



# BIBLIOMETRIC ANALYSIS OF ONLINE LEARNING USING R AND VOS-VIEWER

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## ABSTRACT

Swift technical progress, especially the extensive accessibility of the internet, has significantly transformed educational delivery. Consequently, online education has proliferated at an unparalleled rate worldwide. The Indian online education industry is projected to grow by USD 8.53 billion, with a compound annual growth rate (CAGR) of 29% from 2024 to 2029. This study performs a thorough bibliometric analysis of 523 articles published in Scopus database from 2010 to 2025. The bibliometrix and Vos Viewer software packages are used for analyses purpose. Both the software helps in comprehensively investigating the publishing trends, principal authors, leading journals, prevalent keywords, co-citation networks, and patterns of international collaboration. The results indicate that: (1) Research on online learning has shown tremendous annual growth, especially post 2018, reinforcing increased scholarly interest; (2) Few nations influence in research activity and collaboration; (3) Co-citation analysis map out influential literature for future research purpose within the discipline; (4) The top three journals with High H- Index are International Journal of Management Education, Technological Forecasting and Social Change and Knowledge Management and E-Learning. (5) Keyword co-occurrence analysis spotlight themes such as E-Learning, Online Learning, Higher Education etc. These findings provide a comprehensive overview of the conceptual framework and developmental trajectory of online learning, which will aid in providing a robust foundation for future study and informing policy decisions by scholars and organizations.

**Keywords:** Online learning, E-learning, Students, Online Platforms.

## Introduction

In the last ten years, higher education institutions globally have progressively acknowledged online learning as a legitimate alternative or supplement to conventional classroom instruction (Larreamey Joerns & Leinhardt, 2006; Tallent-Runnels et al., 2006). Swift technical progress, especially the extensive accessibility of the internet, has significantly transformed educational delivery. Consequently, online education has proliferated at an unparalleled rate worldwide. The Indian online education industry is projected to grow by USD 8.53 billion, with a compound annual growth rate (CAGR) of 29% from 2024 to 2029. Online learning provides a degree of flexibility and convenience that is challenging to attain in traditional face-to-face environments, rendering it particularly advantageous for students managing scholastic obligations alongside employment and family duties. In light of these advantages, educational institutions have always endeavoured to encourage the use of online learning among students and faculty alike. The transition became markedly evident during the COVID-19 pandemic, as institutions were necessitated to halt in-person sessions to mitigate viral transmission, resulting in a pervasive shift to online teaching and learning modalities (Park & Lee, 2021).

Clark & Mayer (2016) characterized online learning as the utilization of digital devices, including desktop computers, laptops, tablets, and smartphones, to facilitate instruction via the internet. Previous studies refer to it as 'blended learning,' 'e-learning,' and 'remote learning.' Online courses provide students with a plethora of benefits such as convenience, flexibility and opportunities to work collaboratively across the World. Furthermore, it gives students range of courses and degrees which can be pursued from online platforms. These courses can also be pursued along with their regular studies. It gives them opportunity to interact with bigger base of learners and communicate effectively.

Although many studies have comprehensively advanced the concept of online learning, several critical gaps remain, there is a requirement for research that offers an exhaustive overview of the present work, stressing the progress achieved and identifying research gaps from many viewpoints. This study conducts a bibliometric assessment of the extensive literature published between 2010 to 2025 in the Scopus database on the theme Online Learning. Using Vos Viewer and related visualization tools, this research systematically explores publication trends, well recognized authors, key institution and keyword occurrences. It further seeks to address the following research questions:

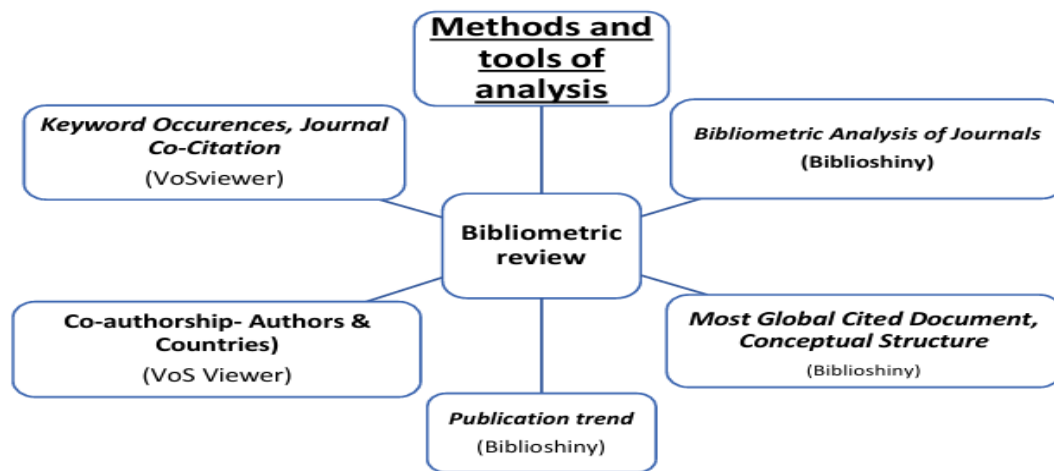
1. What is the progression of publications pertaining to online learning from 2010 to 2026?
2. Which journals and authors are most pertinent to online learning?
3. What are the presiding themes and their intellectual relationships based on grouping of themes, keywords or documents?
4. What are the main research keywords for online learning within the last decade?
5. Which countries are the most prominent in the field of online learning research?

