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Review Article

A cross-database bibliometrics analysis of blended learning in higher education: Trends and capabilities

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ABSTRACT

This study looks closely at research papers about blended learning (BL) from the last 10 years (2014-2023). It pulls information from Scopus and Web of Science (WoS). By using both, it gives a full picture of what is being published and what's important in BL research. The search found 1,704 articles in Scopus and 1,545 in WoS. After putting them together and removing duplicates, there were 2,455 articles for the study. The study used a Bibliometrix R to look at who published a lot, which countries and schools did most, who worked together, and which articles got mentioned a lot. Each year, the number of articles grew by about 15.58%. Most of these, 93.00%, were articles. Universities in Australia were among those that wrote the most. "Education and Information Technologies" and "International Journal of Educational Technology in Higher Education" were often cited, which shows they have big roles in this research area. Some of the main researchers who connect a lot of the work are Zhu, Graham, and Jackson. It is found that keywords "higher education", "online learning", "students", and "COVID-19" are very common in discussions and help shape the research being done. While much research comes from Australia and the West, there is also growing work from Asia and the Middle East. This shows that BL is becoming important in different parts of the world. But there's a chance to get more research from less wealthy countries. This study puts together a clear picture of BL research. It looks at what's been published, who talks to who, and which places are doing the work. The research has grown who the main people are, where there's a gap between different regions, and what we should think about for the future. This can help make policies and change how we teach.

Keywords: bibliometrics, blended learning, higher education, research impact, knowledge mapping

INTRODUCTION

Blended learning (BL) is kind of like mixing classroom teaching with learning on the Internet. Very big change for how schools and universities do things. It is like having a teacher right there and using computers and online stuff to learn more. This way, everyone can learn in their own style, using both the good parts of being in class and learning online. Some smart people wrote about this, saying it's part of big changes in schools, where knowing how to use technology is important now (Garrison & Kanuka, 2004).

The changing way BL shows big shifts in how universities and colleges work nowadays. It's all about being good with digital stuff and merging it into learning (Dziuban et al., 2018; Means et al., 2013; Platonova et al., 2022; Rasheed et al., 2020). Educators are trying to deal with these new challenges, like making learning easy for everyone to get, arranging it to each person, and not wasting resources. So, BL looks like a strong answer (Khahro & Javed, 2022). It combines face-to-face time in class with the flexibility of learning on the Internet (Khahro & Javed, 2022). This is important today when education needs to work for everyone, everywhere, but also fit each person's needs.

Putting in place BL is not simple. This method is tricky and has many parts to it (Hapizah et al., 2022). Teachers must think differently about how they teach, what to include in the syllabus, and how to keep students interested (Heilporn et al., 2021; Hijazi & AlNatour, 2020; Platonova et al., 2022; Rasheed et al., 2020). Plus, for BL to work well, you need good technology and people who know how to use it (Lee et al., 2017). So, it's very important to really get how BL works and what it means for schools.

This research is a big deal for learning. It looks at lots of different information to give a clearer and deeper picture of BL. Before this, we did not know as much. This study shows the main points, strengths, and missing parts in what we know now. This can help decide what to do next in schools and universities. It shares important information about technology, teaching methods, and how schools are organized for BL. All of this is key for people who teach, run schools, and make rules all over the world. It's a super useful guide for making BL better in all kinds of places, where people learn.

LITERATURE REVIEW

Evolution & Impact of Blended Learning

BL has become a big thing in universities over the last 20 years. It's all thanks to better technology and new ways of teaching (Boelens et al., 2017; Graham, 2006). There's a lot of study on how this mix of online stuff, like videos and group work, can help students learn better. It can also make things easier for teachers. Research says that students do better and like learning more when they can talk with teachers and join in more (Bernard et al., 2014; Kintu et al., 2017).

When schools start using BL, they go step by step. First, they think about how to plan their courses. Then, they deal with tech needs and how to motivate the teachers (Dziuban et al., 2018; Porter et al., 2014). The beginning is important. Schools must be smart about mixing online learning with regular classes. They want to do it without losing what the course is all about. Later, they must handle bigger things like tech stuff and how to get teachers on board (Porter et al., 2014). BL does not look the same everywhere. It's flexible. Schools can use different teaching ways and tech tools, depending on what they need (Hrastinski, 2020; Kintu et al., 2017). Some might do live online classes with face-to-face sessions. Others might use online work with big group meetings in person. This way, every school can blend learning to their own style, what they can afford, and what their students need.

A lot of research has been done to see if students do better with BL than with just regular classes or online ones. Bernard et al. (2014) found that students did a bit better with BL. It was not a huge difference, but it was important. Dziuban et al. (2018) also looked at this and found that BL was better for students from all kinds of backgrounds. When asking students, they seemed to really like BL, especially because they could talk to their teachers more and get involved in their learning (de Brito Lima et al., 2021; Kintu et al., 2017; Suriagiri et al., 2022). BL is not just one thing. It's a mix of different ways of teaching, tools, and experiences (Hrastinski, 2020). Even though it can be different depending on where you are, BL usually involves learning online, talking

in virtual discussions, and having fewer in-person classes compared to old-school styles (Chen, 2022; Kintu et al., 2017; Yick et al., 2019).

Defining Attributes & Affordances of Blended Learning

BL mixes online learning with regular classroom lessons. In universities, it helps make classes more interactive and flexible (Graham, 2013; Moradimokhles & Hwang, 2020). But it can also make things harder for teachers who must design and check on student progress (Bernard et al., 2014; Manwaring et al., 2017; Porter & Graham, 2016). Even so, students do just as well or even better than in normal classes, especially in courses, where practical skills are important (Bernard et al., 2014). BL lets teachers meet the different needs of students, even if it means more work for them (Castro, 2019; Porter & Graham, 2016; Porter et al., 2014). But we're not sure yet if students like it more or if fewer students drop out (Nortvig et al., 2018).

More and more universities are using BL because it brings in technology, which is a big part of learning these days (Serrano et al., 2019). Technology is important for making modern learning spaces, but we do not fully get how to use it best (Charteris & Smardon, 2018). BL works well when the learning management system helps students stay interested and engaged (Arrosagaray et al., 2019; Fisher et al., 2017; Talan & Gulsecen, 2019). Using digital assignments in different ways can help too, but you must design them carefully, so students find them interesting and feel motivated.

Challenges in Blended Learning Implementation

When starting BL, schools face many problems. These include tech issues, changing how teaching is done, and getting ready for big changes (Rasheed et al., 2020). What students think about BL is also important. Their views are shaped by their age group and culture (Joksimović et al., 2015). Problems they face include bad internet, managing time, not knowing how to use tech tools, and how different students' personalities can affect how well they do in school (Alammary et al., 2014; Pye et al., 2015).

Students also must learn how to study on their own and get good at using technology for BL (Kintu et al., 2017; Serrano et al., 2019). Before the pandemic, BL was not fully part of regular school life (Suriagiri et al., 2022). This showed the need for strong leadership and clear rules. Teachers also needed ongoing training and support to help make BL a normal part of school (Porter & Graham, 2016).

Sure, teachers and schools must think hard about the best way to mix classroom teaching and online lessons. This mix needs to work well and be something students like. But we still need to study more to fix the problems that come up with BL (Porter & Graham, 2016; Xu et al., 2020; Zhu et al., 2021). Knowing more will help us make BL better for colleges and universities.

Some studies have shown that students in BL do a little bit better than in just regular classes. They also seem to be happier, especially because they can talk to their teachers more and take part in class activities (Bernard et al., 2014; de Brito Lima et al., 2021; Dziuban et al., 2018; Kintu et al., 2017; Suriagiri et al., 2022).

BL is a mix of teaching in person and using online stuff, like videos and forums for talking about classwork. Even though it's not the same everywhere, usually students learn online on their own time and have some classes with their teachers (Chen, 2022; Hrastinski, 2020; Kintu et al., 2017; Yick et al., 2019).

Bibliometric Analysis

Bibliometric analysis is a way to check how research in a certain area is growing. It looks at how many studies are published and what trends are there over time (Ellegaard & Wallin, 2015). In BL research, past bibliometric studies have usually looked at a small part of the data. They focused on certain places like graduate studies (Omar et al., 2021), one database (Chen et al., 2023), or just Spanish studies (López-Pérez et al., 2011).

This study, though, is trying something new. It's looking at BL research from a wider view, using big databases like Scopus and Web of Science (WoS). The goal is to give a full picture of the research in higher education. It checks how many studies are published each year, who writes a lot in this field, what main topics they cover, and how often these studies are mentioned by others.

