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# A Bibliometric Analysis of Blended Learning in Higher Education: Perception, Achievement and Engagement

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**Abstract.** This article presents a bibliometric analysis of publications on blended learning in higher education. The analysis is grounded on statistics obtained from the online Scopus database on 11 December 2019. The study used Microsoft Excel to conduct a frequency analysis, VOSviewer for data visualization, and Harzing's Publish or Perish for citation metrics and analysis. In total 1,064 valid documents were analyzed, based on keyword search results for "blended learning", "perception", "achievement", "engagement", "higher education" and "bibliometric analysis". This article reports descriptive and content analysis on document type and source type. Analysis shows that number of publications per year increased from 2000 to 2018. English is the most widely used language for publications, and most publications are from the social sciences. The United States contributes the most publications. The most active journals, influential institutions, citation metrics and highly cited articles are listed. Network visualization maps demonstrate keyword analysis of author keywords; co-authorship by country and author; number of authors per document; citations by country and document; co-occurrence of all keywords; and, lastly, co-citation by cited sources. The visibility of work on blended learning in highly cited journals in the past two decades reveals that blended learning has gained significant attention among educators and researchers. Future research

could include systematic literature reviews or other mapping tools, such as HistCite.

**Keywords:** achievement; bibliometric analysis; blended learning; engagement; perception

## 1. Introduction

Blended learning (BL) is an educational approach first postulated in 2000 (Cooney et al., 2000); since then, it has been used in many fields of leadership training (Voci & Young, 2001) and higher education (Garrison & Kanuka, 2004; Raman & Rathakrishnan, 2019). However, not many bibliometric analyses have been carried out on BL in higher education contexts, especially not related to perception, achievement, and engagement (Dwivedi et al., 2019). Bibliometrics is a quantitative analytic technique that uses mathematical and statistical methods to ascertain the relationships between and impacts of publications in a particular field of study (Lee et al., 2020). In bibliometrics, bibliometric mapping is an important research area that is fast gaining popularity among e-learning researchers (Börner et al., 2003). However, there is still a dearth of bibliometric information relating to BL and e-learning research globally in the educational setting (Diem & Wolter, 2013; Lee et al., 2009) and information technology (Hsiao et al., 2015). Moreover, the latest publications on e-learning demonstrate a wide bibliometric interrelation amongst its articles, which are predominantly in the social sciences (Tibaná-Herrera et al., 2018).

Engagement is a widely relevant predictor of student satisfaction and achievement in BL, because engagement has the potential to improve the student experience (Lane et al., 2021). Moreover, there is a significant correlation between BL and students' perception of using BL approaches, and academic achievement (Alamri, 2021). However, there is limited visibility of BL in higher education in relation to students' perceptions about BL, and its role in achievement and engagement. Therefore, this research aimed to fill this gap, by investigating the scholarly networks and worldwide trends involving BL in higher education, based on a bibliometric analysis of highly cited articles published between 2000 to 2019 and visible in the Scopus database. The purpose of this research was to evaluate published literature on BL, perception, achievement, engagement in higher education, based on publication output, author keyword occurrence, most productive journals, most productive institutions, authors, and country contributions.

The purpose of this paper is to examine the effect of BL on perception, achievement, and engagement in higher education. The central research questions relating to BL in higher education that guided the bibliometric analysis of this study are as follows: RQ1: What are the document and source types? RQ2: What is the research productivity? RQ3: What are the most used languages in documents? RQ4: What subject areas are researching BL in higher education? RQ5: What are the most active journals publishing papers? RQ6: What are the most influential institutions that contributed to BL in higher education? RQ7: What is the distribution of author keywords and co-occurrences of author

keywords? RQ8: What is the geographical distribution of publications by country? RQ9: How many authors collaborate per document? RQ10: Who are the most active authors? RQ11: What is the distribution of co-authorship by authors? RQ12: What is the citation analysis of documents?

## 2. Literature Review

### 2.1. Bibliometric Mapping

Bibliometrics can be defined as quantitative and descriptive statistical analysis of publications, such as journal articles (Ding et al., 2016), conference proceedings papers (Michels & Fu, 2014), and book chapters (Zuccala & van Leeuwen, 2011). By searching the Web of Science and Scopus databases by topic, author, journal, and time period, bibliographic data can be retrieved. Over the past two decades, quantitative analysis of publication and citation data has been widely used in education settings to assess prominent authors, conceptual and intellectual maps, and trends in scientific ecosystems (Aria & Cuccurullo, 2017). The creation of bibliometric maps (distance-based maps) and the graphical illustration of those maps (graph-based maps) are two aspects of bibliometric mapping. Constructions of maps are more widely used and discussed in bibliometric literature than graphical illustrations of maps (Van Eck & Waltman, 2010). Computer programs, such as SPSS and Pajek, generate simple graphical illustrations for bibliometric literature, which are only suitable for small maps of less than 100 items (Chen, 2003; Skupin, 2004). Therefore, a new computer program that can plot larger maps was developed (Klavans & Boyack, 2006, Van Eck & Waltman, 2020).

### 2.2. Visualisation of Similarities (VOSviewer)

VOS (Visualisation of Similarities) viewer is a computer program that was designed to create and visualise bibliometric maps, free of charge (Van Eck & Waltman, 2020). Several computer programs can be used for bibliometric mappings, such as Histcite, SPSS and Pajek (Chen, 2003; Skupin, 2004), but VOS emphasizes graphical representation. The speciality of VOSviewer is that it can display large bibliometric maps, for example, it can construct maps of authors or journals based on keyword, co-citation, and co-occurrence data. Another advantage of VOS is that it can be used for more than 100 items. The VOS mapping technique demonstrates excellent performance in viewing and constructing maps, the procedures of which are wholly integrated into VOSviewer. Three types of visualizations can be demonstrated, namely network, overlay, and density visualization. However, for this study, only the network visualization was generated and analyzed (Van Eck & Waltman, 2020).

### 2.3. Scopus Database

Sophisticated analytical tools are now available to ensure that bibliometric analysis is accurate, and to cover a large pool of publications over long periods. Some of the widely used databases are Scopus, Google Scholar, and Web of Science (Li et al., 2010). For this study, the Scopus database was searched using keywords applicable to this article. As of 2 February 2020, no results were returned by the Scopus database for the keywords “blended learning”, “perception”, “achievement”, “engagement”, “higher learning” and “bibliometric analysis”. However, there was an article reporting a study on the relationship

between student perceptions in BL courses and their in-course achievement in higher education (Owston et al., 2013). This analysis was carried out due to the existence of this prevailing gap between BL and perceptions, achievement, and engagement in higher education.

### 2.4. Bibliometric Indicators

Bibliometrics measures the impact of scientific research by using bibliometric indicators, such as the impact factor and the h-index. Bibliometric indicators measure the impact of a paper by counting the number of other papers that have cited it. Harzing's Publish or Perish software is widely used to calculate citation metrics, such as h-index and g-index (Harzing, 2020).

### 2.5. Definitions of Blended Learning, Perception, Achievement and Engagement

BL systems integrate face-to-face instruction with computer-mediated instruction (Graham, 2018). BL is described by Garrison and Kanuka (2004, p. 96) as "the careful combination of classroom face-to-face learning experiences with online learning experiences".

Perception can refer to the presence of an experiencing person or perceiver; second, it can be what is being perceived (object, person, situation, or relationship); third, the context of the situation in which objects, events, or persons are perceived; and finally, the process nature of perception, which begins with the experience of several stimuli by the perceiver (Jordaan & Jordaan, 1996, cited by Lewis, 2001).