The research is going to deliver a detailed, well -structured and systematized Knowledge map of the subject. The results will help in promoting the concept of online learning, thereby assisting the stakeholders in the promotion of online learning as an alternative to traditional learning.

## METHOD

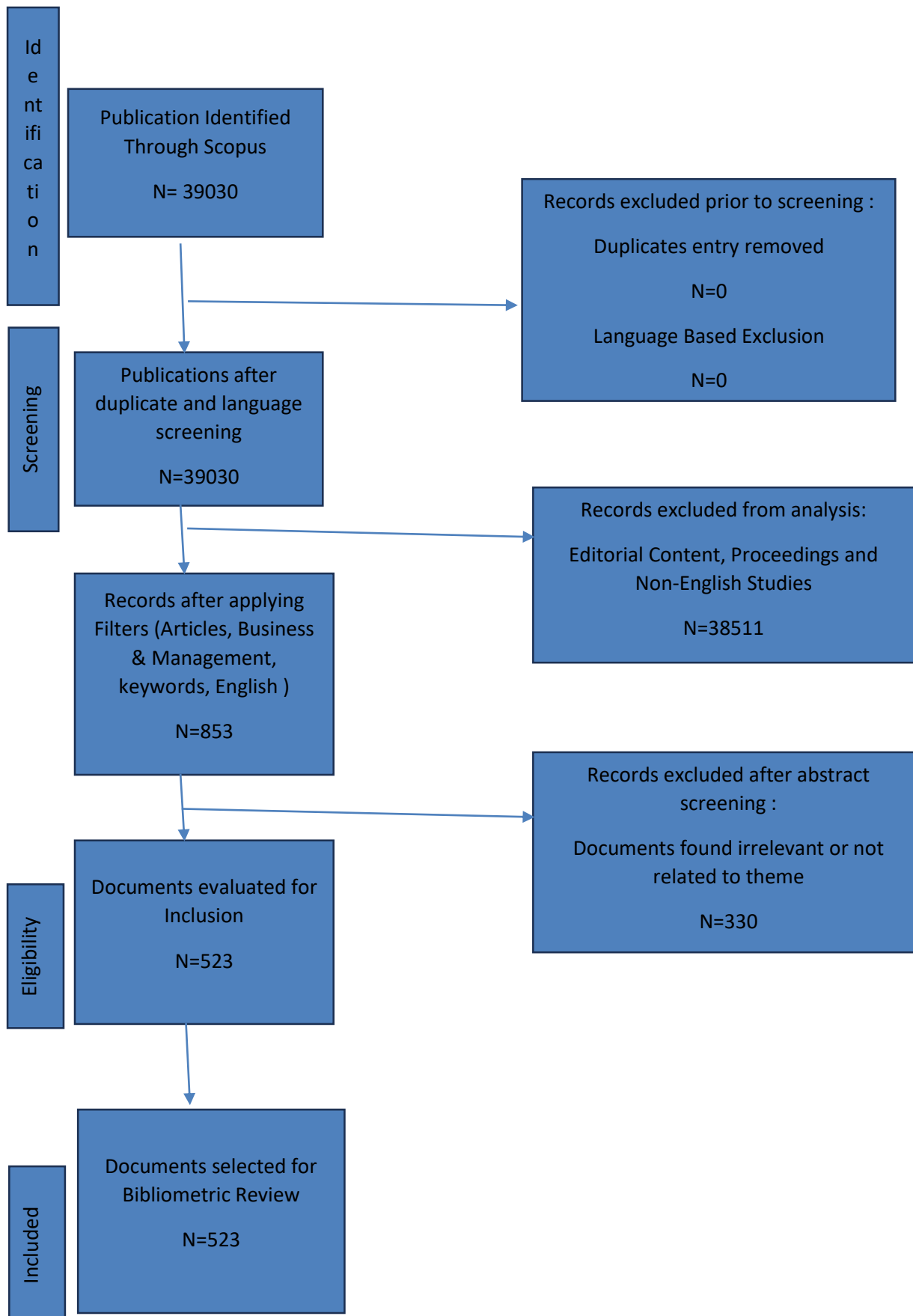
This research incorporates data obtained from the Scopus Database. The Scopus database core collection is regarded as a reliable and trustworthy resource for bibliometric research, offering comprehensive coverage across disciplines and ensuring the inclusion of high-quality scholarly articles. The subsequent advanced query employed to retrieve data from the Scopus database: - ( TITLE-ABS-KEY ( "ONLINE LEARNING" OR "E-LEARNING" OR "DIGITAL LEARNING" OR "ONLINE EDUCATION" OR "INTERNET BASED EDUCATION" ) AND TITLE-ABS-KEY ( "STUDENT\*" OR "LEARNING" OR "ADOPTION" OR "INTENTION" OR "READINESS" ) AND TITLE-ABS-KEY ( "UNIVERSITY" OR "COLLEGE" OR "TAM" OR "UTAUT" OR "VAM" ) ) AND PUBYEAR > 2010 AND PUBYEAR < 2025 AND ( LIMIT-TO ( SUBJAREA , "BUSI" ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( LIMIT-TO ( EXACTKEYWORD , "E-learning" ) OR LIMIT-TO ( EXACTKEYWORD , "Students" ) OR LIMIT-TO ( EXACTKEYWORD , "Teaching" ) OR LIMIT-TO ( EXACTKEYWORD , "Online Learning" ) OR LIMIT-TO ( EXACTKEYWORD , "Higher Education" ) OR LIMIT-TO ( EXACTKEYWORD , "Online Education" ) OR LIMIT-TO ( EXACTKEYWORD , "Blended Learning" ) OR LIMIT-TO ( EXACTKEYWORD , "Technology Acceptance Model" ) OR LIMIT-TO ( EXACTKEYWORD , "Online Teaching" ) OR LIMIT-TO ( EXACTKEYWORD , "Online Course" ) OR LIMIT-TO ( EXACTKEYWORD , "E - Learning" ) OR LIMIT-TO ( EXACTKEYWORD , "Technology Acceptance Model (tam)" ) OR LIMIT-TO ( EXACTKEYWORD , "Tam" ) OR LIMIT-TO ( EXACTKEYWORD , "UTAUT Model" ) OR LIMIT-TO ( EXACTKEYWORD , "Utaut" ) OR LIMIT-TO ( EXACTKEYWORD , "On-line Education" ) OR LIMIT-TO ( EXACTKEYWORD , "Massive Open Online Course" ) ). To warrant data honesty and citation extensiveness, the dataset covers publications from 2010 to 2025. The data was accessed on 31/10/2025 at 11.00 pm. A total of 523 valid records were retrieved after excluding irrelevant articles. Key bibliographic fields such as title, author(s), institutional affiliation, abstract, keywords, citation count and publication year were extracted and exported in "CSV" format for analysis.