By looking at all these things, the study shows us where BL research stands right now. It starts conversations about the progress in this field. It's also looking ahead, showing where more research can be

done in BL. This wide view is a big step in understanding how BL is used in higher education today. It's a solid base for educators and researchers who are interested in how this way of learning is changing.

METHODOLOGY

This study uses bibliometrics. It is a way to look at writing trends and knowledge using numbers and pictures, to understand BL research around the world. It uses math and visuals to spot patterns in the research that's been published (Donthu et al., 2021). This method has clear steps for collecting data, preparing it, analyzing it, and making sense of it.

For this study, big databases like Scopus and WoS were used because they have a lot of educational research. The study looked at ten years' worth of research articles about BL. It picked these articles using special search words and rules to make sure they were on topic. All this data was put together in one place to study it better.

The study used a tool called Bibliometrix R-tool. This tool is great for bibliometrics because it helps measure research impact, make visuals to show knowledge areas, and find links between concepts (Aria & Cuccurullo, 2017). The study looked at which areas had the most research, what kinds of documents were being written, who was writing them, where they were published, how much they were cited, how researchers worked together, what new areas were popping up, and how knowledge was grouped.

Data Section Process

This analysis aims to investigate the scope and trends of BL in higher education from 2014 to 2023. The study employs a systematic data collection approach using specific search queries in Scopus and WoS. The process is outlined, as follows:

Search strategy in Scopus & initial retrieval

The primary data was collected using a structured search query designed to capture relevant literature in the domain of BL within higher education settings. The search query used was, as follows:

`TITLE-ABS-KEY (((“blended learning” OR “hybrid learning” OR “mixed learning” OR “integrated learning”) AND (“higher education” OR “university education” OR “tertiary education” OR “college education”))) AND PUBYEAR>2013 AND PUBYEAR<2024 AND (LIMIT-TO (DOCTYPE, “ar”)) AND (LIMIT-TO (LANGUAGE, “english”))`.

This query was aimed at identifying articles (denoted by “ar” in DOCTYPE) published in English between the years 2014 and 2023. The initial number of studies retrieved using this query was 1,724.

Exclusion of non-author studies

In the next step, studies without identifiable authors (‘nouthor’ studies) were excluded. This step is crucial for ensuring the credibility and traceability of the research data. As a result, 20 studies were excluded, bringing the number of final studies considered for analysis to 1,704.

Search in Web of Science

To augment the data collection, a search was conducted in WoS database using a similar but adapted query: `TS=((“blended learning” OR “hybrid learning” OR “mixed learning” OR “integrated learning”) AND (“higher education” OR “university education” OR “tertiary education” OR “college education”)) AND LANGUAGE: (English) AND DOCUMENT TYPES: (Article OR Conference Paper)`. This search focused on articles and conference papers published in English and yielded 1,545 records.

Merging & deduplication

The studies retrieved from Scopus and WoS database were then merged. This combined dataset initially consisted of 2,455 studies. A crucial step of deduplication was then performed to remove any duplicated studies across the two datasets. This process ensures that each study is unique and is counted only once in the analysis.

Table 1. Descriptive information on data sets

Description	Scopus	WoS	Merged
Main information about data			
Timespan	2014:2023	2014:2023	2014:2023
Sources (journals, books, etc.)	666	568	910
Documents	1,704	1,545	2,455
Annual growth rate (%)	16.74	13.86	15.58
Document average age	3.04	3.29	3.18
Average citations per document	14.23	10.88	11.74
References	1	53,591	53,306
Document contents			
Keywords plus (ID)	1,830	1,357	2,249
Author's keywords (DE)	4,088	4,220	5,775
Authors			
Authors	4,687	4,147	6,106
Authors of single-authored documents	289	248	397
Authors collaboration			
Single-authored documents	314	275	449
Co-authors per documents	3.1	3	3
International co-authorships (%)	19.42	19.22	12.10
Document types			
Article	1,687	1,393	2,286
Article	17		17
Article: Book chapter		62	62
Article: Early access		74	74
Article: Proceedings paper		16	16

Final dataset for analysis

Following the deduplication process, the final dataset was prepared for bibliometric analysis. All three datasets were used to make comparisons across databases.

Data Analysis

The data analysis leveraged the Bibliometrix R-tool for conducting a bibliometric review of BL publications indexed within Scopus and WoS databases for 2014-2023. Datasets were extracted from these databases and a merged integrated dataset was constructed using Bibliometrix to enable comparative analyses. Publication metadata was processed using Bibliometrix functions to determine various performance metrics and intellectual structure mapping. The integrated dataset held the largest volume with 2,455 publications sourced from 910 titles after merging databases via Bibliometrix. Descriptive statistical functions quantified output growth at 15.58% annually, peaking in 2022. Articles constituted 93.00% of all documents. Bibliometrix analyses of citations, h-index, and impact factors highlighted the influence of articles outlining BL frameworks and examining COVID-19 impacts. Prolific authors were identified based on h-index calculations in Bibliometrix. Co-occurrence matrices and bibliographic coupling networks generated in Bibliometrix exposed relationships between terms and themes. Collaboration analytics tools in Bibliometrix determined patterns in co-authorships across countries and among individual researchers. Results showed a strong research partnership culture among Australian and European colleagues but limited participation from developing regions. In summary, the Bibliometrix R-package enabled a multi-faceted bibliometric review, providing enhanced visualization and insights into BL research trends compared to using databases independently. The findings will inform future research efforts and policy directions.

FINDINGS

The bibliometric analysis of BL research from 2014-2023 through the merged Scopus and WoS dataset reveals several key findings relating to publication trends, contributor productivity and influence, regional participation, focus areas, and research networks.

Table 1 presents a comparative analysis of bibliometric data across two major databases–Scopus and WoS–as well as a dataset that merges the two, covering the period from 2014 to 2023.

Regarding the sources, which include journals, books, and other documents, Scopus has indexed 666, which is more than WoS's 568, but the merged dataset outnumbers both with 910 sources. This suggests that there are unique sources in each database that, when combined, result in a larger total count.

In terms of document count, Scopus has a larger repository with 1,704 documents, compared to 1,545 in WoS, and the merged dataset expands this further to 2,455 documents. This could indicate that some documents are indexed in both databases, while others are exclusive to one. The annual growth rate of documents, which signifies the yearly percentage increase in document count, is highest for Scopus at 16.74%, with WoS trailing at 13.86%. The merged dataset shows a slightly lesser growth rate than Scopus at 15.58%, possibly due to averaging the individual growth rates of the two databases.

The average age of documents is relatively similar across the datasets, with Scopus having the youngest documents on average (3.04 years) and WoS the oldest (3.29 years). The merged dataset falls in the middle with an average document age of 3.18 years. When it comes to the impact of these documents, as measured by citations, Scopus leads with its documents being cited 14.23 times on average, while WoS documents have a lower citation average of 10.88. The merged dataset's average citation per document stands at 11.74.

A curious discrepancy is noted in the reported number of references, with WoS showing a substantially high count (53,591) compared to a solitary reference in Scopus. This suggests a potential data entry error for Scopus or a difference in data collection methods. The datasets also vary in keyword richness, with the merged dataset featuring the highest counts of keywords plus and author's keywords, suggesting a more comprehensive indexing of topics and themes. Authorship data reveal that the merged dataset encompasses the largest number of authors (6,106), indicating a wider collaboration across the two databases. This is further evidenced in the count of authors of single-authored documents and the number of single-authored documents themselves, with the merged dataset displaying the highest figures. However, Scopus and WoS show a higher percentage of international co-authorships compared to the merged dataset, highlighting a stronger international collaboration within each database as opposed to their combination.

Lastly, the document types of section shows that the merged dataset has the highest number of articles. WoS includes additional categories such as book chapters, early access articles, and proceedings papers, which are not listed under Scopus but are included in the merged dataset totals. Overall, the data illustrates the complementarity and individual strengths of the Scopus and WoS databases, with the merged data set offering a broader, albeit less specialized, overview. Each database's unique contributions result in a more comprehensive bibliometric picture when combined.

