BLENDED LEARNING IN HIGHER EDUCATION: A BIBLIOMETRIC ANALYSIS

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ABSTRACT

This research aims to analyze the past literature on blended learning in higher education and investigate the research trends on this subject. Thus, it aims to present a roadmap for future studies. In this context, bibliometric and descriptive analysis methods were used in the study carried out with the descriptive survey model. 1970 studies were accessed using the Web of Science (WoS) database to reach the data within the scope of the research. As a result of the filtering process on the database, the distribution of the relevant publications by year, document type, publication language, country and WoS indexes, the most influential institutions and research, cooperation between institutions and countries, the most cited authors, and the most studied topics were reviewed. According to the research results, the studies on blended learning in higher education were primarily published in the form of articles in English between the years 2002-2021. It is also deduced that Spain stands out, especially in producing publications, and these studies are generally published in the Conference Proceedings Citation Index - Social Science & Humanities (CPCI-SSH) index type. The most active journal with high citation density is Computers & Education, and the country that collaborates most is England. Regarding the keywords used in the articles, while the concepts of online learning, higher education, and student participation are prominent in the studies conducted in the first years, the concepts such as flipped classrooms, Edmodo, sustainability, gamification, mobile learning, and emotions came to the fore in the following years. In this context, discussions were conducted within the framework of the literature, and suggestions were made related to the findings obtained.

Keywords: Blended learning, bibliometric analyses, higher education, bibliometric mapping.

INTRODUCTION

The transformation and development processes of learning and teaching processes continue in online environments in line with the needs of the age. It is a fact that changing technologies and applications in online learning environments make the education process more dynamic. This fact highlights the necessity of teachers to understand the changing needs of students under these conditions and use appropriate teaching methods (Alharthi & Zhang, 2021; Azizan, 2010; Duman, 2023; Gambo & Shakir, 2022; Hartono & Ozturk, 2022). Thus, learner-centered online teaching methods have diversified, and different learning practices have been developed.

With the increase in online learning applications, the accessibility of learning content has led to the emergence of different models in learning environments. Instructors use blended learning as one of these models through different applications (Bates, 2015). These applications are carried out by sending online assignments to support teaching in the classroom environment or carrying the course content to the classroom environment with a technological presentation or video tool. However, blended learning is used in different ways, some of which are conducted in the online environment, while others are conducted in the classroom environment with traditional methods. In this context, blended learning offers the potential to benefit from the advantages of online and traditional learning environments. Providing the right blending in the pedagogical, technological, and social context in the use of blended learning methods in different environments results in increased functionality and flexibility (Bozkurt & Sharma, 2021). This can be interpreted as the fact that blended learning requires the responsibility of developing blended strategies in the conduct of teaching methods and activities, as well as providing flexibility in the choice of environment.

The need for flexibility of students in higher education the effort of teaching staff to use teaching methods appropriate to the diversity of learners (Boelens et al., 2018) are among the reasons why blended learning models are used. Besides, this type of learning is preferred in terms of its potential to provide learning experiences to learners in various environments and its positive effect on learner performance and achievement (Graham et al., 2005; Ndibalema, 2021; Vo et al., 2020). Especially in higher education, learning models and applications blended with the prolongation of the COVID-19 epidemic process is in high demand. Realizing the potential of blended learning in higher education requires further studies of applications and the development of teaching staff in this regard, and a holistic understanding of these studies. In this sense, this research aims to examine the studies conducted in the field of blended learning with a current approach from a broad perspective using the bibliometric analysis method.