Achievement refers to success in relation to the academic objectives that students are required to accomplish as a result of their learning activities (Hattie & Anderman, 2013). Engagement, according to the National Survey of Student Engagement, is defined as the amount of time students devote to educational activities in order to achieve the desired outcomes, as well as the quality of their related efforts (Kuh, 2009). Furthermore, engagement is described as "the degree to which students participate in activities that have been linked to high-quality learning outcomes in higher education research" (Krause & Coates, 2008).

## 3. Method

The data in this analysis were established by searching 24,600 active titles and 5,000 publishers on the Scopus database and Scopus indexed content. Although several databases are widely available, the bibliometric analysis in this research is based entirely on Scopus databases. In addition, to create sample articles for the analysis, only five keywords were utilized as search terms, namely "blended learning"; "perception"; "achievement"; "engagement", and "higher education". Network visualization and bibliometric indicators will be illustrated to answer the research questions.

Scopus uses rigorous original metadata to associate people, published theories, and institutions. By using refined tools and analytics, Scopus creates accurate citation outcomes and comprehensive researcher profiles. "Blended learning" OR

"perception" OR "achievement" OR "engagement" AND "higher education" was used as the string to search titles, abstracts, and keywords. Documents published between 2000 to 2019 were retrieved for analysis. This research employed the stepwise procedure commonly used in bibliometric studies, which is illustrated in the flowchart in Figure 1 (Zare et al., 2017).

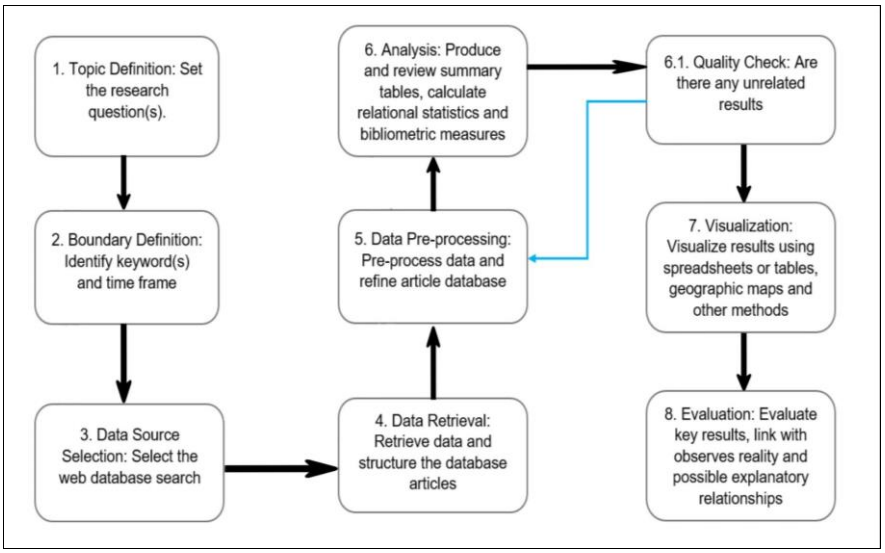



**Figure 1: Steps in the bibliometric research method (Zare et al., 2017)**

### 3.1. Bibliometric analysis

Bibliometrics is a computerized investigation of publications by statistical designs (Ellegaard & Wallin, 2015). Over the last decade, bibliometric analysis has gained popularity as a method that can reveal the trends of visibility in open-access and conference publications. Publication outlet, type of publication, authorship, affiliation, country, and h-index are most frequently analyzed (Ahmi & Mohamad, 2019). According to Rusly et al. (2019), a bibliometric analysis could analyse data concerning publications over a period, by referring to frequency of keywords, citations, and authors.

### 3.2. Source and Data Collection

The search query, "The Effect of Blended Learning on Perception, Achievement, and Engagement in Higher Education" was searched within the 'article title' box at the Scopus database on 2 February 2020. Overall, 1,064 documents were produced for advanced investigation. The retrieval data from Scopus database were exported in the form of RIS and CSV for further analysis. Software, such as Microsoft Excel, VOSviewer and Harzing's Publish and Perish, was used to analyze the collected Scopus documents. Microsoft Excel 2019 was used to calculate the frequency and percentage of each publication, as well as to generate suitable graphical representations; VOSviewer (version 1.6.15) was used to visualize the bibliometric networks; and citation metrics were calculated using Harzing's Publish and Perish program (Mansour et al., 2021).

## 4. Results

The research findings comprise information on document and source types; research productivity; the language of documents; subject area; most active journals; author keywords analysis and co-occurrences of author keywords; geographical distribution of publications; the number of authors per document; most active authors, co-authorship by authors, most influential institutions; and citation analysis. In addition, visualization maps were used to enhance keyword analysis, the explanation of geographical distribution of publications, the number of authors per document, most influential institutions, highly cited articles/most influential papers through Google Scholar (2000–2019), the geographical distribution of publications, and frequently cited articles through Google Scholar (2000–2019).

### 4.1. Document and source types

Publications obtained from the Scopus database can be classified according to document type and source type. Document type includes information on the origin of publications, such as journal articles, conference papers, and book chapters (Sigogneau, 2000; Sweileh et al., 2017; Ahmi & Mohamad, 2019). Conference papers are classified as papers that were presented at conferences, and which might also have been published as journal articles (Ahmi & Mohamad, 2019). In this study, nine types of documents were published by Scopus between the years 2000 and 2019 (Table 1). Out of the 1,064 documents published, 723, or 67.95%, were articles. This was followed by 145 conference papers (13.635%); 112 book chapters (10.53%); 38 reviews (3.57%); 18 books (1.69%); eight editorials (0.75%); and seven notes (0.66%). A total of six documents were classified as errata (0.56%), and seven documents were undefined by Scopus (0.66%).

**Table 1. Document type**

| Document type | Frequency | % (N=1,064) |
|---|---|---|
| Article | 723 | 67.95 |
| Conference Paper | 145 | 13.63 |
| Book Chapter | 112 | 10.53 |
| Review | 38 | 3.57 |
| Book | 18 | 1.69 |
| Editorial | 8 | 0.75 |
| Note | 7 | 0.66 |
| Erratum | 6 | 0.56 |
| Undefined | 7 | 0.66 |
| **Total** | **1,064** | **100.00** |

Documents published under the category of source type consisted of journals (73.21%) – the highest percentage – followed by books (11.84%); conference proceedings (11.65%); book series (3.10%) and trade publications (0.19%) (Table 2). Source type conference papers can be published as either book chapters or conference proceedings (Sweileh et al., 2017).

**Table 2. Source type**

| Source type | Frequency | % (N=1,064) |
|---|---|---|
| Journals | 779 | 73.21 |
| Books | 126 | 11.84 |
| Conference Proceedings | 124 | 11.65 |
| Book Series | 33 | 3.10 |
| Trade Publications | 2 | 0.19 |
| **Total** | **1,064** | **100.00** |

### 4.2. Research productivity

Research productivity is normally defined by the number of publications (Fox, 1983; Reynolds, 1971). Analysis of documents by year of publication enables researchers to track the pattern and visibility of research (Ahmi & Mohamad, 2019). In this study, the total annual publications ascertained research productivity. It is illustrated by a percentage and cumulative percentage of publications from 2000 to 2019. This analysis found that the number of publications per year, the percentage, and cumulative percentage of publications increased gradually from 2000 to 2018, with a slight dip in 2016, as shown in Table 3 and Figure 2. The highest number was achieved in 2018, with 151 publications, and the lowest in 2000, with only five publications. This finding shows that the search strings of this study had increased in visibility in the last two decades and is increasingly becoming a favorite research topic, especially among e-learning researchers (Johnson et al., 2016).

