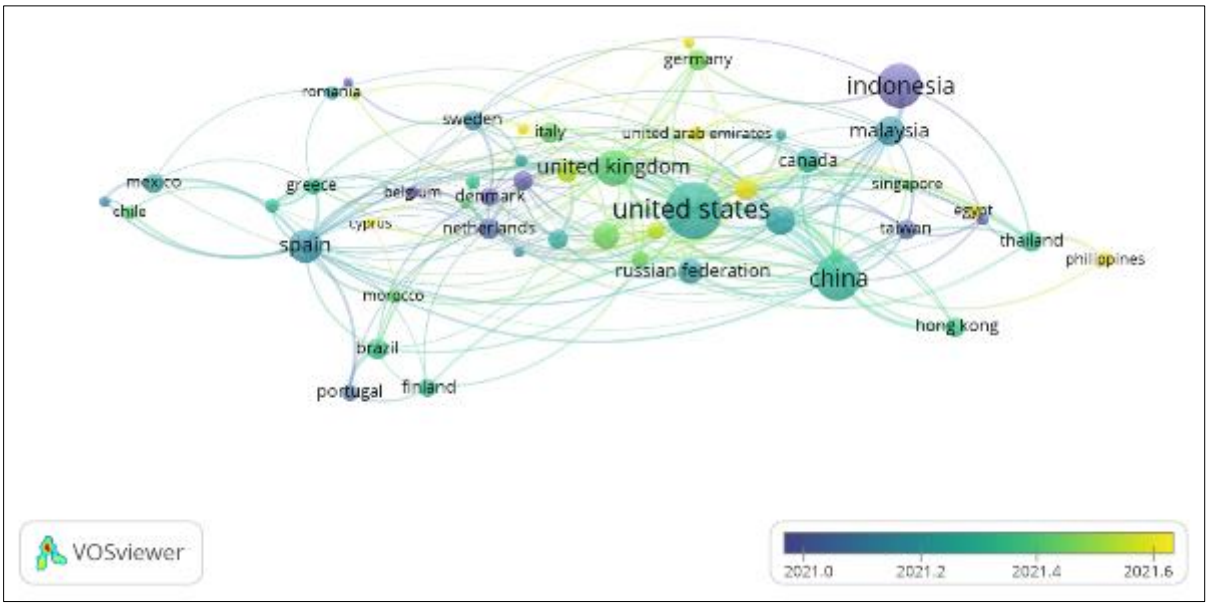


**Figure 3** Visualization of Country/Region Network Based on Number of Documents

**Table 3** The Top 10 Countries in the State Network in Hybrid Learning Research in Higher Education

| No | Country | Documents | Citations | Total Link Strength |
|---|---|---|---|---|
| 1 | United States | 168 | 439 | 37,000 |
| 2 | China | 109 | 254 | 35,000 |
| 3 | spain | 60 | 570 | 26,000 |
| 4 | United Kingdom | 70 | 254 | 22,000 |
| 5 | Australia | 47 | 308 | 20,000 |
| 6 | Malaysia | 48 | 180 | 17,000 |
| 7 | Saudi Arabia | 26 | 55 | 15,000 |
| 8 | Norwegian | 23 | 74 | 13,000 |
| 9 | Netherlands | 24 | 60 | 12,000 |
| 10 | Pakistan | 16 | 34 | 12,000 |

Source: Vosviewer Output (2022)

### 3.4. Collaborative Research Organizations

By placing the minimum documents for organizations are 2 documents, 2,212 organizations and 71 research organization networks are obtained which are interconnected, and shown in Figure 4. It can be seen that the organizational networks are slightly spread out. So, this article only covers the top 3 members, namely educational technology and e-learning organizations, laboratory of mechanical design, and research group on materials.