Trend in Publication

Figure 1 reflects the annual publication count related to BL in two academic databases, Scopus and WoS, along with a merged dataset that combines the two, from 2014 to 2023. Initially, in 2014, Scopus listed 75 publications while WoS had slightly fewer at 69; however, the merged dataset had a significantly higher count at 107, indicating that there were publications exclusive to each database. In 2015, there was a slight decrease in publications in Scopus to 71 but an increase in WoS to 86, with the merged dataset continuing to be higher at 118. From 2016 onwards, there is a clear upward trend in the number of publications across all datasets. Scopus shows a steady year-on-year increase, starting from 91 publications in 2016 to a peak of 323 in 2022. WoS also shows a general upward trend, though it has a less steep increase from 87 in 2016 to its peak at 286 in 2022. Merged dataset follows a similar trajectory, starting at 131 in 2016 and reaching the highest count of 444 in 2022.

Notably, there is a significant jump in publication counts in 2020 across all datasets, which could potentially be attributed to the increased interest in BL due to the global shift towards remote education during the COVID-19 pandemic. In 2023, there is a decline in the number of publications across all datasets with Scopus listing 302, WoS 222, and the merged dataset 394. This could be due to the data being incomplete for the year or a real decline in the publication rate. The overall trend indicates a growing academic interest and research output in the field of BL over the last decade. The merged dataset consistently shows a higher publication count, confirming that each database holds unique contributions to the literature on BL. The peak in 2022 followed by a decline in 2023 suggests a possible saturation point or a shift in research trends, though more data would be needed to confirm this.

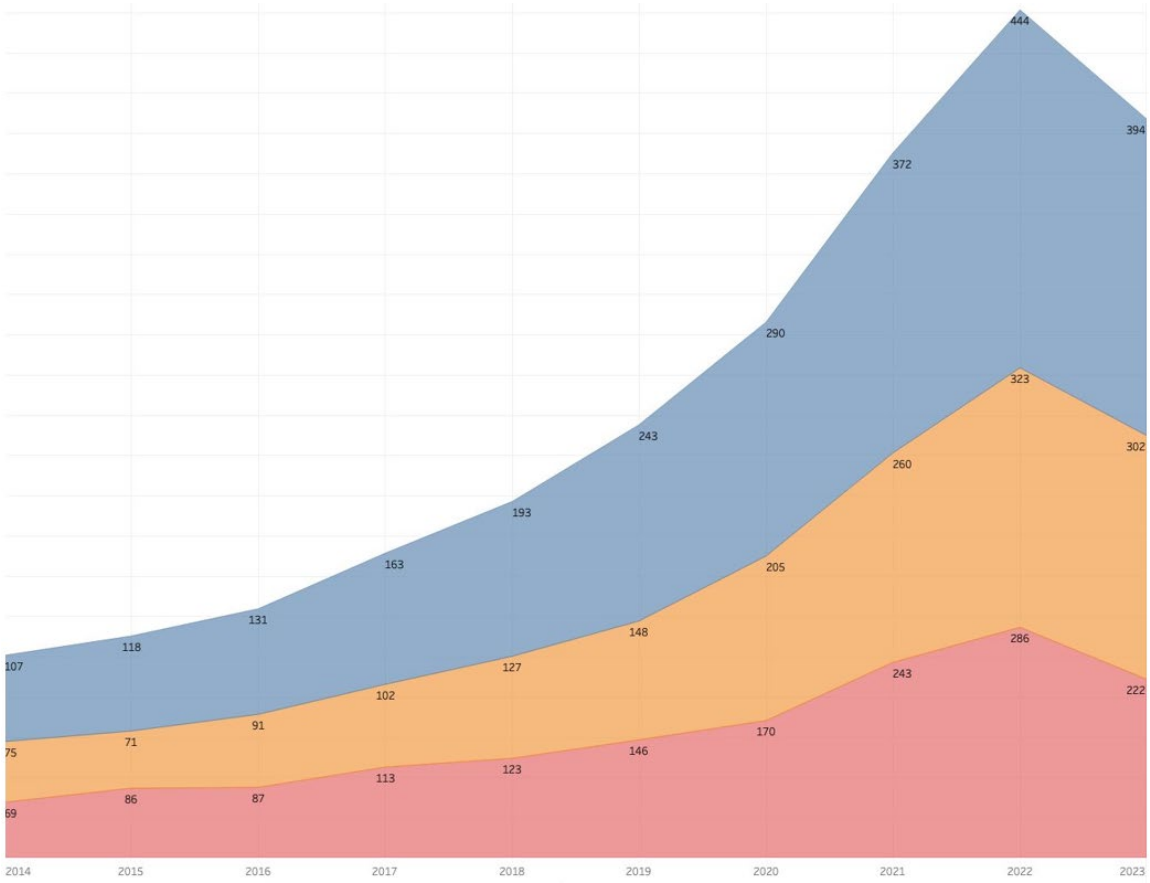

Figure 1. Trends in studies in blended learning in higher education (Source: Authors)

Figure 2 shows data on two metrics: mean total citations per article (MeanTCperArt) and mean total citations per year (MeanTCperYear). The data covers the period from 2014 to 2023. It compares two databases, Scopus and WoS, as well as a merged dataset.

Looking at MeanTCperArt, Scopus had the highest mean of 36.32 citations per article in 2014. However, it showed a declining trend over the years. In 2023, Scopus reached its lowest point with 1.18 citations per article. This decline could be due to factors like an increasing number of publications or changes in citation practices over time. WoS also showed a similar declining pattern for MeanTCperArt. But it started from a lower mean of 20.28 citations per article in 2014. Like Scopus, WoS ended at 1.18 citations per article in 2023. Throughout the period, WoS remained below Scopus for MeanTCperArt. This suggests that articles in Scopus may have had broader visibility or higher citation rates. The merged dataset's MeanTCperArt started at 29.32 citations per article in 2014. This was lower than Scopus but higher than WoS for that year. The merged dataset followed a declining trend like the individual databases. In 2023, it ended at 1.04 citations per article, which was slightly lower than both Scopus and WoS. For MeanTCperYear, Scopus began at 3.63 in 2014. It showed fluctuations over the period, with a peak at 4.6 in 2018. After that, it followed a declining trend to reach 1.18 in 2023. MeanTCperYear indicates the average citations per year for each article. The fluctuations might reflect changes in citation patterns, or the impact of articles published in those years.

WoS started lower than Scopus in 2014, with a MeanTCperYear of 2.03. It showed a slight increase in citation rates over the years. WoS peaked at 3.12 in 2020 before falling to 1.18 in 2023. The pattern in WoS was less volatile than in Scopus, but it still showed a downward trend towards the end of the period. The merged dataset started at 2.93 MeanTCperYear in 2014. Like WoS, it experienced a peak, reaching 3.49 in 2018. After that, it showed a subsequent decline. In 2023, the merged dataset ended at 1.04 MeanTCperYear, which was lower than both Scopus and WoS. This dataset combined the citation patterns of both databases, which could explain the mid-period peak and final figures being lower than the individual databases in 2023.

Data suggests that while Scopus generally has higher citation metrics, all datasets show a declining trend in both MeanTCperArt and MeanTCperYear over time. The peak citation years might be influenced by specific