**Table 3: Publications by year**

| Year | No. of publications | Percentage (%) (N=1,064) | Cumulative percentage (%) |
|---|---|---|---|
| 2000 | 5 | 0.47 | 0.47 |
| 2001 | 6 | 0.56 | 1.03 |
| 2002 | 6 | 0.56 | 1.59 |
| 2003 | 5 | 0.47 | 2.06 |
| 2004 | 13 | 1.22 | 3.28 |
| 2005 | 15 | 1.41 | 4.69 |
| 2006 | 12 | 1.13 | 5.82 |
| 2007 | 16 | 1.50 | 7.32 |
| 2008 | 28 | 2.63 | 9.95 |
| 2009 | 29 | 2.73 | 12.68 |
| 2010 | 48 | 4.51 | 17.19 |
| 2011 | 44 | 4.14 | 21.33 |
| 2012 | 61 | 5.73 | 27.06 |
| 2013 | 74 | 6.95 | 34.01 |
| 2014 | 83 | 7.80 | 41.81 |
| 2015 | 109 | 10.24 | 52.05 |
| 2016 | 94 | 8.83 | 60.88 |
| 2017 | 117 | 11.02 | 71.9 |
| 2018 | 151 | 14.19 | 86.09 |
| 2019 | 148 | 13.91 | 100 |
| **Total** | **1,064** | **100** | |

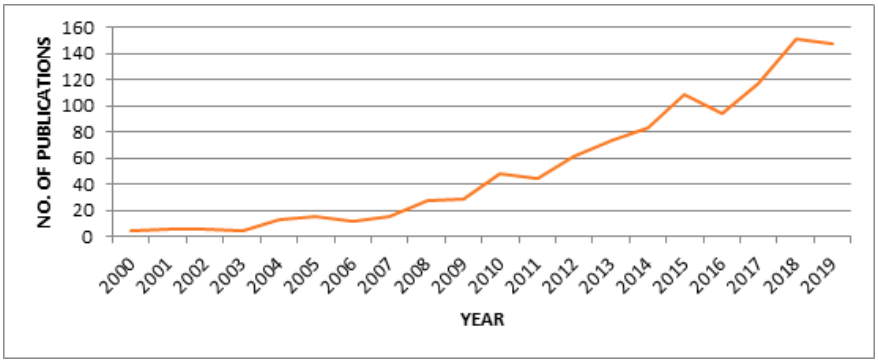



**Figure 2. Number of publications by year**

### 4.3. Language of documents

English is the most widely used language for publications, covering 92.89% of the total number of publications, followed by Spanish (3.23%) and Portuguese (1.94%) (Table 4). The rest of the publications were in other languages, namely Afrikaans, French, German and Croatian. Asian languages, such as Japanese, Korean, and Thai, were used in 0.09% of publications. A few other European languages that are used in publications in Scopus are Russian, Turkish, and Ukrainian (0.095). A total of 19 publications were found to be published in dual languages, which explains the frequency of 1,083, although the total number of publications in this analysis is 1,064 (Table 1).

**Table 4: Languages used for publications**

| Language | Frequency* | % (N=1083) |
|---|---|---|
| English | 1,006 | 92.89 |
| Spanish | 35 | 3.23 |
| Portuguese | 21 | 1.94 |
| Afrikaans | 5 | 0.46 |
| French | 4 | 0.37 |
| Croatian | 3 | 0.28 |
| German | 3 | 0.28 |
| Japanese | 1 | 0.09 |
| Korean | 1 | 0.09 |
| Russian | 1 | 0.09 |
| Thai | 1 | 0.09 |
| Turkish | 1 | 0.09 |
| Ukrainian | 1 | 0.09 |
| **Total** | **1,083** | **100.00** |

*19 documents were prepared in dual languages

### 4.4. Subject area

The publications were categorized further according to 25 subject areas, as summarized in Table 5. Results confirm that BL is a method that most widely used in the social sciences, as 53.93% of all publications in this study are, in fact, about the social sciences. Next-most-common subject areas are computer science (12.46%) and business, management and accounting (8.12%). BL and perception of, and achievement and engagement in higher education are also integrated into other subject areas, as shown in Table 5. Other significant contributing areas are

the arts and humanities, psychology, and engineering. The total frequency of 1,565, which is much higher than the actual total of 1,064 publications, indicates that BL is a multidisciplinary field about which work is published and categorized across more than one subject area.

**Table 5. Subject area**

| Subject area | Frequency | % (N=1,565) |
|---|---|---|
| Social Sciences | 844 | 53.93 |
| Computer Science | 195 | 12.46 |
| Business, Management and Accounting | 127 | 8.12 |
| Arts and Humanities | 77 | 4.92 |
| Psychology | 69 | 4.41 |
| Engineering | 65 | 4.15 |
| Economics, Econometrics and Finance | 35 | 2.24 |
| Medicine | 25 | 1.60 |
| Decision Sciences | 21 | 1.34 |
| Mathematics | 20 | 1.28 |
| Environmental Science | 19 | 1.21 |
| Health Professions | 15 | 0.96 |
| Energy | 9 | 0.58 |
| Agricultural and Biological Sciences | 8 | 0.51 |
| Multidisciplinary | 8 | 0.51 |
| Physics and Astronomy | 6 | 0.38 |
| Biochemistry, Genetics and Molecular Biology | 5 | 0.32 |
| Earth and Planetary Sciences | 5 | 0.32 |
| Nursing | 4 | 0.26 |
| Chemical Engineering | 2 | 0.13 |
| Neuroscience | 2 | 0.13 |
| Pharmacology, Toxicology and Pharmaceutics | 2 | 0.13 |
| Materials Science | 1 | 0.06 |
| Veterinary | 1 | 0.06 |
| **Total** | **1,565** | **100** |

*Publications were classified according to source title. Some of the source titles were categorized in more than one subject area.

### 4.5. Most active journals

The search for the most active journals generated 15 journals, as listed in Table 6. *Studies in Higher Education* topped the list, with 20 articles. This was followed by *Higher Education Research and Development* (16), *Higher Education* (14), J*ournal of Applied Research in Higher Education* (12 articles), and *Journal of Further and Higher Education* (11 articles). Ten articles on BL and the keywords analyzed in this paper were published in *Assessment and Evaluation in Higher Education* and *Computers and Education Journal*. The journals that published seven articles over the period studied are *British Journal of Educational Technology*, *Christian Higher Education, Higher Education Policy* and *Proceedings of The European Conference on E-Learning (Ecel)*.

Cite score, which encompasses more social sciences and humanities journals, is grounded on information obtained from the Scopus database, and has a three-year citation window. The top three ranked journals *Internet and Higher Education*

(9.41), followed by *Computers in Education* (7.72) and *British Journal of Educational Technology* (4.07). Although *Higher Education* (N/A) published 14 articles in that period, Scopus did not provide the cite score.

**Table 6. Most active journals**

| Journals | Number of Articles | Cite Score (2018) |
|---|---|---|
| Studies in Higher Education | 20 | 3.28 |
| Higher Education Research and Development | 16 | 2.58 |
| Higher Education | 14 | N/A |
| Journal of Applied Research in Higher Education | 12 | 0.64 |
| Journal of Further and Higher Education | 11 | 1.63 |
| Assessment and Evaluation in Higher Education | 10 | 2.72 |
| Computers and Education | 10 | 7.72 |
| Internet and Higher Education | 9 | 9.41 |
| Journal of Higher Education Policy and Management | 9 | 1.55 |
| Communications in Computer and Information Science | 8 | 0.46 |
| Quality Assurance in Education | 8 | 1.53 |
| British Journal of Educational Technology | 7 | 4.07 |
| Higher Education Policy | 7 | 1.47 |
| **Total** | **141** | |

### 4.6. Most influential institutions

The most influential institutions that contributed documents on BL were also analyzed for this paper. Out of 164 institutions that had published a minimum of seven publications, Monash University (Australia) topped the list, with 11 publications (6.67%). This was followed by Universiti Teknologi Malaysia, Curtin University (Australia), and the University of London, with ten publications (6.06%) each. This proves that BL and e-learning have gained the attention of researchers from both Western and Eastern countries. It is interesting that eight of the top 20 institutions were in Australia, four in the United Kingdom; three in Portugal; two each in Malaysia and the United States of America, and one in Spain.