Biblioshiny and VOS Viewer were utilized for analysis and visualization of bibliometric data. The purpose behind performing bibliometric analysis is to develop an exhaustive framework for the area of research. According to Denyer and Tranfield (2009) bibliometric review contributes by understanding trends and pinpointing research gaps. The VOS Viewer software and the Biblioshiny Package from R-studio facilitate the display of bibliometric networks, including keyword co-occurrence, author and institution collaboration, national cooperation, and co-citation analysis. Software makes it easy to directly process SCOPUS export files (CSV) and creates network graphs and heatmaps that clearly show how academic communication works and point out research hotspots in the field. Figure 1 summarises the various tools used in this study to answer the various research questions and Figure 2 shows the data screening process:



Source: Author's Compilation

**Figure 1-***Methods and Tools of Analyses*

**PRISMA (Preferred Reporting Items for Systematic Reviews and Meta Analysis)****Figure 2: - Data Selection Process**

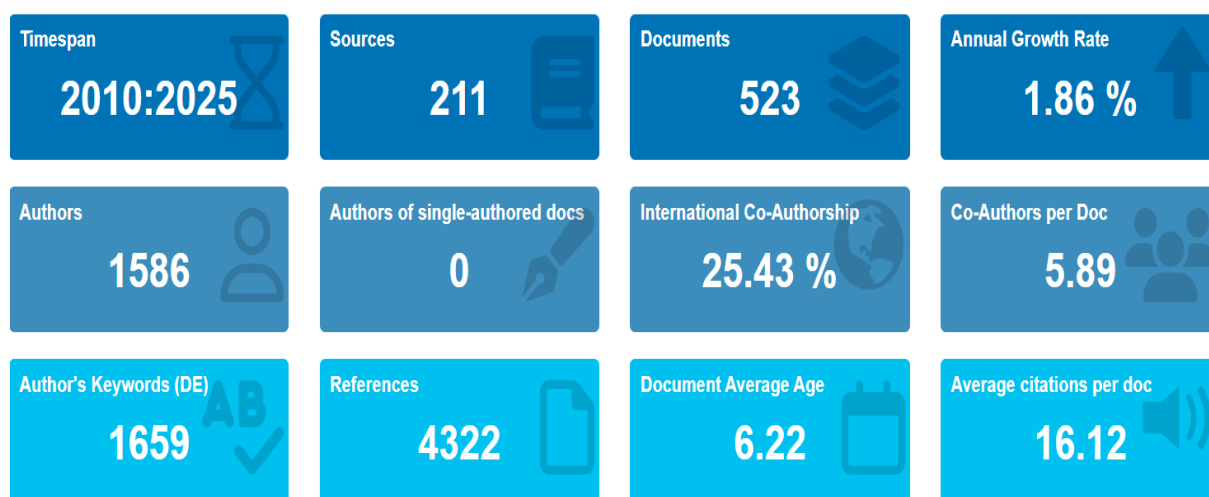
## Data Analysis and Findings

This part presents an analysis encompassing descriptive analysis, which outlines the entire dataset, influential elements of the literature, co-occurrence and collaborative patterns, as well as emerging issues within the current literature base.