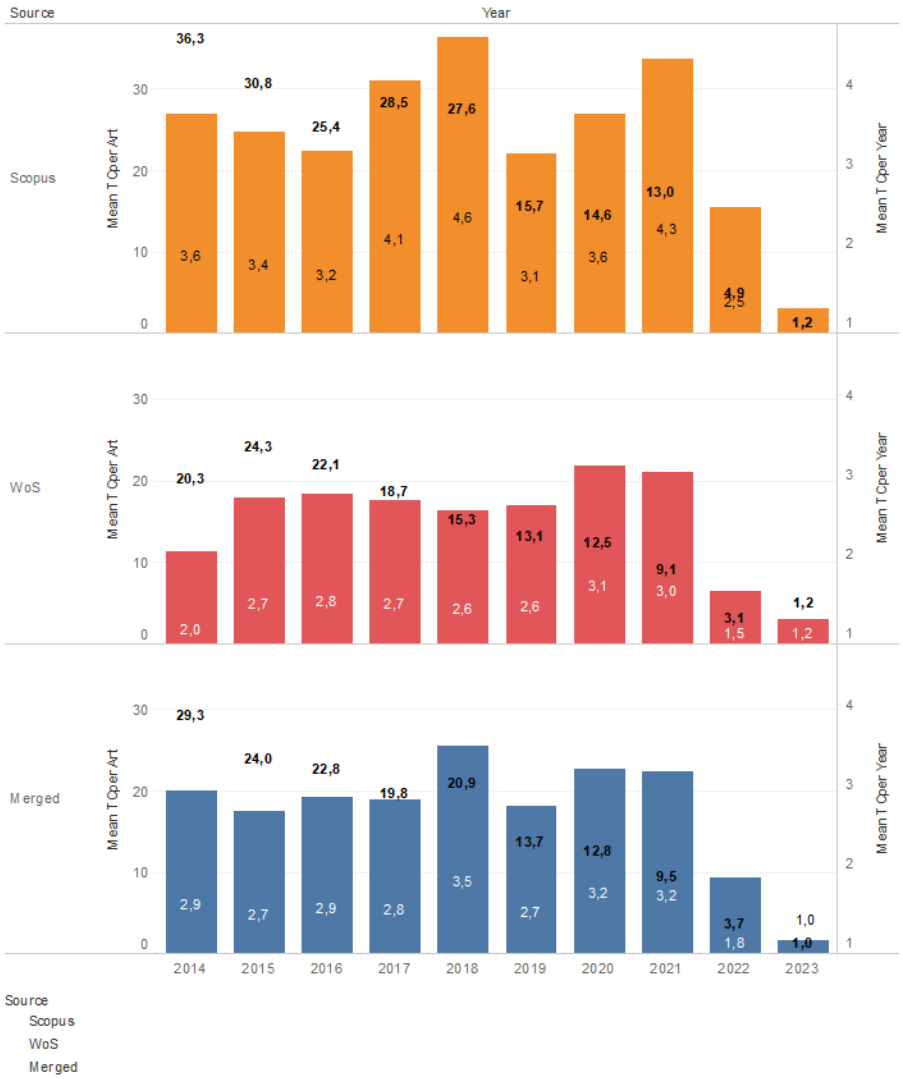

Figure 2. Mean total citation over year & article each dataset (Source: Authors)

influential articles or shifts in research focus, while the decline in recent years could be due to several factors, including a larger volume of articles leading to lower average citations per article, or a shift in the research landscape affecting citation practices. Data for 2023 across all datasets shows a notable drop, which could be attributed to the year being incomplete at time of data collection, or a real decline in citations per article.

Table 2 provides bibliometric indicators for the top 10 sources in the field of education technologies and related disciplines as indexed by Scopus, WoS, and a merged dataset. These indicators are the number of articles (n), the h-index, and the total number of citations each source has received. For Scopus, "Education and Information Technologies" leads with the highest number of articles (43) and the highest total citations (992), along with a strong h-index of 16, suggesting both prolific publication and significant impact in the field. "Education Sciences" follows with 41 articles and an h-index of 12, although with fewer total citations (561). Notably, the "International Journal of Work-Integrated Learning" shows a lower h-index of eight but a substantial number of articles (35), indicating it is an active but perhaps newer or less-cited journal in the field.

In WoS, "Higher Education Skills and Work-Based Learning" has the most articles (41) but a moderate h-index of 10, suggesting a solid yet smaller impact. In contrast, "Education and Information Technologies" has a higher h-index of 14 with slightly fewer articles (33), indicating a strong influence within WoS. "Studies in Higher Education" has a particularly high h-index of 13, with total citations (820) indicating a significant impact. The merged dataset combines data from both databases, often resulting in higher total citation counts. The journal "Education and Information Technologies" stands out in the combined dataset. It has an h-index of 17 and the most citations, with 1,035. This shows that it's a major source. The "International Journal of Work-Integrated Learning" has the most articles (55), but its h-index is just six. This means that it publishes a lot, but

Table 2. Most influential source published studies in blended learning in higher education

Sources	n	h-index	Total citations
Scopus			
Education and Information Technologies	43	16	992
Education Sciences	41	12	561
International Journal of Work-Integrated Learning	35	8	240
International Journal of Emerging Technologies in Learning	31	11	375
Higher Education, Skills, and Work-Based Learning	25	10	206
Sustainability	23	7	169
Frontiers in Education	21	5	155
Higher Education Research and Development	20	10	371
Studies in Higher Education	20	10	449
Asia-Pacific Journal of Cooperative Education	18	10	240
Wos			
Higher Education Skills and Work-Based Learning	41	10	268
International Journal of Work-Integrated Learning	38	5	112
Education Sciences	34	8	261
Education and Information Technologies	33	14	598
Higher Education Research & Development	33	12	330
Asia-Pacific Journal of Cooperative Education	31	11	430
International Journal of Mobile and Blended Learning	29	6	86
Sustainability	25	7	138
International Journal of Educational Technology in Higher Education	22	11	476
Studies in Higher Education	22	13	820
Merge			
International Journal of Work-Integrated Learning	55	6	202
Education and Information Technologies	52	17	1,035
Education Sciences	44	11	503
Higher Education Skills and Work-Based Learning	41	10	268
International Journal of Emerging Technologies in Learning	37	10	357
International Journal of Mobile and Blended Learning	36	7	132
Higher Education Research & Development	33	12	330
Asia-Pacific Journal of Cooperative Education	31	12	438
International Journal of Educational Technology in Higher Education	30	12	1,204
Studies in Higher Education	30	15	920

each article does not get cited much on average. The "International Journal of Educational Technology in Higher Education" is also influential, with a good h-index of 12 and the most citations in total, 1,204.

A h-index is a way to measure how much impact a journal has in its field. A higher h-index means the journal is more influential. Total citations tell us how far the journal's articles reach in the academic world. To sum up, some journals have many articles and get cited often, like "Education and Information Technologies" and "Education Sciences." Others are different in how much impact they have. When we put all the data together, we get a full picture of how important and productive these journals are. This is helpful for researchers who want to pick well-known and often-cited journals.

Table 3 lists the top authors who write about BL, using information from three places: Scopus, WoS, and a combined set of data.

Table 3. Most influential authors related to studies in blended learning in higher education

Author	h_index	g_index	m_index	TC	NP	PY_start
Scopus						
Zhu, C.	7	11	0.88	468	11	2016
Jackson, D.	7	11	1.00	255	11	2017
Graham, C.	6	7	0.60	1,208	7	2014
Aristovnik, A.	6	7	0.67	144	7	2015
Umek, L.	6	7	0.67	144	7	2015
Ferns, S.	5	7	0.50	195	7	2014
Yang, W.	5	7	0.50	163	7	2014
Keržič, D.	5	6	0.56	133	6	2015
Tomaževič, N.	5	6	0.56	133	6	2015
Kamaludin, A.	5	5	1.25	130	5	2020

Table 3 (Continued). Most influential authors related to studies in blended learning in higher education

Author	h_index	g_index	m_index	TC	NP	PY_start
WoS						
Jackson, D.	12	22	1.33	951	22	2015
Ferns, S.	7	10	0.70	171	10	2014
Cameron, C.	5	7	0.56	50	8	2015
Broadbent, J.	4	4	0.57	379	4	2017
Smith, C.	4	5	0.40	139	5	2014
Yang, W.	4	6	0.40	122	6	2014
Fung, F.	4	4	0.80	89	4	2019
Lakhal, S.	4	5	1.33	30	5	2021
Gasevic, D.	3	3	0.38	678	3	2016
Zhu, C.	3	3	0.38	87	3	2016
Merged						
Jackson, D.	12	24	1.33	986	24	2015
Zhu, C.	8	12	1.00	476	12	2016
Graham, C.	7	10	0.70	1,216	10	2014
Ferns, S.	7	11	0.70	175	11	2014
Aristovnik, A.	6	7	0.67	128	7	2015
Cameron, C.	6	8	0.60	68	9	2014
Yang, W.	5	8	0.50	152	8	2014
Smith, C.	5	8	0.50	150	8	2014
Kamaludin, A.	5	5	1.25	130	5	2020
Romli, A.	5	5	1.25	130	5	2020

In Scopus, Zhu, C. and Jackson, D. are leading with an h-index of seven each. Zhu, C.'s work has been cited more, showing big impact in just a short time since 2016. Graham, C. R. may have a smaller h-index of six, but a high total citation count (1,208), meaning their work is very influential. In WoS, Jackson, D. is ahead with the highest h-index of 12 and a big g-index of 22, showing that their work is widely recognized and used. Ferns, S. also has a good h-index of seven, meaning they have been contributing steadily since 2014. The combined data shows Jackson, D. at the top again with an h-index of 12, a g-index of 24, and the most citations (986), which points to their big and lasting impact. Zhu, C. is also important in the combined data with a high h-index of eight and a lot of citations. Kamaludin, A. has a notable m-index of 1.25 in Scopus and the combined data, which means they gained recognition fast.