**Table 7. Most influential institutions**

| Country | Frequency | % (N=165) |
|---|---|---|
| Monash University | 11 | 6.67 |
| Universiti Teknologi Malaysia | 10 | 6.06 |
| Curtin University | 10 | 6.06 |
| University of London | 10 | 6.06 |
| RMIT University | 9 | 5.45 |
| Universidade do Minho | 9 | 5.45 |
| Universidade de Aveiro | 9 | 5.45 |
| The University of Sydney | 9 | 5.45 |
| Universidade de Lisboa | 9 | 5.45 |
| National University of Ireland Galway | 8 | 4.85 |
| Griffith University | 8 | 4.85 |
| Universitat de Barcelona | 7 | 4.24 |

| | | |
|---|---|---|
| Universiti Teknologi MARA | 7 | 4.24 |
| Brigham Young University | 7 | 4.24 |
| University of Salford | 7 | 4.24 |
| University of Southern Queensland | 7 | 4.24 |
| Indiana University | 7 | 4.24 |
| Lancaster University | 7 | 4.24 |
| University of Plymouth | 7 | 4.24 |
| University of Queensland | 7 | 4.24 |
| **Total** | **165** | **100.00** |

### 4.7. Analysis of author keywords and co-occurrences of author keywords

Descriptive analysis of the 20 keywords most frequently used by authors revealed that the most frequently used keyword is "higher education" (15.24%), followed by "students" (5.85%), "education" (4.08%), "blended learning" (3.50%), and "e-learning" (3.16%). "Perception" and "student engagement" were found to each represent only 2.19% of the total search returns of this study, followed by "academic achievement", which had a percentage of 1.00% (Table 8).

**Table 8: Author keywords analysis**

| Author keywords | Frequency | Percentage |
|---|---|---|
| Higher Education | 396 | 15.24% |
| Students | 152 | 5.85% |
| Education | 106 | 4.08% |
| Blended Learning | 91 | 3.50% |
| E-learning | 82 | 3.16% |
| Teaching | 78 | 3.00% |
| Perception | 57 | 2.19% |
| Student Engagement | 57 | 2.19% |
| Human | 39 | 1.50% |
| Engineering Education | 36 | 1.39% |
| Student | 35 | 1.35% |
| Higher Education Institutions | 33 | 1.27% |
| Education Computing | 30 | 1.15% |
| Engagement | 29 | 1.12% |
| Computer-aided Instruction | 28 | 1.08% |
| Article | 27 | 1.04% |
| Learning | 27 | 1.04% |
| University | 27 | 1.04% |
| Academic Achievement | 26 | 1.00% |
| Humans | 25 | 0.96% |

To map widely used keywords with VOSviewer, co-occurrence analysis was administered and author keywords were chosen. The network visualization map of co-occurrences by author keywords was generated and is shown in Figure 3. From the analysis, six clusters of blended learning were developed. The largest label and circle, which is for "higher education", reveals that the keyword "higher education" has the largest number of occurrences in the Scopus database. The second cluster, which has the second-largest font, represents "blended learning". The third cluster represents "student engagement" and is linked to other

keywords, such as “social media”, “Web 2.0”, and “Facebook”. This is followed by “employability”, which is linked to “mobile learning”, “instructional design”, “motivation”, “academic achievement”, and, lastly “, perception”.

The distance between “higher education” and “assessment” was, furthermore, compared to the distance between “higher education” and “student engagement”. This means that the relationship between “higher education” and “student engagement” is stronger than that between “higher education” and “assessment”. The distance between “higher education” and “blended learning” is the shortest, and this shows that the relationship between these two variables is the strongest. The relationship between “higher education” and “achievement” is the weakest, as these two terms are situated furthest away from each other.