### Descriptive Analysis and Important Observations

#### Dataset

The present study considers a dataset of total 523 articles published in the database -Scopus in the domain of Online Learning. The time period under deliberation ranges from 2010-2025. The 523 documents have been published in 211 sources which have been composed by 1586 authors having a total of 1659 keywords. Figure 3 presents an overall summary of the dataset under consideration for the bibliometric analysis. On an annual basis, the rate of research publishing has increased by 1.86%. Interestingly, 25.43% of the papers or 133 papers have been written by international authors. On an average, a paper has been authored by 6 authors while average document age is 6.22 years and average citations per document is 16.12.

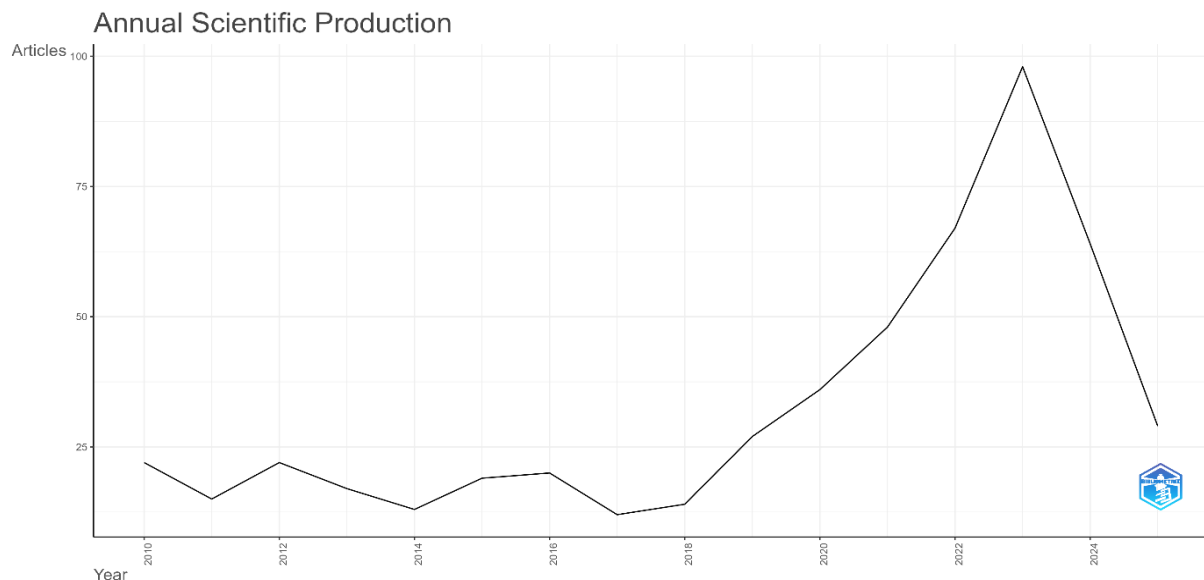


**Source:** - Biblioshiny

**Figure3:** - Main Information About Dataset

#### Analysis of Annual Publication

Figure 4 depicts the annual publication trends in the field of online learning over a 15-year period from 2010 to 2025. The general trajectory demonstrates an upward trend, with particularly notable growth occurring after 2018. This development signifies an increasing scholarly emphasis and engagement with the issue over the past decade. Between 2010 and 2014, the yearly publishing volume shown a moderate and rather consistent growth. Beginning in 2018, the field began to progress swiftly. The period from 2018 to 2023 represented an era of rapid progress. In 2023, the number of published papers rose to 100. The data for 2025 consists of merely 29 publications, as the retrieval took place on October 31, 2025, and hence does not represent the complete year. The figure clearly illustrates a declining trend in article publication.