LITERATURE

Blended Learning

Blended learning is one of the fundamental innovative methods that emerged due to the increase in online learning experiences and the use of current technologies in classroom environments. It comes with varied definitions in the literature (Abass et al., 2021; Alammary et al., 2014; Dankers et al., 2022; Faridah et al., 2022; Gault & Cuevas, 2022; Hrastinski, 2019; Osguthorpe & Graham, 2003). One of the most common definitions was made by Graham (2006): "Blended learning systems combine face-to-face instruction with computer-mediated instruction" (p. 5). According to Rossett (2002), blended learning uses more than one education method together to increase the teaching quality. According to another definition, it is the use of different education methods in a traditional learning environment as well as the technologies used (Singh, 2003). The overall consideration of the definitions suggests the basic components of blended learning are face-to-face and online education. However, despite the existing definitions, some researchers argue that there is uncertainty regarding the term blended learning (Driscoll, 2002; Oliver & Trigwell, 2005).

Blended learning is the combination of face-to-face and online teaching through a deliberate design that serves the purpose of supporting learning (Assylzhanova et al., 2022; Boelens et al., 2015; Drysdale et al., 2013; Nurhayati et al., 2021; Ojaleye & Awofala, 2018; Seage & Turegun, 2020; Thompson & McDowell, 2019). This unification takes place through the blending of learning environments, online learning tools, and presentation methods (Bonk & Graham, 2012). Blended learning can also be regarded as an educational approach that bonds various models of traditional and distance education and makes use of all kinds of technology.

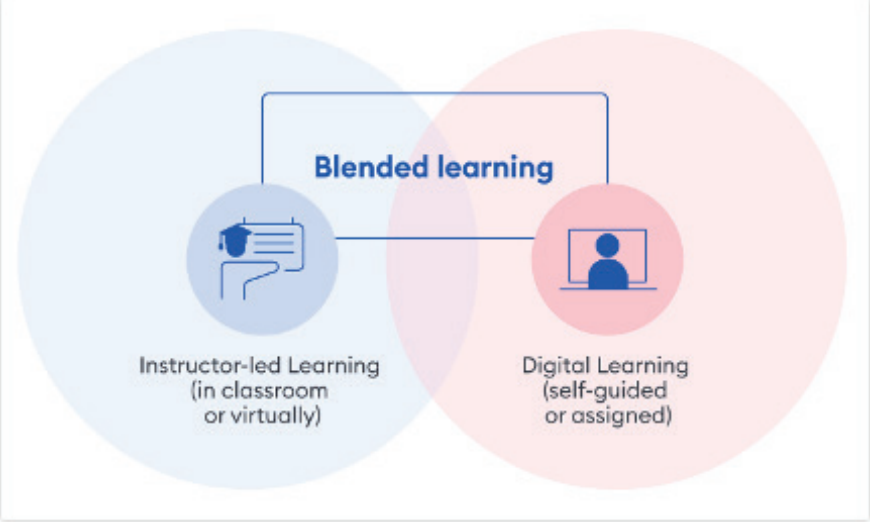

Figure 1. Blended learning (Kokoulina, 2021)

During the blending process, 30% to 79% of the course content is presented online (Allen et al., 2007). In this context, blended learning aims to support the quality of learning by carrying the advantages of face-to-face and online environments into learning processes.

Blended Learning Models

There are different applications in the design process of blended learning content presented in various environments, in what order and how, depending on the teaching purposes (Bryan & Volchenkova, 2016). This situation brings certain classification efforts and highlights blended learning models. Table 1 presents the classification methods for blended learning models.

Table 1. Classification Forms of Blended Learning Models

Valiathan	Rossett & Frazee	Horn & Staker	Staker & Horn	Hannon & Macken
2002	2006	2011	2012	2014
Skill driven model	Anchor blend	Face-to-face driver	Rotation model - Station-Rotation model - Lab-Rotation model - Flipped-Classroom model - Individual-Rotation model	Blended presentation and interaction
Attitude driven model	Booked Blend Model	Online Laboratory Model	Flex model	Blended block mode
Competency driven model	Field Blend	Rotation model	Self-Blend model	Predominantly online
		Flex model	Enriched virtual model	
		Self-Blend model		
		Online driver model		

Valiathan (2002) discusses blended learning models in three groups.