Some names like Jackson, D., Ferns, S., and Yang, W. keep showing up across all datasets, showing that their work is well-known in BL. In short, these results show us who the important authors are in BL. The h-index and total citations tell us about their effect and reach. The g-index and m-index give us more insight into how respectful their work is and how quickly they became known.

Table 4 shows important numbers for the top-10 BL research articles found in Scopus, WoS, and a combined set of both. It looks at how many times each article has been cited in total, how many times it's cited each year on average, and a special count that adjusts for how old the article is and the normal citation numbers for different fields.

Looking at Scopus, the paper by Dziuban et al. (2018) from the "International Journal of Educational Technology in Higher Education" has been cited 424 times. It's cited about 71 times every year, which shows it's very influential. The article by Bernard et al. (2014) in the "Journal of Computers in Higher Education" also has many citations, 401 in total, and it's cited a lot every year too. Over at WoS, the article by Kim et al. (2014) in "Internet and Higher Education" has the most citations with 434, and is cited a lot each year, showing its big impact. Baloran (2020), which is already well-cited in Scopus, has even more citations in WoS, pointing out its importance. The combined data from both Scopus and WoS gives a fuller picture of how often these articles are cited. Articles by Dziuban et al. (2018) and Kim et al. (2014) stay at the top, which means their research is valued in both databases. Newer articles, like Baloran (2020), get a lot of attention fast, showing they're important right now. The adjusted citation count tries to make it fair to compare articles from different years and fields. Articles with high adjusted counts are considered very influential.

Table 4. Most influential studies in blended learning in higher education

Paper	DOI	Total citations	TC per year	Normalized TC
Scopus				
Dziuban et al. (2018)	10.1186/s41239-017-0087-5	424	70.67	15.37
Bernard et al. (2014)	10.1007/s12528-013-9077-3	401	40.10	11.04
Broadbent (2017)	10.1016/j.iheduc.2017.01.004	373	53.29	13.09
Porter et al. (2014)	10.1016/j.compedu.2014.02.011	320	32.00	8.81
Wals (2014)	10.1016/j.jclepro.2013.06.007	297	29.70	8.18
Thai et al. (2017)	10.1016/j.compedu.2017.01.003	290	41.43	10.18
Wanner and Palmer (2015)	10.1016/j.compedu.2015.07.008	276	30.67	8.98
Baloran (2020)	10.1080/15325024.2020.1769300	264	66.00	18.14
Nortvig et al. (2018)		257	42.83	9.32
Lapitan et al. (2021)	10.1016/j.ece.2021.01.012	205	68.33	15.79
WoS				
Kim et al. (2014)	10.1016/j.iheduc.2014.04.003	434	43.40	21.41
Baloran (2020)	10.1080/15325024.2020.1769300	368	92.00	29.52
Jackson (2015)	10.1080/03075079.2013.842221	346	38.44	14.25
Gašević et al. (2016)	10.1016/j.iheduc.2015.10.002	325	40.63	14.70
Broadbent (2017)	10.1016/j.iheduc.2017.01.004	297	42.43	15.85
Thai et al. (2017)	10.1016/j.compedu.2017.01.003	240	34.29	12.80
Wanner and Palmer (2015)	10.1016/j.compedu.2015.07.008	213	23.67	8.77
Cheng et al. (2019)	10.1007/s11423-018-9633-7	180	36.00	13.74
Galway et al. (2014)	10.1186/1472-6920-14-181	173	17.30	8.53
Law et al. (2019)	10.1016/j.compedu.2019.02.021	158	31.60	12.06
Merged				
Kim et al. (2014)	10.1016/j.iheduc.2014.04.003	434	43.40	14.80
Dziuban et al. (2018)	10.1186/s41239-017-0087-5	424	70.70	20.30
Bernard et al. (2014)	10.1007/s12528-013-9077-3	401	40.10	13.70
Baloran (2020)	10.1080/15325024.2020.1769300	368	92.00	28.80
Jackson (2015)	10.1080/03075079.2013.842221	346	38.40	14.40
Gašević et al. (2016)	10.1016/j.iheduc.2015.10.002	325	40.60	14.30
Porter et al. (2014)	10.1016/j.compedu.2014.02.011	320	32.00	10.90
Broadbent (2017)	10.1016/j.iheduc.2017.01.004	297	42.40	15.00
Wals (2014)	10.1016/j.jclepro.2013.06.007	297	29.70	10.10
Nortvig et al. (2018)		257	42.80	12.30

Table 5. Intuitions contribution to studies in blended learning in higher education

Affiliation	Scopus	WoS	Merged
Monash University	44	63	84
Griffith University	35	80	94
Deakin University	33	84	95
University of Wollongong	27	32	52
Curtin University	25	46	54
Edith Cowan University	20	48	53
Universiti Teknologi Mara	19	6	9
Queensland University of Technology	17	23	29
Macquarie University	16	34	37
Universiti Teknologi Malaysia	16	7	14
National University of Singapore	2	36	37
University Sydney	4	34	36
Cape Peninsula University Technology	4	33	36

In summary, the articles in these datasets are some of the most important ones in the study of BL. They are often cited by other researchers. Seeing the same articles in different datasets confirms they are well-respected and important in the academic world.

Which Countries & Institutions Have Contributed to Research

Table 5 lists various universities and their respective publication counts in the field of BL as indexed by Scopus, WoS, and a combined dataset.

The number of publications is used as an indicator of each institution's research output and effectiveness in this field. Monash University leads in Scopus with 44 publications, but when looking at the merged dataset, which is a more comprehensive indicator that combines both Scopus and WoS, Deakin University takes the

lead with 95 publications. Griffith University, while having fewer publications in Scopus (35), shows a significantly higher output in WoS (80) and merged (94), suggesting that their research in BL is highly regarded in the databases indexed by WoS. The University of Wollongong, Curtin University, and Edith Cowan University also have substantial publication counts, indicating their active contribution to the field. Notably, the Universiti Teknologi Mara shows a marked difference between the number of publications in Scopus (19) and WoS (six), which may reflect different indexing coverage or a focus of the researchers in publishing in journals that are indexed in Scopus. In the research world, sometimes different databases show different results. For example, the National University of Singapore and University Sydney have more research articles listed in WoS than in Scopus. When we combine the numbers from both databases, we see that these universities might be getting more attention in WoS. Cape Peninsula University of Technology has a few articles in Scopus (four), but a lot more in WoS (33). So, when we put them together, it has 36, showing that WoS has a fuller record of its research work.

When we merge data from both Scopus and WoS, we get a complete picture of what each university is doing in terms of research. The number of published articles can tell us how active a university is in research. But it does not always say if the research is good or making an impact. Still, if a university has a lot of articles in both databases, it usually means they're important in their field. For BL, Deakin University, Griffith University, and Monash University are the ones with the most articles published in the combined database.

Table 6 lists countries with their corresponding total citations and average citations per article in the field of BL, as indexed by Scopus, WoS, and a merged dataset.

Table 6. Contribution of countries in studies in blended learning in higher education

Country	Total citations	Average article citations
Scopus		
Australia	3,223	15.3
USA	1,420	22.9
United Kingdom	1,309	11.6
China	1,218	16.2
Spain	1,163	15.5
Belgium	979	75.3
Canada	867	27.1
Malaysia	615	10.6
Netherlands	561	22.4
Philippines	469	93.8
Korea	355	29.6
Colombia	322	32.2
Singapore	161	40.2
Malta	106	53.0
Croatia	98	32.7
Mali	64	64.0
Ethiopia	31	31.0
WoS		
Australia	4,045	14.1
China	1,753	12.0
USA	1,583	14.4
United Kingdom	1,515	12.1
Spain	1,016	11.0
Canada	632	11.7
Philippines	467	93.4
South Africa	439	5.4
Belgium	327	40.9
Turkey	320	13.3
Greece	220	22.0
Singapore	188	18.8
Jordan	159	19.9
Vietnam	155	17.2
Kenya	109	36.3
Mauritius	86	43.0
Tunisia	34	34.0
Argentina	24	24.0

Table 6 (Continued). Contribution of countries in studies in blended learning in higher education

Country	Total citations	Average article citations
Merged		
Argentina	24	24.0
Australia	5,218	14.1
Belgium	937	52.1
Canada	1,265	18.6
China	2,293	12.5
Croatia	95	31.7
Ethiopia	31	31.0
Kenya	109	36.3
Malaysia	632	7.8
Mali	64	64.0
Malta	101	33.7
Mauritius	94	31.3
Netherlands	552	17.8
Philippines	467	66.7
South Africa	618	5.5
Spain	1,424	11.9
Tunisia	34	34.0
United Kingdom	2,093	12.3
USA	2,715	19.5

The number of citations reflects the impact and recognition of research work from each country within the academic community. In Scopus, Australia leads with the highest total citations (3,223), but it is Belgium that has an exceptionally high average citation per article (75.3), which suggests that while Belgium may have fewer articles, the ones published are highly influential. The Philippines also has an extraordinarily high average citations per article (93.8), indicating that the research from the Philippines is receiving significant attention per article. In WoS dataset, Australia again has the highest total citations (4,045), yet the Philippines tops the average citations per article (93.4), consistent with its performance in Scopus. This suggests that research from the Philippines is both highly cited and impactful across both databases. In the merged dataset, which combines citation data from both Scopus and WoS, Australia maintains the lead in total citations (5,218), with Belgium having a very high average citation rate (52.1) and the Philippines maintaining a high average (66.7). This merged dataset provides a broader perspective, showing that while some countries like Australia and the USA have a high volume of research output, other countries like Belgium and the Philippines achieve high citation rates per article, indicating potentially influential research contributions on a per article basis.