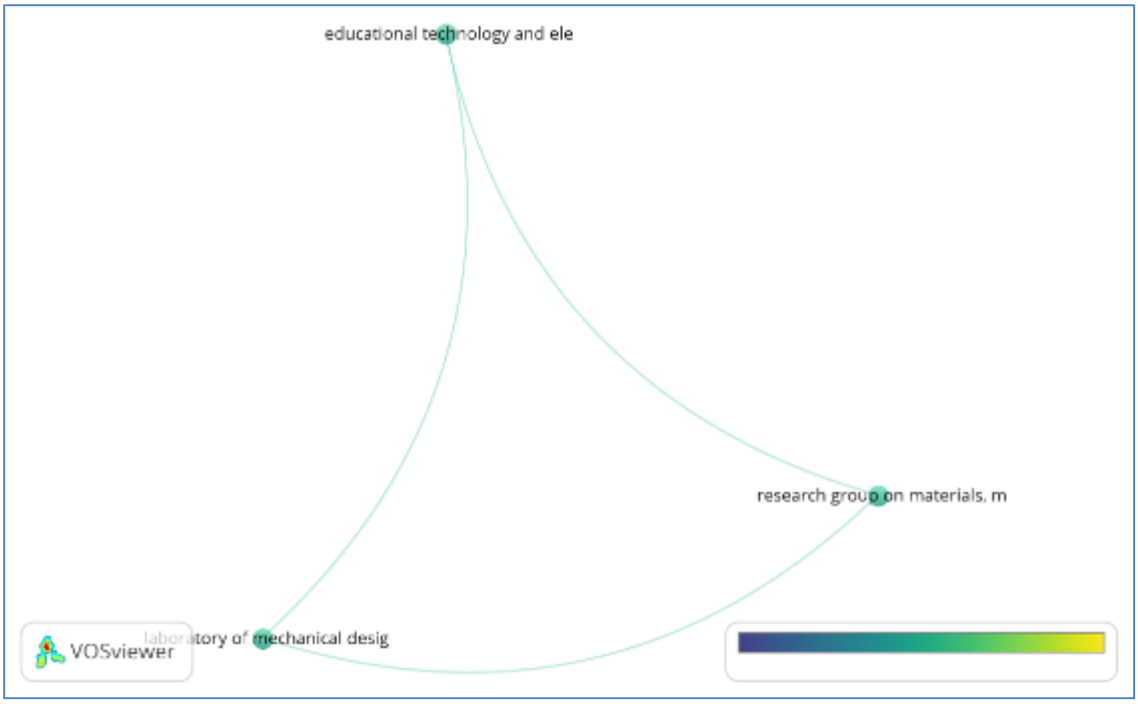


**Figure 4** Organizational Network Based on Document Weight

### 3.5. Main Journal Sources

From the 1,110 documents sourced from the Scopus database, researchers took a minimum of 2 documents, and obtained 561 journal sources and 174 linked journals. The Computer and Education Journal has the highest number of citations, namely 221 citations with 10 documents, then the British Journal of Educational Technology with 179 citations out of 18 documents. The third highest number of citations is Sustainability (Switzerland) with 159 citations out of 39 documents, then Education Sciences with 148 citations and 21 documents. The fifth most is the Education and Information Technology Journal with 113 and 19 document citations. Details of the top 10 journals are presented in Table 4 and Figure 5.

**Table 4** 10 Most Productive Journals

| No | Journal Rating | Number of Documents | Number of Quotations | Total Link Strength |
|---|---|---|---|---|
| 1 | British Journal of Educational Technology | 18 | 179 | 42 |
| 2 | Computer and Education | 10 | 221 | 38 |
| 3 | Learning Environments Research | 4 | 84 | 37 |
| 4 | Education and Information Technology | 19 | 113 | 27 |
| 5 | Sustainability (Switzerland) | 39 | 159 | 25 |
| 6 | Postdigital Science and Education | 14 | 109 | 22 |
| 7 | Frontiers in Psychology | 14 | 47 | 11 |
| 8 | Acm International Conference Proceedings | 21 | 24 | 10 |
| 9 | Education Sciences | 21 | 148 | 10 |
| 10 | Interactive Learning Environments | 12 | 74 | 10 |

Source: Vosviewer Output (2022)