1. Skill-driven model
2. Attitude-driven model
3. Competency-driven model

Through these models, this learning method aims to help learners acquire skills suitable for their pace, change behavior and attitude, and learn through interaction (by observing an expert at work). For these purposes, online and face-to-face activities are used. The model proposed by Rossett and Frazee (2006), on the other hand, is mainly focused on the programs that offer training for competence. This model includes classroom activities enriched with workplace experience and online learning.

Horn and Staker (2011) first discussed blended learning with six different classifications. Their very recent study removed the face-to-face learning and online laboratory categories and rearranged the classification to accommodate diversity (Staker & Horn, 2012). Thus, the following models emerged.

1. In the *flex model*, learning content is basically offered online. Thus, in a customized and adaptable program, the student can deliver homework and content in any environment.
2. In the *self-blend model*, some courses are taken entirely online to complement face-to-face teacher-taught lessons.
3. In *rotation* models, education takes place in a face-to-face school, while lessons are supported by online content and activities. These models include enriched learning, online activity, and face-to-face activities.

In the models proposed by Hannon and Macken (2014), the use of face-to-face activities consisting of individual and group activities together with online work and collaborative activities is significant. The consideration of the classification types of blended learning models indicates that the understanding of blending in course design changes by the purpose and pedagogy of learning, teaching mode, and environments.

Benefits and Challenges of Blended Learning

Although the blended use of online and face-to-face learning activities in the blended learning process looks simple and easy, effective blended learning is only possible with the design of learning experiences and their suitability for the process (Garrison & Kanuka, 2004; Garrison & Vaughan, 2013; Ghimire, 2022; Mursid et al., 2022; Namyssova et al., 2019). The advantages and disadvantages of a blended learning process designed in this way are shown in Table 2.

Table 2. The Benefits and Challenges of the Blended Learning

Benefits	(Singh & Reed, 2001; Osguthorpe & Graham 2003; Esfandiari, 2005; Posner, 2005; Wilson & Smilanich, 2005; Oh & Park, 2009)	- Time and cost-efficient - Ease of access to the course and course content, - Individual and active learning - Communication skills - Effective and easy teaching applications, - Supporting individual differences such as learning speed, - Flexibility - Positive results on achievement, motivation interaction, and feedback.
Challenges	(Arabasz & Baker, 2003; Koohang et al., 2006)	- The necessity of providing time, education, and resource qualifications for the integration of activities and course contents in accordance with blended learning, - Internet speed bandwidth problems, - High costs, - Problems caused by software and hardware.

Although blended learning has uncertainties in terms of costs and outcomes (Horn & Staker, 2011), research shows that blended learning contributes positively to learning performance (Graham et al., 2005; Hebebci & Usta, 2015). In the lessons in which the blended learning method is used, the continuous availability of content and materials, allocating more time to activities, the use of social networks, interaction, and participation rates are the factors that increase learner achievement (Bozkurt, 2018; Francis & Shannon,

2013; Means et al., 2009). Nevertheless, one of the factors that prevent the positive outcome of the blended learning process is that the content for learners includes the obligation to use, and the preferences for the presentation of the content are not taken into account (Ash, 2012). Nevertheless, the quality blended learning process is expected to be sensitive to the individual learners' needs. Additionally, integrating the potential of technological tools with the instructors' skills for meaningful learning experiences in digital transformation processes is among the meaningful expectations (Azizan, 2010; Bruggeman et al., 2021; Kir, 2020). In addition to this integration, which is valid for the course environment, studies show that blended learning needs institutional transition strategies to be implemented (Graham et al., 2013). In this context, it requires institutional decision-makers to develop strategies, instructors to develop digital skills, and learners to participate in the process by accessing content and resources.