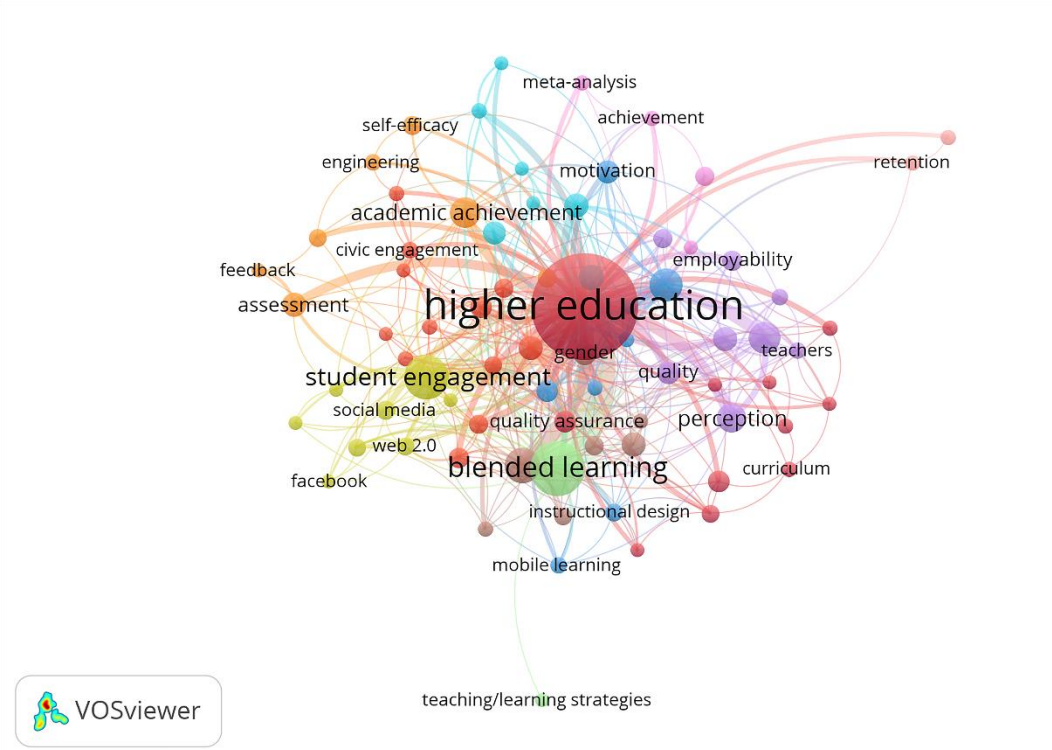



**Figure 3. Network visualization map of co-occurrences by author keyword**

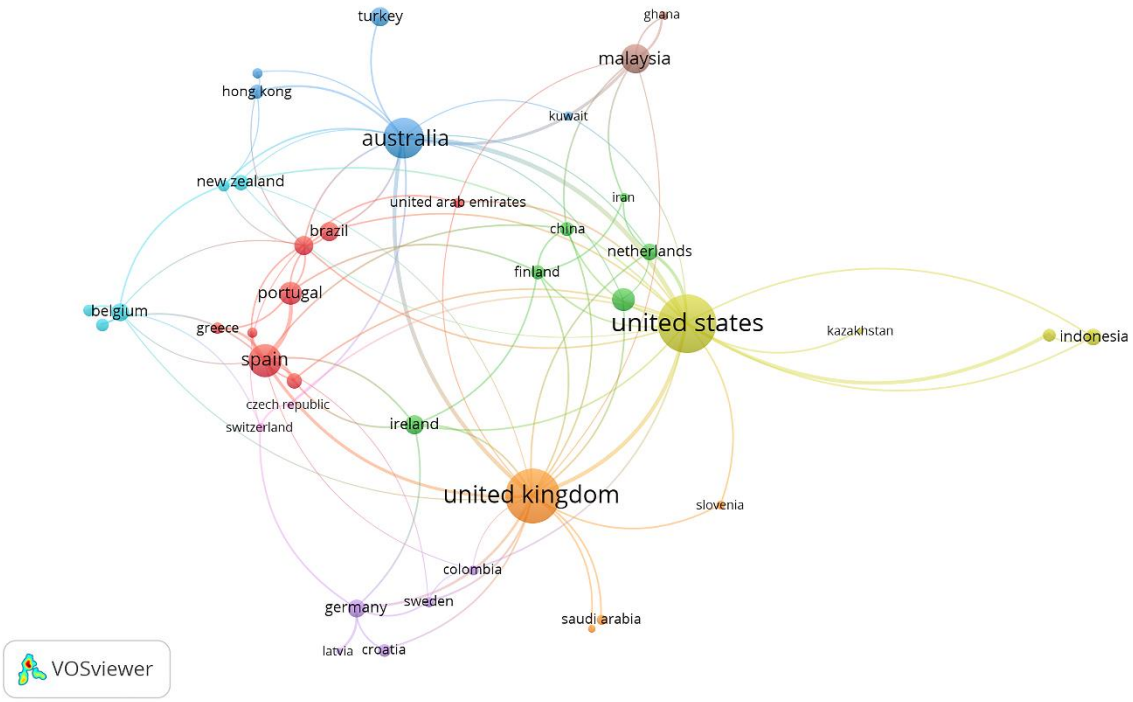
### 4.8. Geographical distribution of publications

A total of 1,220 publications from around the world were identified in the Scopus database for the period of study. However, after descriptive analysis, we selected only the 20 most influential countries. From 2000 to 2019, a total of 938 papers was published. Overall, the United States contributed the largest number of publications on BL and the keywords researched (22.71%), followed by the United Kingdom (19.83%), Australia (11.19%), and Spain (7.25%). This study reveals that developed countries were at the forefront of research on BL and other fields of educational technology. Following closely behind the leading countries were developing countries, such as Malaysia (5.65%), South Africa (3.52%), and Brazil (2.675).

**Table 9. Top 20 countries' contribution to publications**

| Country | Frequency | % (N=938) |
|---|---|---|
| United States | 213 | 22.71 |
| United Kingdom | 186 | 19.83 |
| Australia | 105 | 11.19 |
| Spain | 68 | 7.25 |
| Malaysia | 53 | 5.65 |
| Portugal | 35 | 3.73 |
| South Africa | 33 | 3.52 |
| Brazil | 25 | 2.67 |
| Canada | 25 | 2.67 |
| Ireland | 22 | 2.35 |
| Turkey | 22 | 2.35 |
| Belgium | 20 | 2.13 |
| Germany | 20 | 2.13 |
| India | 19 | 2.03 |
| Netherlands | 19 | 2.03 |
| Indonesia | 17 | 1.81 |
| Chile | 15 | 1.60 |
| New Zealand | 15 | 1.60 |
| Hong Kong | 14 | 1.49 |
| China | 12 | 1.28 |
| **Total** | **938** | **100.00** |

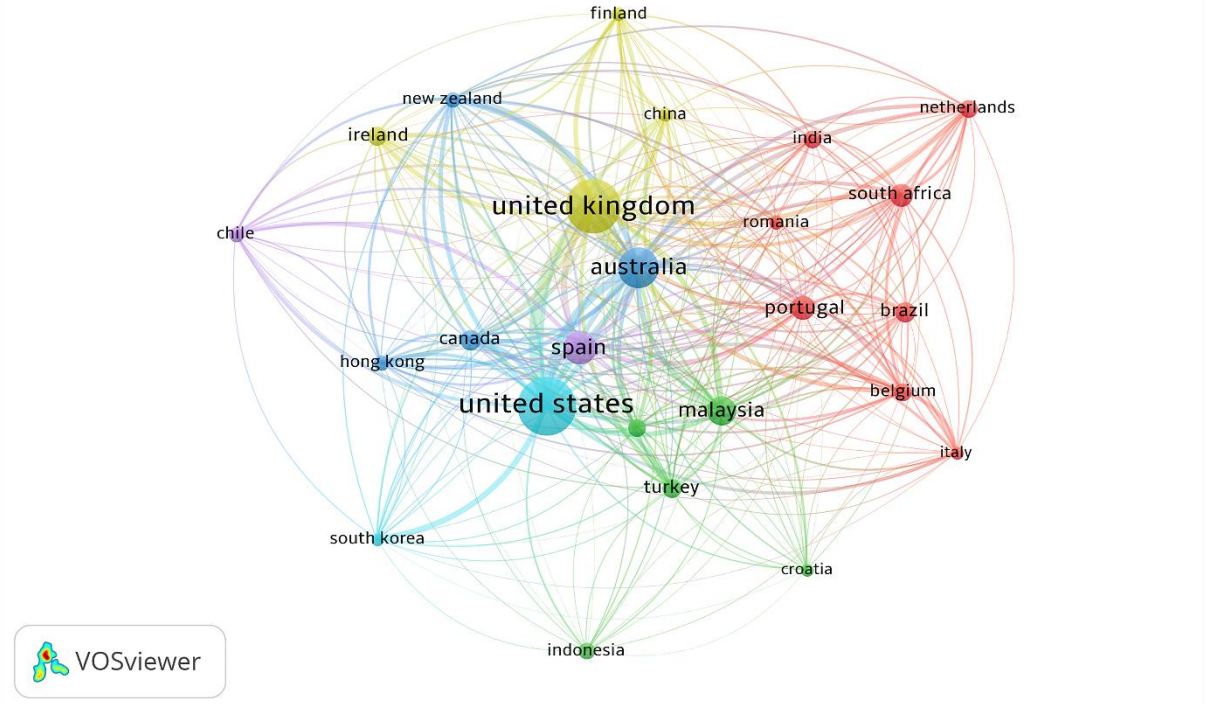
The network visualization map of the co-authorship by country is shown in Figure 4. This analysis was carried out using fractional counting, with a minimum of three documents and citations per country. The United States contributed the most publications on BL, followed by the United Kingdom, Australia, Spain and Malaysia. The links between differently colored clusters show that authors from different countries collaborated to produce articles, for example, between the United States, United Kingdom, and Australia. There was also collaboration among authors from countries within the same cluster, for example, authors from Australia, Turkey, Hong Kong, New Zealand, and Belgium produced papers collectively.




Unit of analysis: Countries
Counting method: Fractional counting
Minimum number of documents of a country: 3
Minimum number of citations of a country: 5

**Figure 4. Network visualization map of the co-authorship by countries**

A network visualization map of citations by country, with a minimum of five documents and ten citations per country, is shown in Figure 12. According to the circles, clusters, labels, and links, the United States produced the highest number of citations, followed by the United Kingdom, Australia, Spain, Malaysia, and Portugal, in that order.




Minimum number of documents per country: 5
Minimum number of citations per country: 10

**Figure 5. Network visualization map of the citation by countries**

### 4.9. Number of authors per document

The number of authors who contributed to a document was calculated by descriptive analysis, that is frequency and percentage, as shown in Table 9. Most of the publications had two authors (28.57%), followed by three authors and one author (25.75%) per document. Publications that had been prepared by five or more authors made up 8.36% of the total number of publications.

**Table 10. Number of the author(s) per document**

| Author count | Frequency | % (N=1,064) |
|---|---|---|
| 0* | 5 | 0.47 |
| 1 | 274 | 25.75 |
| 2 | 304 | 28.57 |
| 3 | 278 | 26.12 |
| 4 | 114 | 10.71 |
| 5 | 53 | 4.98 |
| 6 | 25 | 2.35 |
| 7 | 5 | 0.47 |
| 8 | 2 | 0.19 |
| 9 | 2 | 0.19 |
| 10 | 1 | 0.09 |
| 11 | 1 | 0.09 |
| (blank) | | 0.00 |

*Conference review documents. No authors listed.