**Source:** - Biblioshiny

**Figure 4:** - Annual Trend of Publication

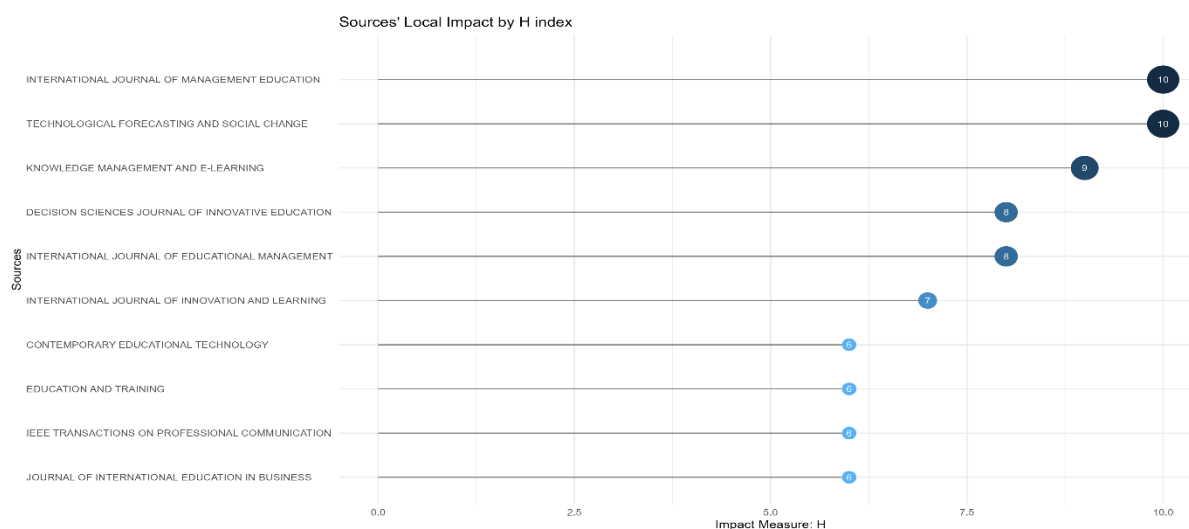
### Bibliometric Analysis of Journals

This study conducted a bibliometric analysis of journals within the gathered literature to identify the leading publication platforms and high-impact journals in the domain of online learning. Table 1 & Figure 5 shows the 15 best journals based on the number of papers published and the number of times they have been cited. The Journal of International Journal of Management Education has the most articles 16 which is a big part of all the articles published. Technological Forecasting and Social Change, on the other hand, is in second place with 11 publications, but it has a far higher citation effect, with an average of 544 citations per piece. Knowledge Management and E-Learning, which is placed third, has more articles published but a lower M Index than Technological Forecasting and Social change. After these come Decisions Sciences Journal of Innovative Education, International Journal of Educational Management and finally the International Journal of Networking and Virtual Organizations. This shows that the field is interdisciplinary. In conclusion, studies on online learning are characterized by the existence of both prolific publications and extensively cited journals.

**Table 1:** List of Top 15 Journal in the domain of Online Learning

| PUBLICATIONS/JOURNALS                                                | RANK | H-INDEX | G-INDEX | M-INDEX  | TC  | NP | PY START |
|----------------------------------------------------------------------|------|---------|---------|----------|-----|----|----------|
| <i>International Journal of Management Education</i>                 | 1    | 10      | 16      | 0.666667 | 293 | 16 | 2012     |
| <i>Technological Forecasting and Social Change</i>                   | 2    | 10      | 11      | 1.666667 | 544 | 11 | 2021     |
| <i>Knowledge Management and E-Learning</i>                           | 3    | 9       | 14      | 0.5625   | 530 | 14 | 2011     |
| <i>Decision Sciences Journal of Innovative Education</i>             | 4    | 8       | 11      | 0.5      | 327 | 11 | 2011     |
| <i>International Journal of Educational Management</i>               | 5    | 8       | 12      | 0.470588 | 351 | 12 | 2010     |
| <i>International Journal of Innovation and Learning</i>              | 6    | 7       | 10      | 0.411765 | 126 | 16 | 2010     |
| <i>Contemporary Education Technology</i>                             | 7    | 6       | 9       | 0.666667 | 330 | 9  | 2018     |
| <i>Education and Training</i>                                        | 8    | 6       | 6       | 0.352941 | 227 | 6  | 2010     |
| <i>IEEE Transactions on Professional Communication</i>               | 9    | 6       | 8       | 0.352941 | 128 | 8  | 2010     |
| <i>Journal of International Business in Education</i>                | 10   | 6       | 8       | 0.4      | 370 | 8  | 2012     |
| <i>Journal of Management Education</i>                               | 11   | 6       | 7       | 0.352941 | 210 | 7  | 2010     |
| <i>Journal of Education for Business</i>                             | 12   | 5       | 8       | 0.3125   | 74  | 10 | 2011     |
| <i>Human Systems Management</i>                                      | 13   | 4       | 4       | 0.25     | 94  | 4  | 2011     |
| <i>International journal of Business Information Systems</i>         | 14   | 4       | 6       | 0.25     | 44  | 6  | 2011     |
| <i>International Journal of Networking and Virtual Organizations</i> | 15   | 4       | 8       | 0.235294 | 84  | 8  | 2010     |

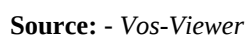
Source: - Biblioshiny



Source: - Biblioshiny

**Figure 5:** - Total Citations of Top 10 Journals

Co-occurrence analysis examines the phrases that predominantly appear in the selected publications (Su & Lee, 2010). Keyword co-occurrence analysis is a fundamental bibliometric method utilized to elucidate study themes and trends. It elucidates the essential concepts, research priorities, and their interrelations by analysing the frequency and co-occurrence patterns of phrases in the literature (Callon M et al.). This method quantitatively illustrates study emphasis and knowledge structures, while also assisting researchers in selecting themes and generating novel ideas, rendering it a vital instrument for ascertaining existing knowledge in academic literature.



In this study, keyword mapping was done on 523 papers using VOS viewer. Keywords with a frequency of 10 or more were selected for visualization. The resulting co-occurrence network, shown in figure 6, was refined by removing duplicates and irrelevant terms.

The results show that the keywords form four different clusters, with larger nodes representing higher frequency of occurrence. As illustrated in Figure 6, high-frequency keywords such as e-learning, students, teaching, higher education, online learning serve as representative terms in this research domain. To get the results through Vos Viewer, full counting method was chosen, with 10 as the minimum number of occurrences of a keyword. Of the 2665 keywords, 51 met the threshold. The created graphic also illustrates the relationship among the words. In the map, the nodes represent the examined objects, and a higher frequency corresponds to a larger node size. Table 2 displays the keywords along with occurrences and total link strength.

| Keyword                 | Occurrence | Total Link Strength |
|-------------------------|------------|---------------------|
| <i>E-Learning</i>       | 270        | 715                 |
| <i>Students</i>         | 97         | 429                 |
| <i>Teaching</i>         | 71         | 330                 |
| <i>Higher Education</i> | 97         | 213                 |
| <i>Online Learning</i>  | 143        | 202                 |