Significance of the Research

Studies on blended learning mostly focus on learners' perspectives and experiences, and the number of studies on academic applications is limited (Torrisi-Steel & Drew, 2013). The literature review reflects an urgent need to define blended learning and understand its applications. However, the changing structure of both learners and learning environments and the experiences in online learning during the COVID-19 epidemic boldly underlines the use of the blended learning model, and such cases show that the tendency of preferring this model in the future is high (Becker et al., 2017; Bozkurt et al., 2020; Pelletier et al., 2021). Besides, the increasing interest in this subject in higher education and the announcement of many universities that they have switched to the blended learning model also reveals the necessity of examining the studies on the subject.

When the literature is examined, it is seen that there is a limited number of studies examining blended learning tendencies in higher education. What distinguishes this study from other bibliometric analysis studies on blended learning (Brown, 2015; Omar et al., 2021; Raman et al., 2021; Yang et al., 2017) is that it focuses on higher education and is based on Clarivate Analytics' Web of Science Core Collection (WoS) data. Considering the year 2020 and after, when the importance of distance education is felt intensely, the bibliometric research prepared in this context should be increased in terms of quality and quantity. In addition, these studies are of great importance in terms of identifying gaps in the literature, contributing to the literature, and guiding future research.

Objective of the Research

The objective of this research is to determine the trend of publications on blended learning in higher education in various perspectives to systematically identify the increasing interest in blended learning in recent years. In this context, answers to the following research questions were sought.

Research Questions

1. What is the distribution of publications on blended learning by year, document type, publication language, country, and WoS indexes?
2. What are the most influential (most-cited) resources, institutions, and researches in the field of blended learning?
3. What kind of cooperation exists between institutions and countries in the field of blended learning?
4. What kind of relationship is there between the most cited authors in the field of blended learning?
5. What is the relationship between the most studied topics in the field of blended learning?

METHOD

This research aims to examine the trends of blended learning studies in higher education by designing in descriptive survey model. In this context, bibliometric and descriptive analysis methods were used to analyze academic studies in blended learning.

Bibliometric analysis, a type of analysis that evaluates the development, scientific quality, impact of studies, and resources on any subject, has recently been used by researchers in different fields frequently (Okhovati & Arshadi, 2021; Hebebci, 2021; Hebebci & Alan, 2021; Kushairi & Ahmi, 2021; Miskiewicz, 2020). Although bibliometric analysis studies cannot replace literature reviews, they have a crucial complementary factor (Talan, 2021). In the descriptive analysis approach, the data obtained are summarized and interpreted according to the previously determined themes (Yildirim & ***Simsek***, 2011). There are two main purposes in bibliometric research: performance analysis and scientific mapping (Cobo et al., 2011; Gutierrez-Salcedo et al., 2018). While performance analysis expresses the scientific publication performance of institutions, authors, and countries, scientific mapping reveals the dynamics and structure of the scientific field through visualization methods (Cobo et al., 2011; Tang et al., 2018).

Data Collection

WoS, Scopus, Google Scholar, PubMed, and MEDLINE databases are among the most prominent in the international context. The literature also suggests that bibliometric studies are generally based on international indexes such as WoS and Scopus. The data of this research was provided through WoS. This index includes bibliometric data on the most comprehensive publications in the sciences, social sciences, and humanities (Aghaei-Chadegani et al., 2013).

The data collection process was carried out through the detailed search tab on WoS with research-oriented keywords. In this context, the criteria used in the filtering process to obtain the documents are shown in Table 3.

Table 3. Search Strategies

Topic	TS=(("blended learn*" or "blended teach*" or "hybrid learn*" or "hybrid teach*" or "blended edu*" or "hybrid edu*") and ("higher edu*"))
Documents Type	Article, Proceedings Papers, Book, Book Chapter, Early Access, Review, Book Review, Editorial Material
Time Span	All years
Indexes	SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI

As a result of the last inquiry, 1970 studies were evaluated within the scope of research (October 2021). As a result of the query, some bibliographic data of these publications (publication years, publication types, publication languages, titles, author names, authors' countries, institutions, number of citations, abstract, keywords, and references) were obtained. No restrictions were made regarding the year, document type, WoS index, and publication language. The roadmap for the research process is shown in Figure 2.