The data suggests that there are differences in the volume and impact of research output across countries. Countries with high total citations are likely to be more active in the field of BL research, while those with high average citations per article may be producing particularly influential work in the field.

Research Front & Intellectual Based on Blended Learning

Figure 3 shows how different keywords in BL research are linked together on information from Scopus.

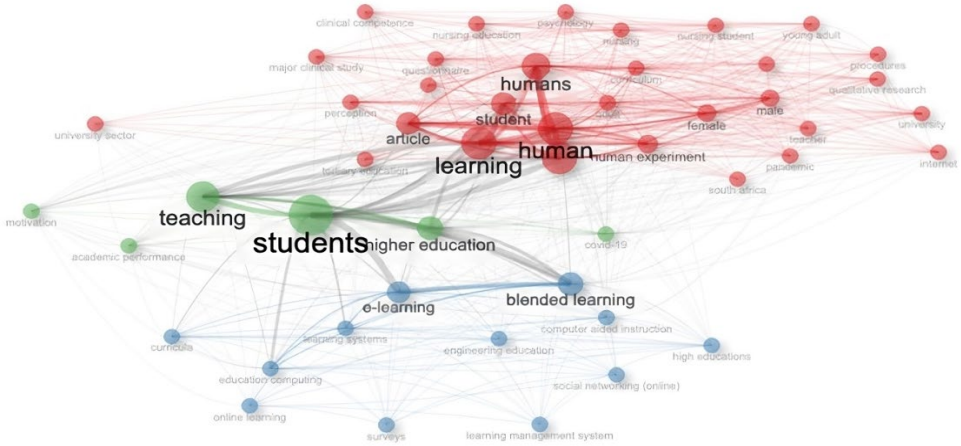

Figure 3. Co-keyword clusters for each dataset (Scopus) (Source: Authors)

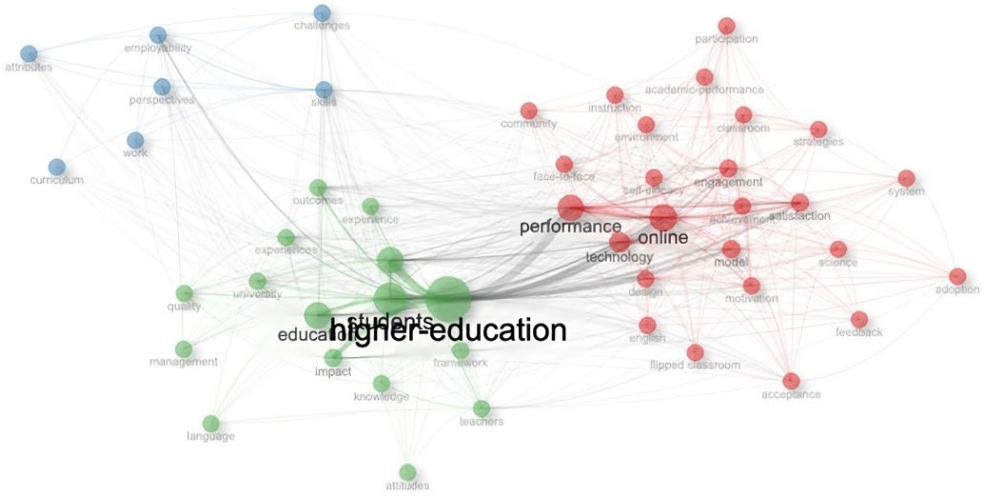

Figure 4. Co-keyword clusters for each dataset (WoS) (Source: Authors)

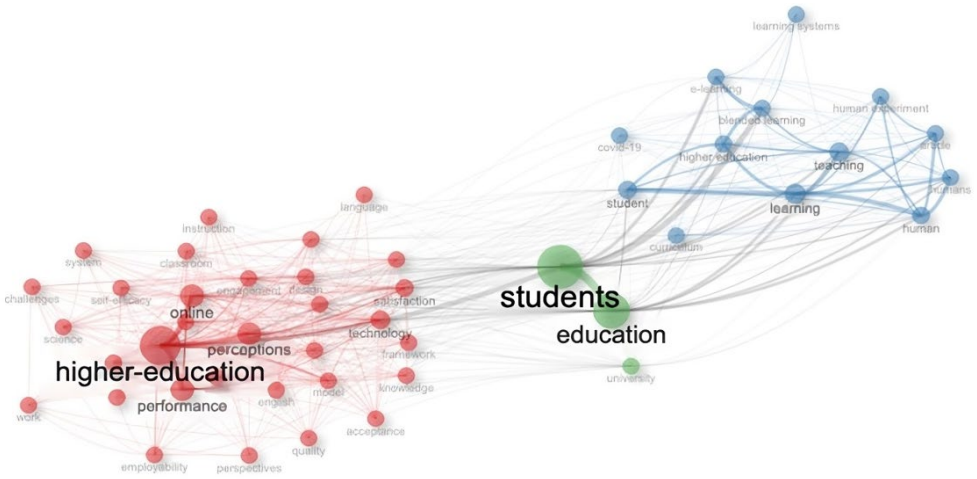

Figure 5. Co-keyword clusters for each dataset (Merged) (Source: Authors)

Figure 4 shows how different keywords in BL research are linked together on information from WoS.

Figure 5 shows a map of how different keywords in BL research are linked together based on information from a combined dataset. These maps use special scores to show which keywords are most important.

In Scopus, words like “learning,” “education,” and “human” are central. They act like hubs, linking to lots of other keywords. They are also close to many keywords and are often linked with other key topics. In WoS, words like “online,” “performance,” and “technology” are the ones that connect different ideas in research. They are central in conversations about BL within WoS. In the combined data, “higher-education,” “online,” and “perceptions” stand out. “Higher-education” is a big connector of different research areas in BL. “Online” is also central and important in the combined research network.

Seeing “blended learning,” “e-learning,” “students,” and “education” in all datasets means these ideas are core to the research, no matter which database you look at. They are key concepts, often cited and connected to other research topics. The word “COVID-19” has become important in the combined dataset. It shows that recent research has been looking at how the pandemic affects education, especially BL.

This analysis points out the main themes that drive research in BL. It shows the key ideas that might be shaping the field. The words that show up as most central could be the ones most talked about in BL research. They can also point to what might be studied in the future.

Figure 6 shows a map of themes based on how often keywords show up and how they connect to each other in Scopus.