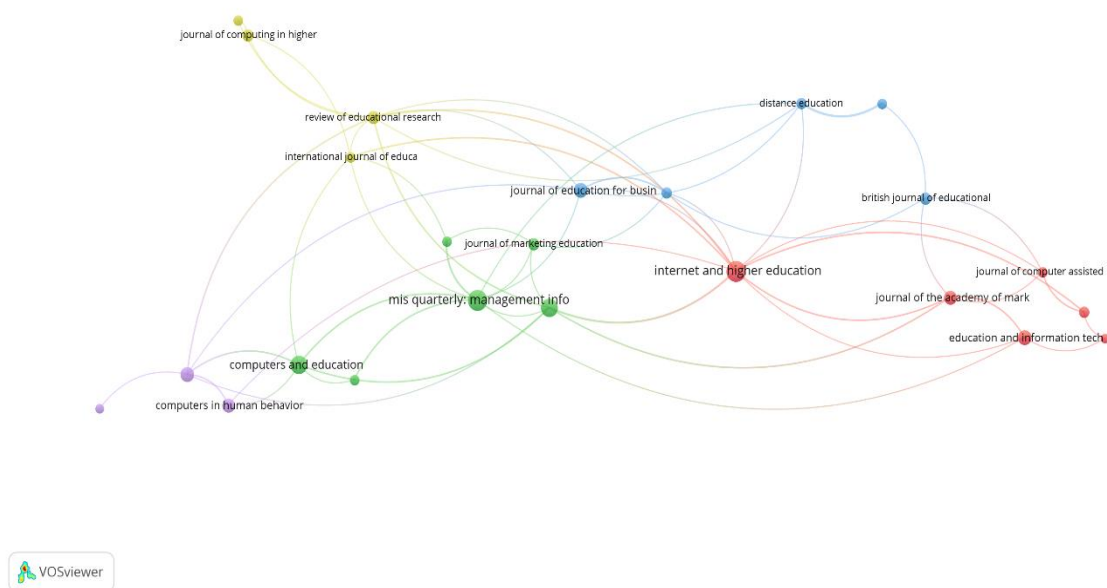
**Source:** - *Vos-Viewer*

## Co-citation Analysis

A co-citation relationship is established when a third document cites two documents concurrently. The intensity of knowledge interrelation among publications within a specific domain is shown by the prevalence of co-citations. This method effectively illustrates the body of knowledge in a research domain by identifying frequently cited works. These are often foundational texts recognized for offering theoretical or methodological foundations.

### Journal Co-citation Analysis

A visual analysis of co-cited journals in online learning, (Figure 7) was conducted, with a minimum citation threshold of 5, resulting in 24 journals included in the co-citation network. Four major clusters, were identified. Each cluster was represented by different colours representing distinct research themes and disciplinary backgrounds.



**Figure 7-** Journal co-citation Mapping

Table 3 displays about the four major journal clusters, represented by different colour themes Red, Green, Blue, Yellow.

**Table 3** -Cluster Analyses of Journals

| Colour Theme | Cluster No. | Journals                                                                                                                                                                                                                                                                                                                                                                                               | Links | Total Link Strength | Citations |
|--------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------|-----------|
| Red          | 1           | <ul style="list-style-type: none"> <li>• <i>Education and Information Technologies</i></li> <li>• <i>International Journal of Emerging Technologies in Learning</i></li> <li>• <i>Internet and Higher Education</i></li> <li>• <i>Journal of Computer Assisted Learning</i></li> <li>• <i>Journal of Management Education</i></li> <li>• <i>Journal of the Academy of Marketing Science</i></li> </ul> | 11    | 17                  | 24        |
| Green        | 2           | <ul style="list-style-type: none"> <li>• <i>Computers and Education</i></li> <li>• <i>Information and Management</i></li> <li>• <i>Journals of Management Information Systems</i></li> <li>• <i>Journal of Marketing Education</i></li> <li>• <i>Management and Information Systems</i></li> <li>• <i>Psychological Bulletin</i></li> </ul>                                                            | 09    | 13                  | 25        |
| Blue         | 3           | <ul style="list-style-type: none"> <li>• <i>British Journal of Education Technology</i></li> <li>• <i>Decision Sciences Journal of Innovative Education</i></li> <li>• <i>Distance Education</i></li> <li>• <i>Journal of Accounting Education</i></li> <li>• <i>Journal of Education for Business</i></li> </ul>                                                                                      | 06    | 07                  | 13        |
| Yellow       | 4           | <ul style="list-style-type: none"> <li>• <i>BMC Medical Education</i></li> <li>• <i>International Journal of Educational Technology in Higher Education</i></li> <li>• <i>Journal of Computing in Higher Education</i></li> <li>• <i>Review of Educational Research</i></li> </ul>                                                                                                                     | 09    | 12                  | 10        |

Source: Vos Viewer

The co-citation network of journals exhibits distinct cross-disciplinary traits. This comprehensive information demonstrates that online learning is influenced by technology, higher education, distance education, emerging technologies in learning etc. The robust co-citation relationships among journals indicate that various research disciplines are highly integrated, and interdependent.