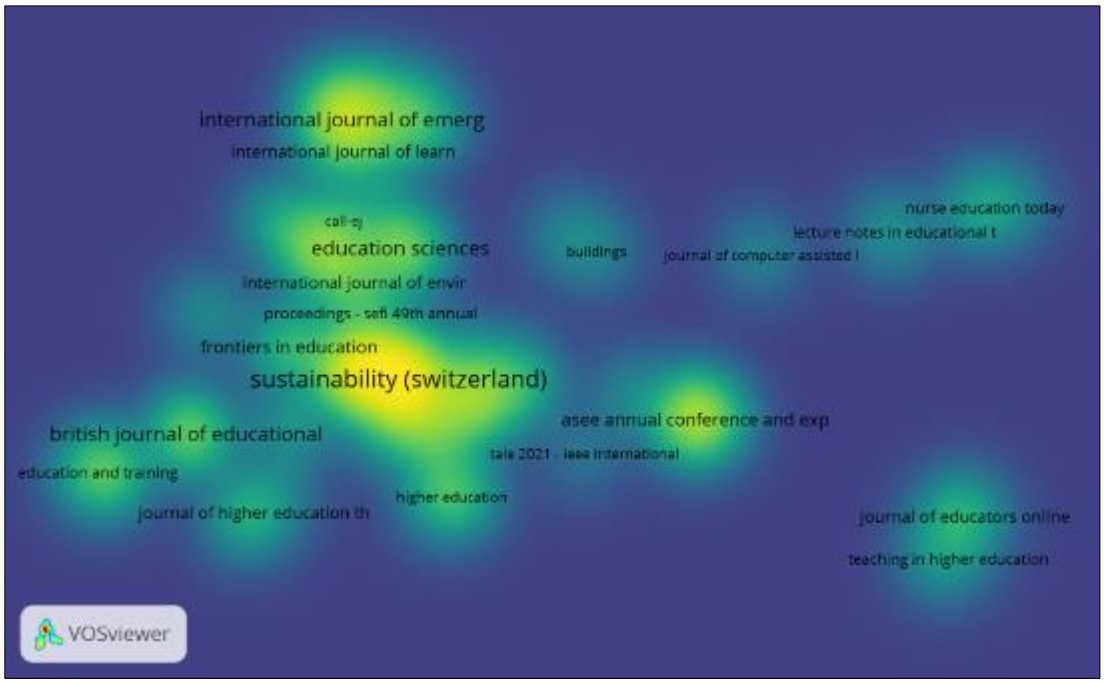


**Figure 5** Density Visualization View Main Journal

## 4. Discussion

Nowadays it cannot be denied that the use of online resources has become commonplace, especially during the last 10 years. This is demonstrated in all literature published over the last decade. In line with Samsudeen's & Mohamed research (2019) which describes the benefits and adaptability gained in distance education classes through online-based learning. Building on the findings of the scientometric analysis performed in all of the previous sections, these findings facilitate the exploration of the most relevant research gaps and future directions for researchers.

Based on 1,110 documents, the researchers on this theme selected the most frequently used keywords and topics derived from their relationships. Their main results show a very significant growth in the use of hybrid learning in higher education during the Covid 19 pandemic. This increase was especially noticeable during the last 2 years, when the Covid 19 pandemic took place. However, it should be noted that hybrid learning is still being used, even though the Covid 19 pandemic has ended. This bibliometric study highlights the fact that more research efforts are needed in terms of the study of hybrid learning strategies and frameworks, assessments and adapted systems.

The results of the scientometric analysis show that there are seven sub-fields of research in one topic, namely education, curriculum, pandemic, human, virtual learning, sars-cov, Indonesia, epidemiology, cross-sectional study, educational measurement, article, controlled study, questionnaire, critical thinking, distance education, mooc, teaching and learning, technology education, distance-learning, colleges and universities, case studies, higher education, learning outcome, innovation, social media, knowledge building, university sector, students, online course, project- based learning, virtual reality, feedback, augmented reality, emergency remote teaching, teachers distance education, face to face, distance learning, remote teaching, ICT, self-directed learning, emergency remote teaching, flipped classroom, pedagogy, problem-based learning, online , covid 19, self-efficacy, remote learning, learning engagement , social presence.