### 4.10. Most active authors

This study also investigated the most active authors who published documents on BL. Table 11 lists 20 of the most active authors who had published at least six publications. The authors Kinchin, Hosein, Medland, Lygo-Baker, Warburton, Gash, Rees, Loughlin, Woods, Price, Usherwood had published the largest number of documents – in total 11 articles (2.08%).

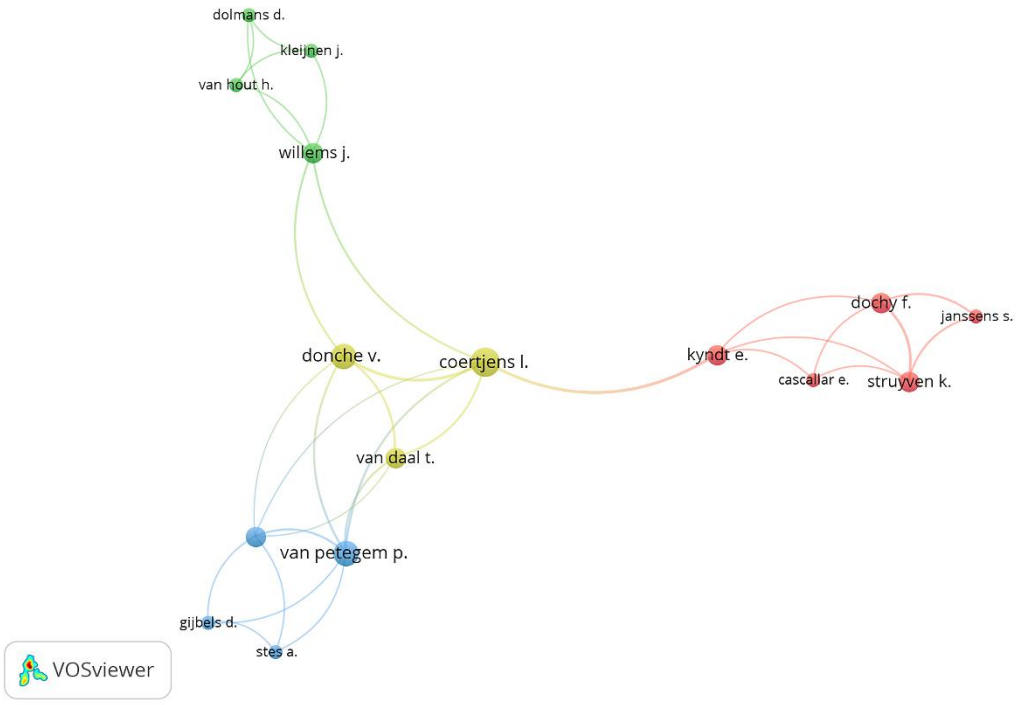
**Table11. Most active authors**

| Author names | No. of publications | Percentage (%) |
|---|---|---|
| Kinchin, I., Hosein, A., Medland, E., Lygo-Baker, S., Warburton, S., Gash, D., Rees, R., Loughlin, C., Woods, R., Price, S. & Usherwood, S | 11 | 2.08 |
| Bokolo A. Jr, Kamaludin, A., Romli, A., Farihan, A., Raffei, M., Nincarean, D. A/L Eh Phon, Abdullah, A., Ming, G. L., Shuker, N. A., Shukri Nordin, M., & Baba, S. | 10 | 1.89 |
| Van der Heijden, K. B., Vermeulen, M. C., Donjacour, C. E., Gordijn, M. C., Hamburger, H. L., Meijer, A. M., van Rijn, J.J., Vlak, M., & Weysen, T. | 9 | 1.70 |
| Sicilia, M-A., Lytras, M. D., Sánchez-Alonso, S., García-Barriocanal, E., & Zapata-Ros, M. | 9 | 1.70 |
| Schmid, R. F., Bernard, R. M., Borokhovski, E., Tamim, R., Abrami, P. C., Wade, C. A., Surkes, M. A., & Lowerison, G. | 8 | 1.51 |
| Nye, A., Hughes-Warrington, M., Roe, J., Russell, P., Peel, M., Deacon, D., Laugesen, A., & Kiem, P. | 8 | 1.51 |
| Vicente, H., Figueiredo, M., Dias, A., Marques, J., Araújo, Is., Maia, N., Ribeiro, J., & Neves, J. | 8 | 1.51 |
| Roberts, R., Wilson, A., Coveney, J., Lind, C., Tieman, J., George, S., Gill, R., & Tonkin, E. | 8 | 1.51 |
| Samah, N. A., Yaacob, A., Hussain, R. M. R., Yusoff, N. M., Meng, N. Y., Othman, R., & Hin, L. C. | 8 | 1.51 |
| Spronken-Smith, R., Bond, C., McLean, A., Frielick, S., Smith, N., Jenkins, M., & Marshall, S. | 7 | 1.32 |
| Araújo, L. S., Wasley, D., Perkins, R., Atkins, L., Redding, E., Ginsborg, J., & Williamon, A. | 7 | 1.32 |
| Maimunah, L., Marzulina, L., Herizal, H., Holandyah, M., Mukminin, A., Pratama, R., & Habibi, A. | 7 | 1.32 |
| Morelock, J. R., Lester, M. M., Klopfer, M. D., Jardon, A. M., Mullins, R. D., Nicholas, E. L., & Alfaydi, A. S. | 7 | 1.32 |
| Hornos, M.J., Hurtado, M.V., Pilar FernÃ¡ndez-SÃ¡nchez M., LÃpez-MartÃnez A., Benghazi, K., RodrÃguez-Almendros, M.L., & Abad-Grau, M.M. | 7 | 1.32 |
| Gregory, S., Scutter, S., Jacka, L., McDonald, M., Farley, H., & Newman, C. | 6 | 1.13 |
| Fong, R. W-T., Lee, J. C-K., Chang, C-Y., Zhang, Z., Ngai, A. C-Y., & Lim, C. P. | 6 | 1.13 |
| Crust, L., Earle, K., Perry, J., Earle, F., Clough, A., & Clough, P. J. | 6 | 1.13 |

| | | |
|---|---|---|
| Basit, T. N., Eardley, A., Borup, R., Shah, H., Slack, K., & Hughes, A. | 6 | 1.13 |
| Kabassi, K., Dragonas, I., Ntouzevits, A., Pomonis, T., Papastathopoulos, G., & Vozaitis, Y. | 6 | 1.13 |
| Venturini, J. C., Pereira, B. A. D., Morales, R., Fleck, C. F., Batistella Junior, Z., & Nagel, M. D. B. | 6 | 1.13 |
| Dismore, H., McDermott, A., Witt, N., Stillwell, R., Neville, S., & Stone, M. | 6 | 1.13 |

### 4.11. Co-authorship by Authors

The network visualization map of co-authorship is shown in Figure 6. Four clusters of authors, which are represented by four different colors, can be seen; they are linked by lines showing co-authorship within clusters and between clusters. There is inter-cluster authorship by Donche, V. and intra-cluster co-authorship with Stes, A.




Unit of analysis: Authors
Counting method: Fractional counting
Minimum number of documents per author: 3
Minimum number of citations per author: 3

**Figure 6. Network visualization map of co-authorship by authors**

### 4.12. Citation analysis

Citation analysis is a conventional method administered in bibliometrics as a way to measure scientific characteristics, especially the number of researchers per publication, the rankings of universities and institutions (Waltman et al., 2012; Weingart, 2005), or publication impact (Frandsen & Rousseau, 2004). Citation

analysis can deliver evidence of interactions between diverse groups of academics, and provide a summary of the literature (Barth et al., 2014).