### Bibliometric Analyses of Most Global Cited Documents

Table 4 presents a compilation of research publications along with their corresponding citation data. This encompasses the aggregate number of citations received (Total Citations), the annual citation count (TC per year), and the adjusted total citation count (Normalized TC). The articles encompass several subjects and publishing years, with certain authors appearing multiple times.

**Table 4-** Most Global Cited Documents

| Paper                                             | DOI                             | Total Citations | TC per year | Normalized TC |
|---------------------------------------------------|---------------------------------|-----------------|-------------|---------------|
| TARHINI, 2017, J. INT. EDUC. BUS.                 | 10.1108/JIEB-09-2016-0032       | 230             | 23          | 6.93          |
| NÚÑEZ CANAL, 2022, TECHNOL. FORECAST. SOC. CHANG. | 10.1016/j.techfore.2021.12.1270 | 192             | 38.40       | 12.57         |
| MULENGA, 2020, CONTEMP. EDUC. TECHNOL.            | 10.30935/cedtech/7949           | 191             | 27.29       | 8.31          |
| RODRÍGUEZ-ARDURA, 2016, INF. MANAG.               | 10.1016/j.im.2015.11.005        | 180             | 16.36       | 5.41          |
| HELAL, 2018, KNOWL.-BASED SYST.                   | 10.1016/j.knosys.2018.07.042    | 161             | 17.89       | 4.38          |
| DANEJI, 2019, KNOWL. MANAG. E-LEARN.              | 10.34105/j.kmel.2019.11.010     | 145             | 18.13       | 7.83          |
| AL-EMRAN, 2020, TECHNOL. SOC.                     | 10.1016/j.techsoc.2020.10.1247  | 141             | 20.14       | 6.14          |
| HAMDAN, 2021, INT. J. EDUC. MANAG.                | 10.1108/IJEM-11-2020-0513       | 134             | 22.33       | 6.03          |
| PARAHOO, 2016, J. MARK. HIGH. EDUC.               | 10.1080/08841241.2015.1083511   | 112             | 10.18       | 3.37          |
| XU, 2014, INF. MANAG.                             | 10.1016/j.im.2014.02.009        | 107             | 8.23        | 4.83          |

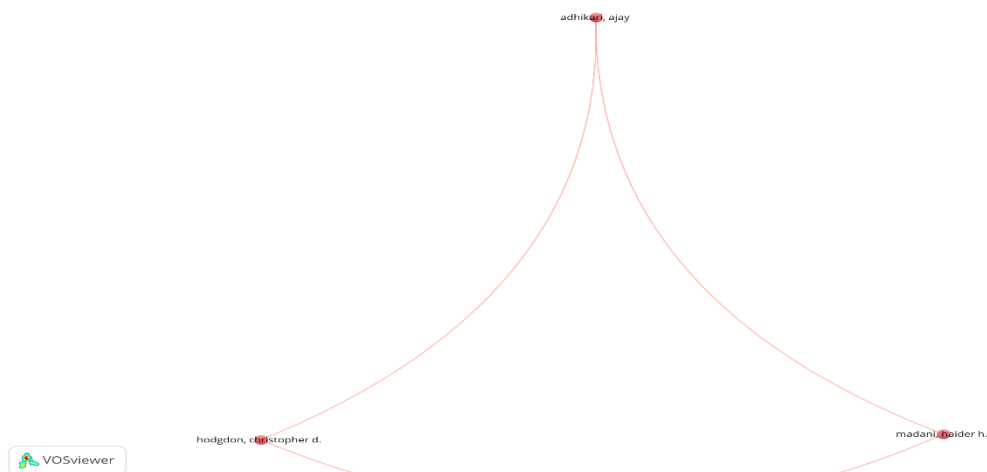
Source: *Biblioshiny*

The papers cover various topics and publication years. The 2017 article by Tarhini in the Journal of International Education Business has the highest overall citations, amounting to 230, and the highest average citations per year, at 23. The Normalized TC column presumably standardizes citation counts across different publishing periods or disciplines, although it lacks clarity concerning its computation methodology (Basumatary, 2023). There exists significant variability among the research attributable to citation data. This

indicates a difference in the significance of research, as some studies garnered far more attention and influence than others.