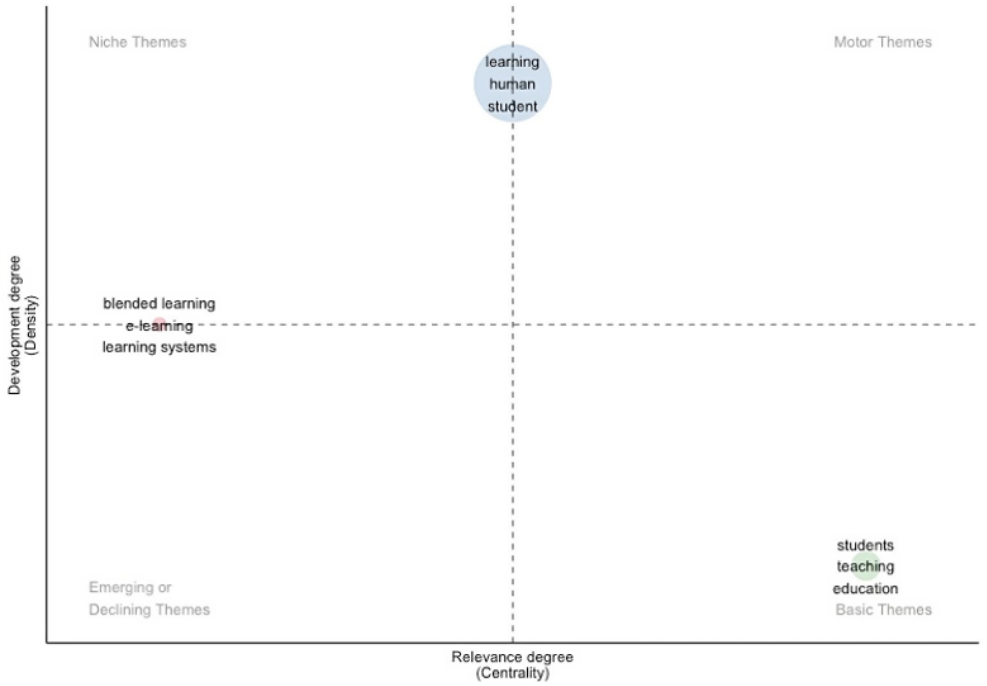

Figure 6. Themes based on keywords studies in blended learning in higher education (Scopus) (Source: Authors)

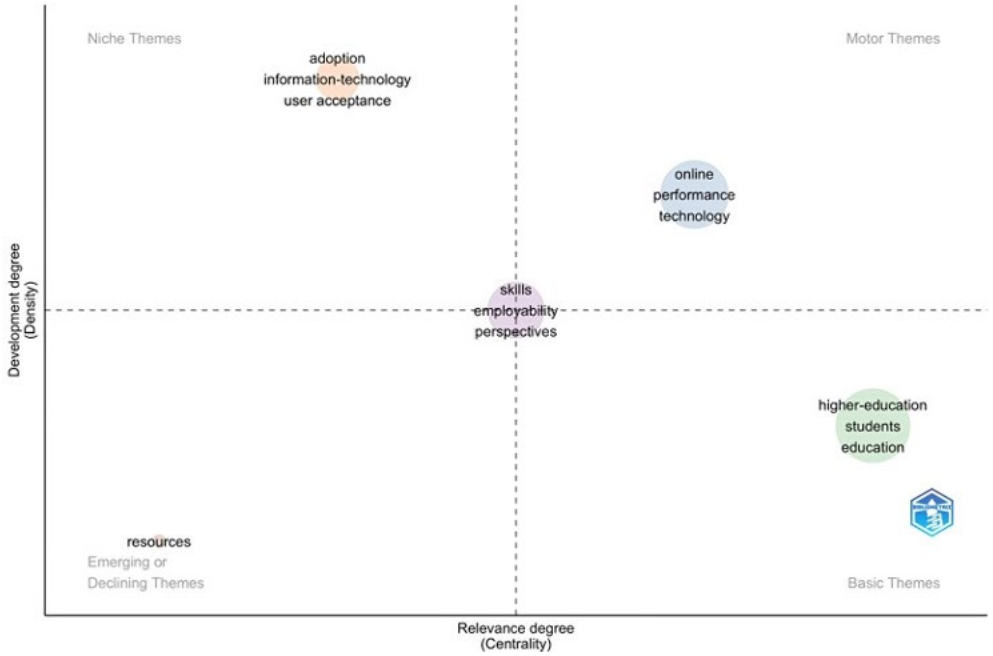

Figure 7. Themes based on keywords studies in blended learning in higher education (WoS) (Source: Authors)

Figure 7 shows a map of themes based on how often keywords show up and how they connect to each other in WoS.

Figure 8 shows a map of themes based on how often keywords show up and how they connect to each other in a combined dataset. These maps look at how important and connected these keywords are in BL research.

In Scopus, “blended learning” is the main word in one group. It’s not just common; it also links a lot of different research topics together. It’s like a bridge between different ideas because it has a high score for being in the middle of things. Words like “e-learning” and “learning systems” are also central, showing their key parts of discussions about BL. In WoS, “online” is the top word in its group. It’s one of the most important

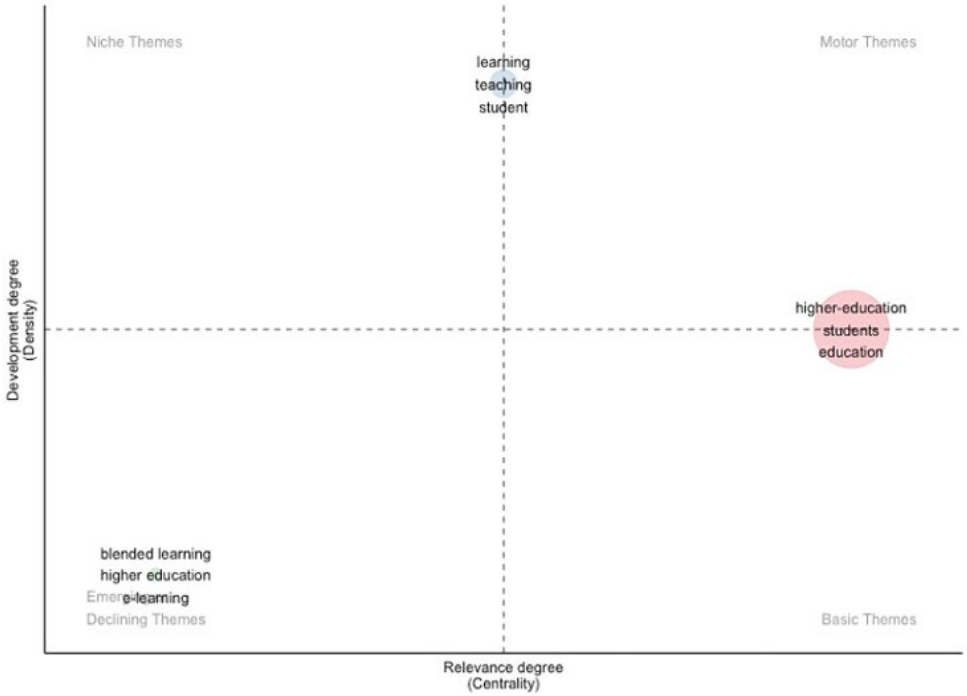

Figure 8. Themes based on keywords studies in blended learning in higher education (Merged) (Source: Authors)

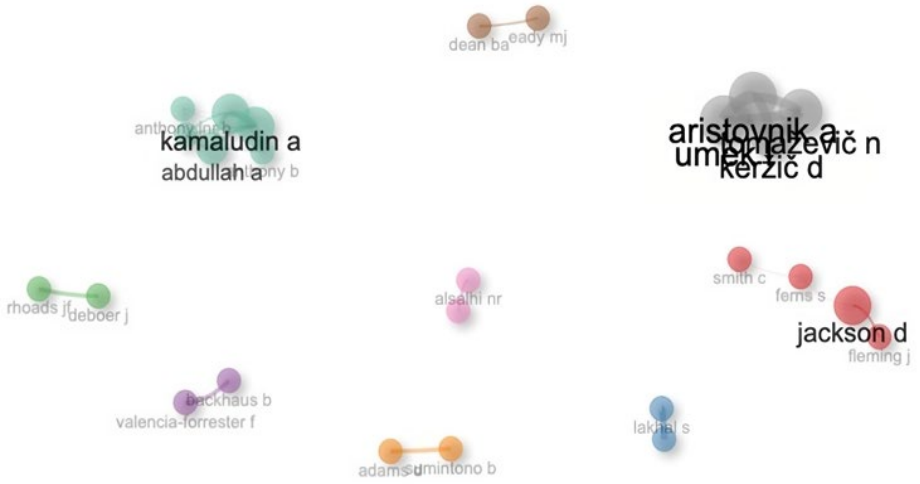

Figure 9. Co-network based on authors studies in blended learning in higher education (Scopus) (Source: Authors)

words when we talk about learning on the Internet. Other big words in this group are “performance” and “technology,” which are about how well online learning works and the tools used for it. In the combined data, “higher-education” connects the most topics. It’s followed by “students” and “education,” which are also big deals in research. They link to many parts of the field.

In all datasets, we often see words like “students,” “education,” “teaching,” and “higher education.” They are key parts of the conversation on BL. They show up a lot and connect to many other research topics. Words about online tools and ways of learning, like “online,” “e-learning,” and “learning systems,” show the tech side of BL research. And with “COVID-19” coming up in the latest data, there’s a clear focus on how the pandemic is changing education.