Citation metrics for documents retrieved on 11 December 2019 are shown in Table 13. As depicted, 1,064 papers were published in the 19 years from year 2000 to 2019, with a total of 11,931 citations and an average of 627.95 citations annually. From the analysis, it can be concluded that papers were cited on average 11.21 times, and citations per author averaged around 4,127.37.

**Table 12. Citation metrics**

| Metrics | Data |
|---|---|
| Publication years | 2000-2019 |
| Citation years | N=19 (2000-2019) |
| Total papers | 1,064 |
| Total citations | 11,931 |
| Average citations per year | 627.95 |
| Citations/paper | 11.21 |
| Citations/author | 4,127.37 |
| Authors/paper | 2.53 |
| Hirsch h-index | 45 |
| Egghe g-index | 92 |

### 4.12.1 Citation analysis by documents

Table 14 reveals the 20 most highly cited articles through Google Scholar (2000-2019) using the keywords, "blended learning", "perception", "engagement", "achievement", and "higher education". The authors, titles of the documents, years published, Google Scholar Cites, Google Scholar cites per year, Google Scholar cites per author, and Google Scholar rankings are also given in Table 14. "Blended Learning: Uncovering its Transformative Potential in Higher Education", by Garrison and Kanuka (2004), achieved the highest number of Google Scholar cites in 2014 (3,801) and highest Google Scholar rank, followed by "NMC Horizon Report: 2016 Higher Education Edition", by Johnson et al. (2016) (3,129 cites), and "From the Achievement Gap to the Education Debt: Understanding Achievement in US Schools", by Ladson-Billings (2006) (2,819 cites). Garrison and Vaughan (2008) (2,715 cites), who authored "Blended Learning in Higher Education: Framework, Principles, and Guidelines", held the third-place GS rank.

**Table 13. Highly cited articles through Google Scholar (2000–2019)**

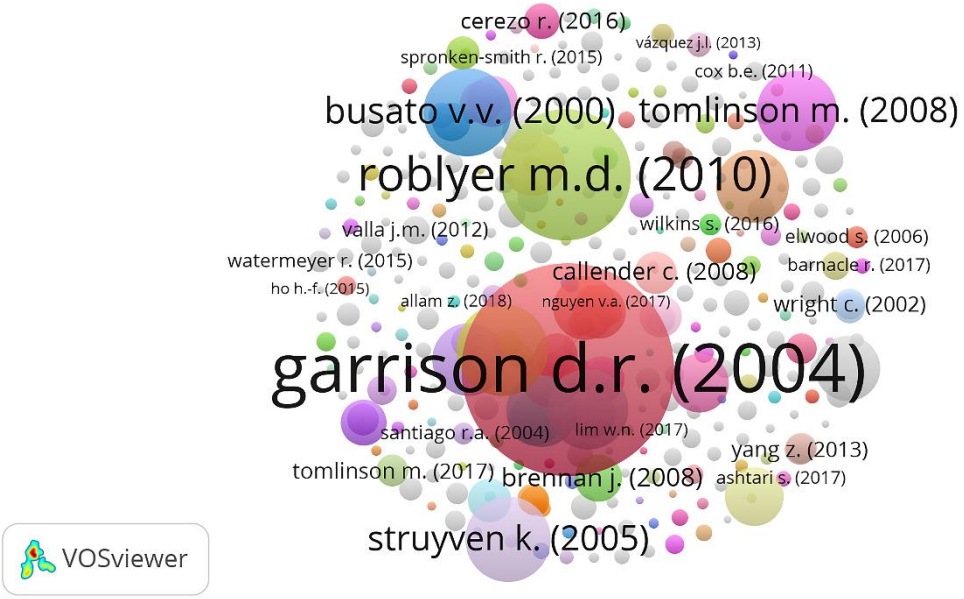
| No. | Articles | GS Cites | Average GS Cites/ Year | GS Cites/ Author | GS Rank |
|---|---|---|---|---|---|
| 1 | Garrison, D., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The Internet and Higher Education*, 7(2), 95–105. https://doi.org/10.1016/j.iheduc.2004.02.001 | 3,801 | 253.4 | 1,901 | 1 |
| 2 | Johnson L., Becker S., Cummins M., Estrada V., Freeman A., & Hall C., (2016). The New Media Consortium. United States. NMC horizon report: 2016 higher education edition: 1-50. Sciepub.com. (2021). http://www.sciepub.com/reference/303571. | 3,129 | 1,043 | 626 | 63 |

| | | | | | |
|---|---|---|---|---|---|
| 3 | Ladson-Billings, G. (2006). From the achievement gap to the education debt: Understanding achievement in U.S. Schools. *Educational Researcher*, *35*(7), 3-12. https://doi.org/10.3102/0013189x035007003 | 2,819 | 216.85 | 2,819 | 443 |
| 4 | Garrison, D. R., & Vaughan, N. D. (2008). Blended learning in higher education: Framework, principles, and guidelines. John Wiley & Sons. http://dx.doi.org/10.1002/9781118269558 | 2,715 | 246.82 | 1,358 | 3 |
| 5 | Graham, C.R. (2006). *Blended learning systems definition, current trends, and future directions*. In Bonk, C.J. and Graham, C.R., Eds., *Handbook of blended learning.* Global Perspectives, Local Designs, Pfeiffer Publishing, San Francisco, 3-21. - References - Scientific Research Publishing. Scirp.org. (2021). https://www.scirp.org/(S(i43dyn45teexjx455qlt3d2q))/reference/ReferencesPapers.aspx?ReferenceID=2143722. | 2,523 | 194.08 | 2,523 | 56 |
| 6 | Gurin, P., Dey, E., Hurtado, S., & Gurin, G. (2002). Diversity and higher education: Theory and impact on educational outcomes. *Harvard Educational Review*, *72*(3), 330-367. https://doi.org/10.17763/haer.72.3.01151786u134n051 | 2,511 | 147.71 | 628 | 644 |
| 7 | Davis-Kean, P. (2005). The influence of parent education and family income on child achievement: The indirect role of parental expectations and the home environment. *Journal of Family Psychology*, *19*(2), 294-304. https://doi.org/10.1037/0893-3200.19.2.294 | 2,483 | 177.36 | 2,483 | 196 |
| 8 | Brubacher, J. S., & Rudy, W. (1997). *Higher education in transition: A history of American colleges and universities*. Transaction Publishers. https://doi.org/10.4324/9780203790076 | 2,235 | 1117.5 | 2,235 | 618 |
| 9 | Kuh, G., Cruce, T., Shoup, R., Kinzie, J., & Gonyea, R. (2008). Unmasking the effects of student engagement on first-year college grades and persistence. *The Journal of Higher Education*, *79*(5), 540-563. https://doi.org/10.1353/jhe.0.0019 | 2,178 | 198 | 436 | 154 |
| 10 | Altbach, P., Reisberg, L., & Rumbley, L. (2010). Tracking a global academic revolution. *Change: The Magazine of Higher Learning*, *42*(2), 30–39. https://doi.org/10.1080/00091381003590845 | 2,067 | 206.7 | 689 | 645 |
| 11 | Kuh, G. (2003). What we're learning about student engagement from NSSE: Benchmarks for effective educational practices. *Change: The Magazine of Higher Learning*, *35*(2), 24–32. https://doi.org/10.1080/00091380309604090 | 2,010 | 125.63 | 2010 | 135 |
| 12 | Carini, R., Kuh, G., & Klein, S. (2006). Student engagement and student learning: Testing the linkages. *Research in Higher Education*, *47*(1), 1–32. https://doi.org/10.1007/s11162-005-8150-9 | 1,912 | 147.08 | 637 | 115 |
| 13 | Kuh, G. (2001). Assessing what really matters to student learning inside the National Survey of Student Engagement. *Change: The Magazine of Higher Learning*, *33*(3), 10–17. https://doi.org/10.1080/00091380109601795 | 1,830 | 101.67 | 1830 | 138 |
| 14 | Goldhaber, D., & Brewer, D. (2000). Does teacher certification matter? High school teacher certification status and student achievement. *Educational Evaluation and Policy Analysis*, *22*(2), 129–145. https://doi.org/10.3102/01623737022002129 | 1,793 | 94.37 | 897 | 729 |
| 15 | Zhao, C., & Kuh, G. (2004). Adding value: Learning communities and student engagement. *Research in Higher Education*, *45*(2), 115–138. https://doi.org/10.1023/b:rihe.0000015692.88534.de | 1,639 | 109.27 | 820 | 84 |
| 16 | Lee, J., & Bowen, N. (2006). Parent involvement, cultural capital, and the achievement gap among elementary school children. *American Educational Research Journal*, *43*(2), 193–218. https://doi.org/10.3102/00028312043002193 | 1,587 | 122.08 | 794 | 791 |
| 17 | Galston, W. (2001). Political knowledge, political engagement, and civic education. *Annual Review of Political Science*, *4*(1), 217–234. https://doi.org/10.1146/annurev.polisci.4.1.217 | 1,541 | 85.61 | 1541 | 432 |
| 18 | Smith, K., Sheppard, S., Johnson, D., & Johnson, R. (2005). Pedagogies of engagement: Classroom-based practices. *Journal of Engineering Education*, *94*(1), 87–101. https://doi.org/10.1002/j.2168-9830.2005.tb00831.x | 1,494 | 106.71 | 374 | 470 |
| 19 | Osguthorpe, R. T., & Graham, C. R. (2003). Blended learning environments: Definitions and directions. *Quarterly Review of Distance Education*, *4*(3), 227–33. https://eric.ed.gov/?id=EJ678078 | 1,449 | 90.56 | 725 | 22 |
| 20 | Braxton, J. M., Hirschy, A. S., & McClendon, S. A. (2011). *Understanding and reducing college student departure.* ASHE-ERIC higher education report. Volume 30, No 3. Jossey-Bass. https://eric.ed.gov/?id=ED501184 | 1,415 | 176.88 | 472 | 779 |