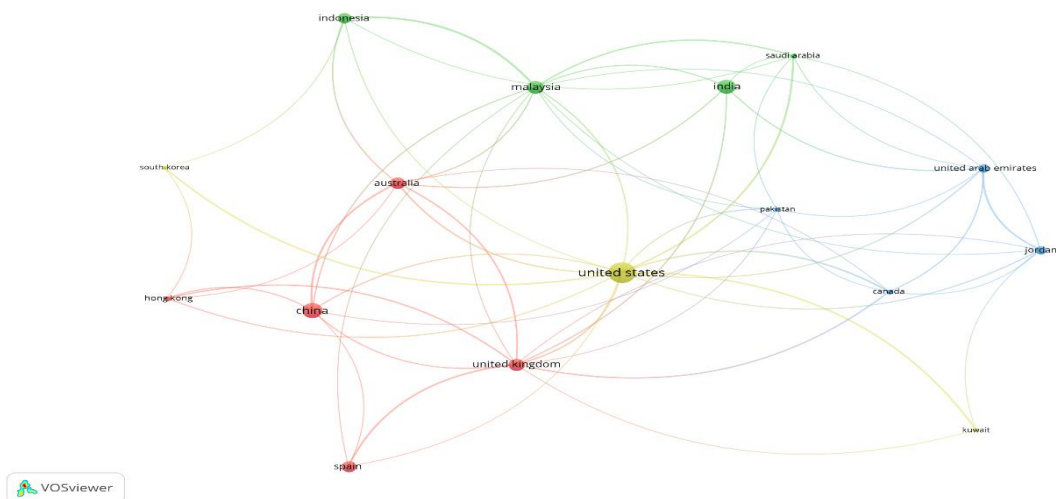
## Co-Authorship Analysis

In doing co-authorship analysis, authors and nations are selected as the unit of analysis using the full counting approach. The minimum requirement for the number of papers authored was set at 2, while the minimum citation count for an author was established at 5. Out of 1492 authors, 36 satisfy the criteria. The clusters are subsequently presented (Figure 8). Among the 36 selected authors, only 3 exhibited interconnections. The nodes represent the writers or countries linked by shared authorship of an article, as illustrated in the picture. Figure 8 illustrates the network visualization map of international co-authorship among countries. Figure 9 illustrates the network visualization map of country co-authorship. Out of 69 countries, 16 satisfy the criterion when the article count for a country is 5 and the minimum citation count is one. Among 69 countries, only 16 are interconnected. Research activities are predominantly concentrated in nations such as the United States, the United Kingdom, China, Australia and rising economies like India and Indonesia. Canada, Malaysia, Spain, Saudi Arabia, and Pakistan have had significant progress in recent years.



Source: VOS Viewer

**Figure 8-** Clusters of authors associated with articles

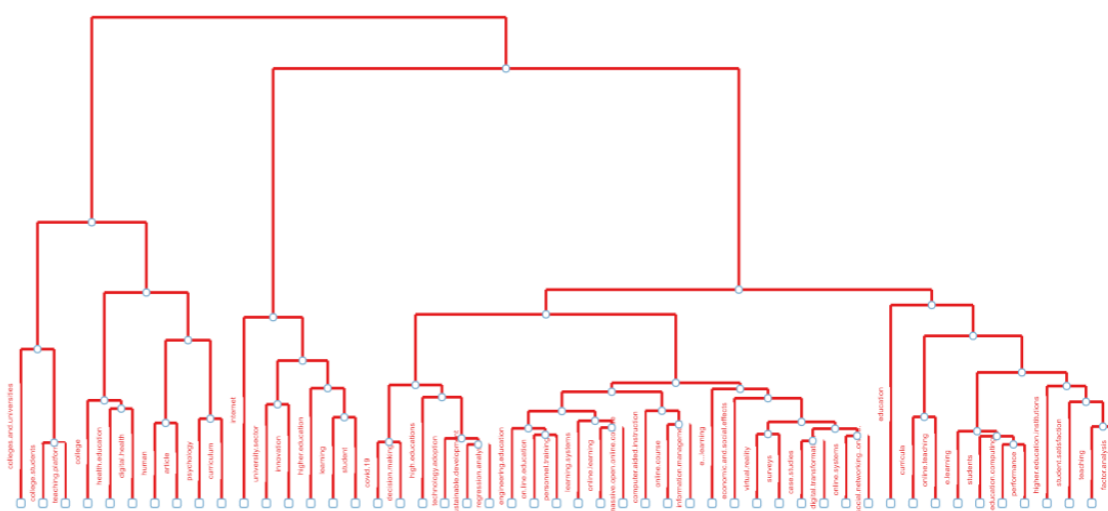


Source: VOS Viewer

**Figure 9-** Co-authorship Analysis of Author Affiliated Countries

## Factorial Analysis

It helps in understanding the conceptual structure of research fields. In simple terms, it depicts how keywords, themes or documents group together based on their similarities. Factorial analysis in Biblioshiny is based on Multiple Correspondence Analysis (MCA) or Principal Component Analysis (PCA). Topic Dendrogram as shown below in Figure no.10 is obtained through Biblioshiny. It shows closely related concepts, subfields or school of thought and thematic concentrations within the literature. Short distance between the items show strong conceptual similarity and large distance between items means weak or no conceptual relationship. Factorial Analysis helps in identifying core vs peripheral topics and interdisciplinary linkages. The results indicate dominant and emerging research themes and their intellectual relationships.



Source: - Biblioshiny

**Figure 10-** Topic Dendrogram

## CONCLUSIONS

The principal objective of the bibliometric analysis is to systematically examine publishing trends, identify prominent authors, key journals, keyword co-occurrences, and conduct co-citation analyses. The Scopus database from 2010 to 2025 was chosen for research purposes. The data indicate an increased trend in the number of articles published up to 2023. The study emphasizes the leading journals, prominent authors based on citations, co-authorship analysis among nations, journal co-citation analyses, most globally cited documents, keyword occurrences, and factorial analysis, providing a more profound understanding of the subject of study. This study clarifies the knowledge framework, trends, and collaborative networks of online learning/e-learning, offering theoretical insights and methodological guidance for future research from a multidimensional perspective. The findings of this research are significant for researchers, as they will serve as a foundation for future literature surveys and provide a comprehensive overview of the area in completing a qualitative literature review.

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