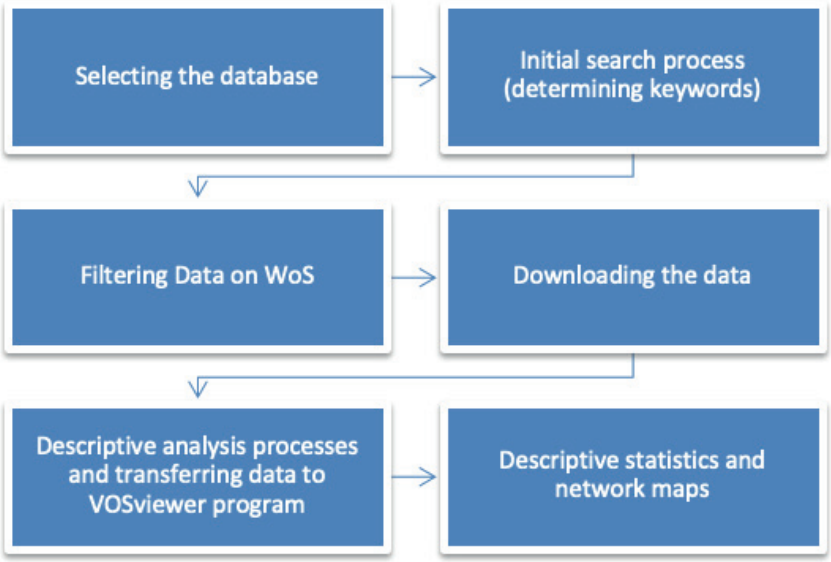

Figure 2. Research Process

Data Analysis

This study used bibliometric and descriptive analysis methods in the data analysis process. The descriptive analysis method was used to analyze the articles based on year, country, journal, and publication language. With regards to the bibliometric analysis, citation analyzes (journal, article, country), co-authorship analyses (countries), co-occurrence analyses (author keywords), and co-citation analyzes (journal) techniques were used.

WoS's analysis system and Microsoft Office software were used during the descriptive analysis processes. Publication year, publication type, WoS category/index, research area, country, and language items were analyzed in this context. VOSviewer 1.6.16 package software was used for bibliometric analysis and visualization. Van Eck and Waltman (2013) developed this free software in Java programming language (see www.vosviewer.com) to visualize and explore maps based on network data. The analysis of the 1970 studies was based on the full calculation method (Van Eck & Waltman, 2010).

FINDINGS

Descriptive Findings

Distribution of Publications by Year

In this study, firstly, the distribution of studies published in the WoS database by year was examined. The obtained results are shown in Figure 3.