*GS – Google Scholar; NSSE – National Survey of Student Engagement

Citation by documents was analyzed using VOSviewer, with a minimum number of five citations per document as cutoff. Garrison and Kanuka (2004) garnered the

most citations, followed by Roblyer (2010), Tomlinson (2008), Busato (2000), and Struyven (2005).




Minimum number of citations of a document: 5

**Figure 7: Network visualization map of the citations by document**

**Table 14. Summary of findings**

| No. | Analysis | Finding |
|---|---|---|
| 1 | Most common document type | Article |
| 2 | Most common source type | Journal |
| 3 | Year with greatest number of publications | 2018 |
| 4 | Most widely used language | English |
| 5 | Most common subject area | The social sciences |
| 6 | Most active journal | *Studies in Higher Education* |
| 7 | Most influential institution | Monash University |
| 8 | Keyword most frequently used* | Higher education |
| 9 | Country producing the most publications | United States |
| 10 | Authors per document (Most) | Two authors |
| 11 | Most active author(s) | Kinchin, I., Hosein, A., Medland, E., Lygo-Baker, S., Warburton, Gash, D., Rees, R., Loughlin, C., Woods, R., Price, S., Usherwood, S. |
| 12 | Co-authorship by authors | Donche, V., De Maeyer, S., Coertjens, L., van Daal, T., & van Petegem, P. |
| 13 | Hirsch h-index/Egghe g-index | 45/92 |
| 14 | Highest GS cites and GS rank | Garrison & Kanuka (2016) |

*Keywords considered: blended learning; perception; achievement; engagement, higher education

## 5. Discussion

Document type and source type were used as indicators in this bibliometric analysis of publications in a particular period, as suggested by Sigogneau (2000). It is clear from the findings that most of the document types in this study were articles, which is similar to findings by Yang et al. (2017) and Halverson (2012), followed by conference papers and book chapters. Journals made up the highest percentage of source types, followed by books and conference proceedings.

Research productivity analysis found that publications have proliferated rapidly and attracted greater research interest, especially between 2016 and 2018. This is confirmed by Güzer and Caner (2014) and Cheng et al. (2014), who cite similar trends in their research findings. This finding is important for further research into ways educators and administrators could organize learning environments to support effective learning using BL. In addition, the results of this study show that the English language, as the international language for scientific publication, is the most frequently used language in the Scopus database over the timespan of this study (Ferguson et al., 2011; Sweileh et al., 2017).

As BL is a field in the social sciences, it is not surprising that more than half of all publications are from this subject area. However, there is still a shortage of quantitative studies in BL. Therefore, the results of this research represents a step forward, towards developing empirical studies (Gemin & Pape, 2017; Heafner & Handler, 2018; Stevens et al., 2018; Raman & Rathakrishnan, 2019). In addition, evidence from this study suggests that the most active journal at the forefront of BL thematic analysis is *Studies in Higher Education*,[1] a prominent, global, journal-publishing, research-based journal.

Author keyword analysis and network visualization of co-occurrences suggest that the most widely used keywords were higher education and blended learning. However, few research studies mention perception, engagement, and achievement. Further investigations are required to analyze BL trends concerning student achievement, perception, and engagement. The United States was the country that contributed the greatest number of publications, which is confirmed by the study of Yang et al. (2017). In addition, Monash University, Australia, was the institution associated with the greatest number of documents published on blended learning. The findings of this research support research by Halverson et al. (2012), who found that Garrison and Manuka are authors with the most Google Scholar citations.

Results of a bibliometric analysis may vary according to the database used (e.g., Web of Science or Google Scholar), and the inclusion of other search terms (e.g., e-learning). Some highly cited articles on topics related to BL were published in certain journals (e.g., PLoS ONE, PNAS) that did not contain the particular keywords of this study. Thus, to demonstrate the keywords network, this study analyzed only documents with obtainable author keywords. Furthermore, a citation threshold of fewer than 200 citations was chosen to determine highly cited articles which were published between 2000 and the end of 2019, with the majority

[1] https://www.tandfonline.com/loi/cshe20

being published between 2006 and 2018. Thus, all analysis, discussions, and conclusions offered in this study were interpreted within the framework of these limitations.

Although Scopus comprises a large number of journals, it is limited to recent articles, and articles of lesser impact (Chadegani et al., 2013); therefore, exploration of other scientific databases, such as Web of Science, is recommended to access more peer-reviewed articles, which could be investigated to increase the scalability of the approach further. Other search keyword combinations should be tried, in order to obtain a wider range of publications and up-to-date citations of BL in higher education. It is also recommended that bibliometric analysis is carried out together with systematic literature reviews, for more in-depth research on existing literature. A further recommendation is to use visualization tools such as HistCite.

## 6. Conclusion

BL in higher education is an undoubtedly emerging and increasingly exploited method of instruction in the new millennium. This analysis contributes to the body of knowledge by presenting the results of an investigation into scholarly networks and worldwide research trends on BE in higher education, more precisely, on the aspects of perception, achievement, and engagement from 2000 to 2019. In referring to 1,064 highly cited research articles retrieved from the Scopus database, this investigation gathered bibliometric information related to publication outputs, journals, author keywords, countries, institutions, and authors. The investigation into the visibility of work on BL published in highly cited journals in the past two decades reveals that BL has gained significant attention among educators and researchers. The findings of this bibliometric analysis can become the basis of and a pivotal platform for spurring further research in BL, and can promote its significant prevalence in the higher education context, both locally and globally. This is the first wide-ranging study about BL, perception, achievement, and engagement in higher education. It can serve as a starting point for further analysis of other variables that affect the BL approach.

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