Finally, using the seven research sub-fields can form new research trends for many researchers. These results are in line with the research of Eduljee, et al (2022); Pinto, et al (2019); Castro-Rodríguez, et al (2021), that according to the results of a bibliometric analysis, it is known that there is a direct relationship between hybrid learning or blended learning, higher education and new research methodologies. For this reason, the keywords considered in this study show a higher density and the relatedness and proximity between them.

Publications that incorporate hybrid learning in the context of learning in higher education highlight how the role of technology is growing rapidly at all levels. This result is supported by a report published by Fundación Telefónica (2017), which states that young people between the ages of 15 and 24 have become “mobile first” or “mobile only”. That is, mobile devices are the primary tool for searching or managing information. In the last decade, research on this theme

in higher education has been carried out by Bozkurt, A. (2022); Siripongdee, et al (2020); Tlili, et al (2020); Brika, et al (2021); Hysa, et al (2022) who describe their experiences in using mobile technology in learning. These authors also highlight the need to display critical perspectives when using mobile devices for learning purposes.

Cuthbertson & Falcone (2014) also emphasized the need to create learning communities and promote motivation in the context of online learning. In line with Nakayama, et al. (2014) reflected on the need for online teaching and learning to promote proactive education, not only for online learning but also for blended or hybrid learning, as researched by Turnbull, et al (2021). Regarding the bibliometric analysis and trends that have been described previously, from the results of the density and cluster display it can be concluded the complexity and dynamism of this research topic. Density displays show consolidated main research lines, whereas groups show overall relatedness.

Researchers in this field have also proven that the last two years have been very important in producing scientific documents in this field. In this sense, referring to Gunn & Miree's (2012) study, which stated that the results of his experiments and observations led him to think that a methodology based on online learning was more effective for some skills than others. However, the combination of methodologies highlighted by the authors increases the option that will be repeated later, namely blended learning/hybrid learning. This is also in line with the research of Russell, et al. (2013), that in terms of the constructivism previously mentioned, highlights the need for a variety of learning methods in tertiary institutions. Mune, et al. (2015) analyzed the spread of hybrid or online learning, implicitly attracting attention because of the ease, novelty, and effectiveness of hybrid and online options. However, the success of a learning is closely related to the competency and professionalism of the teacher, as well as the support from the institutions involved.

## 5. Conclusion

The conclusion of this study is that from 1,110 documents sourced from the Scopus database, seven sub-fields of research keywords were obtained, with the top 7 keywords namely students, e-learning, hybrid learning, covid-19, higher education, blended learning, teaching, learning systems, online learning. The document was published by 3,132 authors from a collaborative network of writers on hybrid learning in higher education during the Covid 19 pandemic. Meanwhile based on the country network there are 105 countries, and the top 7 countries are United States, China, Spain, United Kingdom, Australia, Malaysia, Saudi Arabia, Norway, Netherlands and Pakistan. From this document, 2,212 organizations and 71 networks of interconnected research organizations, educational technology and e-learning organizations, laboratories of mechanical design, and research groups on materials were also obtained. In addition, 561 journal sources and 174 journals that are interconnected were also obtained.

The most prominent limitation of this study is the use of documents in only one database, namely Scopus, due to the limited number of open access publications including content analysis. It is very important to remember that application of practice and materials alone does not guarantee instructional success, but contextual conditioning factors must also be considered. Recommendations for further research are to combine qualitative and quantitative methodologies to study what actually happens in classrooms with hybrid learning systems.

The next recommendation is that the analysis of student competencies needed and developed through the implementation of hybrid learning will be very relevant. Therefore, future research requires better learning planning and design, after selecting adequate tools and materials. In addition, it is necessary to conduct studies with larger and more diverse samples to complement the existing results and facilitate the development of a theoretical framework that integrates other variables in the study. Finally, it is advisable to combine bibliometric indicators with altmetrics from networks such as ORCID, Mendeley, ResearchGate.

## Compliance with ethical standards

### *Acknowledgments*

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### *Disclosure of conflict of interest*

The authors declare no conflict of interest.

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