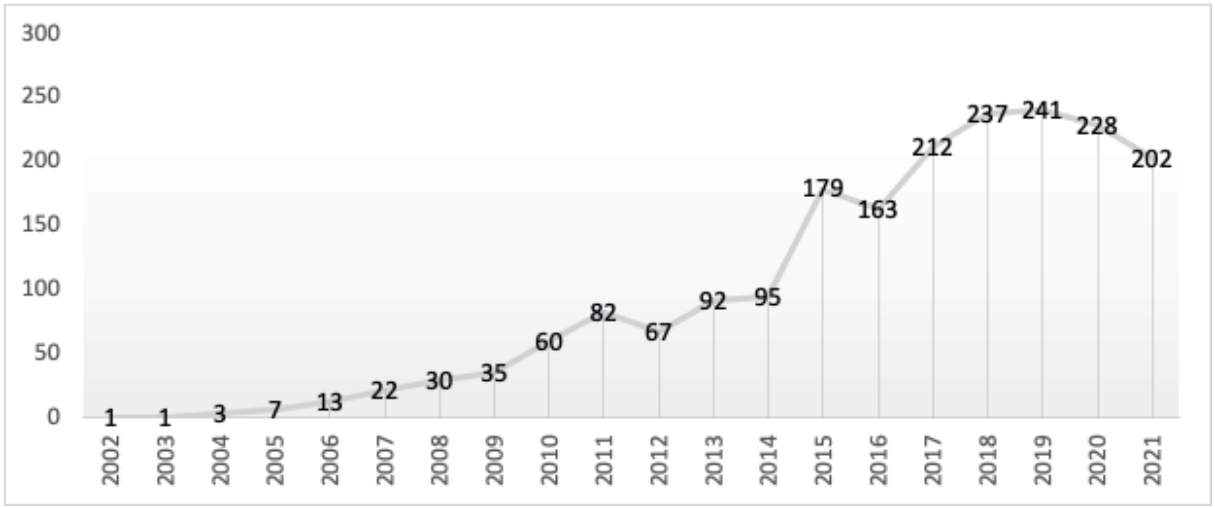

Figure 3. Distribution of Publications by Year

Figure 3 indicates that studies on blended learning in higher education were mainly conducted between 2002 and 2020. The studies generally tend to increase in number. However, it is notable that there is a decline between 2011-2012, 2015-2016, and 2019-2020. It is not possible to make a definite comment about the number of studies in 2021 since it is the year this research was conducted. However, considering the COVID-19 epidemic period, it is thought that studies in this direction will increase even more during the normalization process. Besides, the number of studies on this field has been relatively high since 2016.

Distribution of Publications by Document Type and Language

The distribution of the publications considered within the scope of the research by document type is given in Table 4.

Table 4. Distribution of Publications by Document Type

Document Type	f	%
Article	986	50
Full-text paper	939	47.6
Book chapter	56	2.8
Early access	50	2.5
Compilation	37	1.8
Others (Book, letter, etc.)	16	0.8

Table 4 points out that the studies on the subject in the WoS database are published by different document types. It is noteworthy that most of the studies (approximately 97%) examined between 2002 and 2021 were articles and full-text papers. This finding shows that academic journals and conferences on this research topic are pretty active and productive.

The distribution of publications by language is shown in Figure 4.

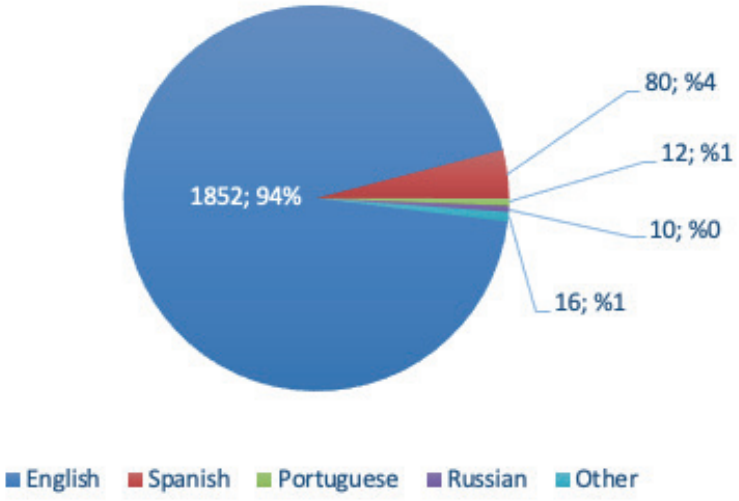

Figure 4. Distribution of Publications by Language

Examining the studies by written language shows that English (f=1852; 94%) is well ahead, followed by Spanish (n=80; 4%), Portuguese (n=12; 1%) and other languages (n=26; 1%).

Distribution of Publications by Country

The distribution of the publications on the research subject by country was examined. All countries with at least one publication were included in the review. The top 10 countries with the most publications are shown in Figure 5.