This map of themes helps researchers see the main topics in BL. It shows how different ideas are linked and points out what people are most interested in right now or what’s starting to get attention.

Figure 9 provides a network analysis of author collaborations based on data from Scopus.

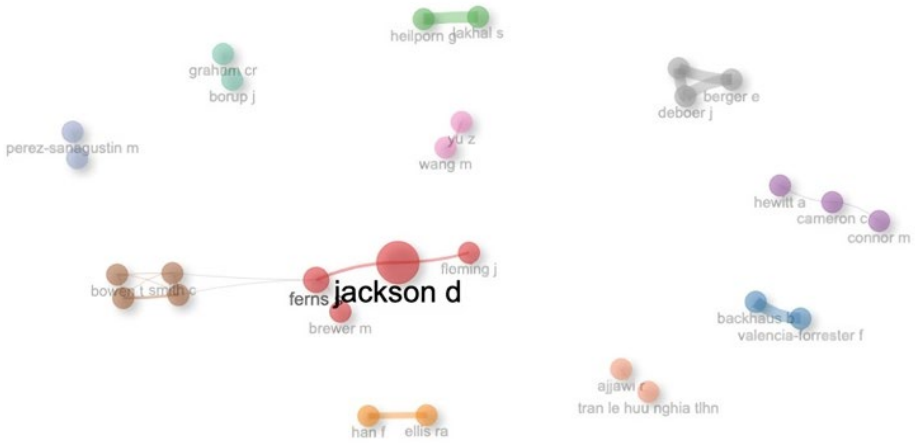

Figure 10. Co-network based on authors studies in blended learning in higher education (WoS) (Source: Authors)

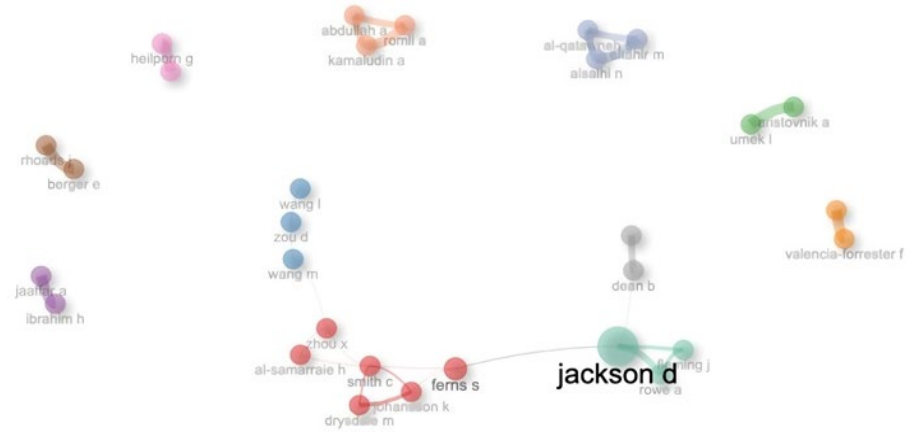

Figure 11. Co-network based on authors studies in blended learning in higher education (Merged) (Source: Authors)

Figure 10 provides a network analysis of author collaborations based on data from WoS.

Figure 11 provides a network analysis of author collaborations based on data from a merged dataset. The collaboration is determined by co-authorship, and the network centrality measures such as betweenness, closeness, and PageRank suggest the influence of each author in the network.

In the Scopus research database, we see authors like Jackson D and Ferns S playing a key role. They are like bridges in the network of researchers, likely working with many different people. They are close to others in the network, which means they can share and get information quickly. They are also often mentioned in research, showing they have an impact.

In WoS database, Jackson, D. and Ferns, S. are also central. They show up a lot and have a big role, just like in Scopus. This means they are important members of their research community. They work on many projects and with many different researchers. In the data that combines Scopus and WoS, Ferns, S. and Smith, C. are central. They connect lots of people in the research network. They are also mentioned a lot, which shows they are important, and their work has a big impact.

Other researchers, like Lakhal, S., Heilporn, G., Deboer, J., Rhoads, J. F., and Valencia-Forrester, F., are in important spots within their own groups in both databases and the combined one. But they do not connect different groups as much as those with higher scores. The data shows that some researchers are central to their own areas, but only a few connect different areas in the wider research field. The ones with high scores in the combined data are likely to be very influential in collaborative research on BL.

This analysis is useful because it points out the main researchers in BL. These people are key to the discussion in this area and link different research topics together. For new researchers or those who want to know who the main contributors are, these researchers could be good to work with or learn from.

DISCUSSION

This study looks at a lot of data to understand BL research. It uses numbers and patterns from different places to see what's been happening in the last ten years. Like Ellegaard and Wallin (2015) said, we can see which way research is going by looking at what gets published. Using information from more than one source gives a better picture than just one alone (López-Pérez et al., 2011; Omar et al., 2021). The data from all the sources put together shows that BL in colleges and universities is growing steadily. Other studies said the same thing, that schools are quickly starting to use BL (Castro, 2019; Graham, 2006; Heilporn et al., 2021). They mix online and classroom teaching. This is getting more popular, and it's happening more and more (Galway et al., 2014; Porter et al., 2014; Shimizu et al., 2019). Universities in Australia, like Deakin, Monash, and Griffith, are doing a lot of work in this area. They are known for being ahead in using BL (Porter & Graham, 2016). Also, articles that talk about the big ideas and plans for BL are cited a lot. This shows they're important for setting the scene for BL research (Kintu et al., 2017; Platonova et al., 2022).

The study also looks at what keywords are used a lot and who works with whom. This supports what other research says: BL is about many things. Topics like "online learning," "students," and "teachers" come up a lot. This fits with what other studies say about needing the right balance in BL programs (Garrison & Kanuka, 2004; Rasheed et al., 2020). But there's not much work together between authors from rich countries and those from poorer ones. This lack of working together has just started to get noticed (Lee et al., 2017; Porter & Graham, 2016). Most research comes from Australia, Europe, and North America. As BL becomes popular worldwide, including more views could help us understand different challenges better. However, when limitations stemming from the methodology should be considered, relying exclusively on indexed databases omits potentially relevant work in BL. Variations in indexing practices can also contribute to underrepresentation (Omar et al., 2021). Citations accumulate over time, disadvantaging more recent publications. Normalization only partially addresses this issue. Still, these findings establish an informative reference point to guide future exploration. Updated analysis in next few years would be prudent to capture post-pandemic shifts, given that this study draws primarily on pre-2020 data. Also, the current findings can inform research targeting less visible perspectives, technologies, and learning environments within blended contexts. Deeper investigation of regional imbalances through qualitative lenses may explain underlying factors. Overall, while not conclusively definitive, this bibliometric study meaningfully pieces together landscape and structure of BL research, identifying extant strengths and open questions warranting inquiry.

CONCLUSIONS

This cross-database bibliometrics study offers valuable insights into research landscape and knowledge structure of BL in higher education. Analysis of data from Scopus, WoS, and an integrated dataset from 2014-2023 reveals a steady growth in publications, suggesting rising academic interest in BL models and online education technologies. Integrated dataset, combining sources from across databases, provides the most comprehensive overview of productivity and impact. Australian universities like Deakin, Monash, and Griffith emerge as prolific contributors, while sources like "Education and Information Technologies" and "International Journal of Educational Technology in Higher Education" are revealed as influential publication venues. Regarding impact, highly cited publications point to priority research areas, with articles discussing BL frameworks, models, and role of educational technology setting agenda. Author citation analysis identifies leading scholars who have advanced theoretical and practical understanding. Mapping of keywords and collaboration exposes a web of connections between learners, instructors, content, technology, and learning experiences as central themes. "Higher education" and "online learning" unify diverse threads of inquiry. The emergence of "COVID-19" related research signals a key contemporary issue affecting BL. While Australia and the USA are dominant, contributions from Asian and European countries highlight the global relevance of BL research. Nonetheless, collaboration between developed and developing country scholars can improve.

In summary, this bibliometric review synthesizes datasets to chart prevailing conversations while surfacing potential gaps in literature. It informs opportunities for research targeting underrepresented perspectives, tools, and learning environments. An updated analysis in future would reveal post-pandemic shifts and refine evaluation of BL's capabilities.

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Declaration of interest: The authors declare no competing interest.

Data availability: Data generated or analyzed during this study are available from the authors on request.

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