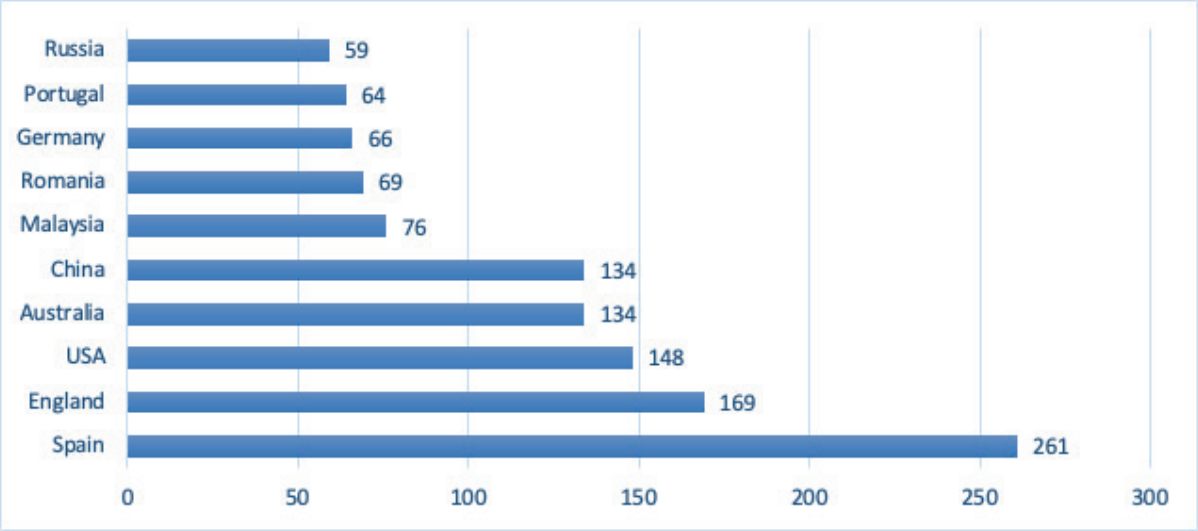

Figure 5. Distribution of Publications by Country

The distribution of publications by country demonstrates that Spain is first with 261 publications, followed by England with 169 publications, and the USA with 148 publications. Besides, Australia (n=134), China (n=134), Malaysia (n=76), and other countries are the ones that succeed the first three.

Distribution of Publications by WoS Indexes

The distribution of the publications within the scope of the research by WoS indexes is shown in Figure 6.

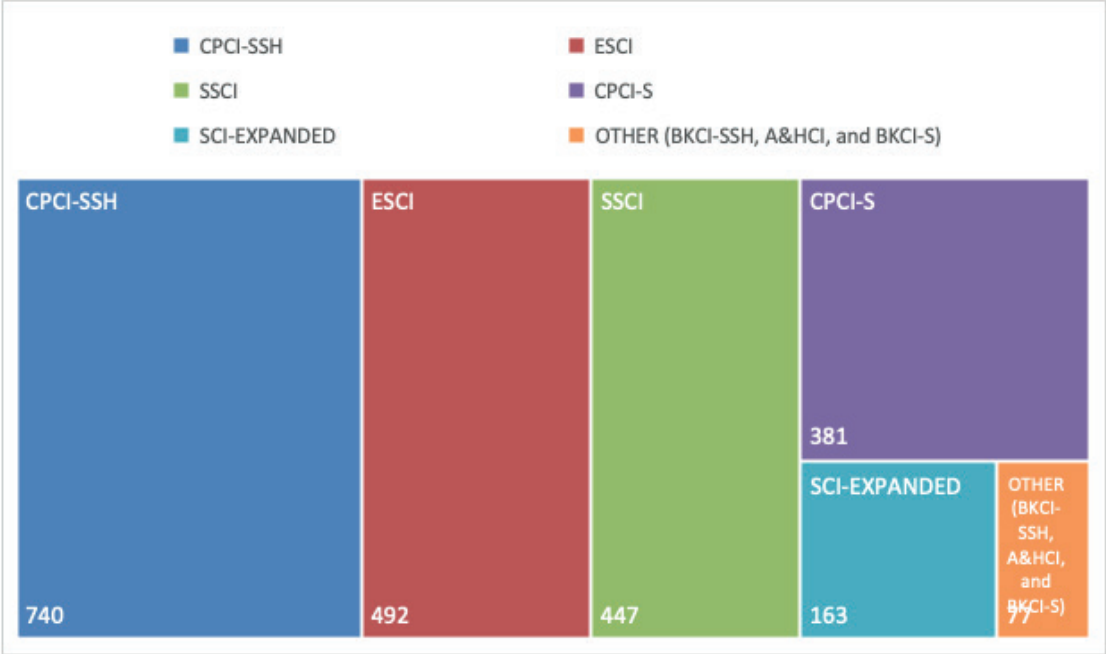

Figure 6. Distribution of Publications by WoS Indexes

Figure 6 shows that Conference Proceedings Citation Index – Social Science & Humanities (CPCI-SSH) has the highest number of publications with 740 based on the WoS indexes, followed by Emerging Sources Citation Index (ESCI) with 492 publications, Social Sciences Citation Index (SSCI) with 447 publications, and Conference Proceedings Citation Index – Science (CPCI-S) with 381 publications.

Citation Analysis (Research, Institution, and Source)

Citation analysis enables the most cited works, authors, countries, or sources to be revealed. In this type of analysis, citations are used as an impact measure (Zupic & Cater, 2015).

Most Cited Studies

Within the scope of the research, the 10 most cited studies in the literature and their details are shown in Table 5.

Table 5. Top 10 Most Cited Studies

Title of the study	Author(s)	Year	Source	Number of citations
Online formative assessment in higher education: A review of the literature	Gikandi et al.	2011	Computers & Education	358
The Effectiveness of Online and Blended Learning: A Meta-Analysis of the Empirical Literature	Means et al.	2013	Teachers college record	305
Blended learning in higher education: Students' perceptions and their relation to outcomes	Lopez-Perez, M. V., Perez-Lopez, M. C., & Rodriguez-Ariza, L.	2011	Computers & Education	300
A framework for institutional adoption and implementation of blended learning in higher education	Graham, C. R., Woodfield, W., & Harrison, J. B.	2013	The Internet and Higher Education	210
A meta-analysis of blended learning and technology use in higher education: from the general to the applied	Bernard, R. M., Borokhovski, E., Schmid, R. F., Tamim, R. M., & Abrami, P. C.	2014	Journal of Computing in Higher Education	185
Blended learning in higher education: Institutional adoption and implementation	Porter, W. W., Graham, C. R., Spring, K. A., & Welch, K. R.	2014	Computers & Education	172
Sustainability in higher education in the context of the UN DESD: a review of learning and institutionalization processes	Wals	168	Journal of Cleaner Production	168
The impact of a flipped classroom design on learning performance in higher education: Looking for the best "blend" of lectures and guiding questions with feedback	Thai, N. T. T., De Wever, B., & Valcke, M.	2017	Computers & Education	153
Student perceptions and achievement in a university blended learning strategic initiative	Owston, R., York, D., & Murtha, S.	2013	The Internet and Higher Education	148
Personalising learning: Exploring student and teacher perceptions about flexible learning and assessment in a flipped university course	Wanner, T., & Palmer, E.	2015	Computers & Education	144

Table 5 gives information about the authors of the most cited studies on WoS, the year of publication, the source, and the number of citations. In this context, the most cited study is Gikandi et al. (2011) with 358 citations, followed by Means et al. (2013) with 305 citations, Lopez-Perez et al. (2011) with 300 citations, and Graham et al. (2013) with 210 citations.

Distribution of Most Cited Institutions

The results of the citation analysis regarding the institutions of the researchers who published the publications are shown in Table 6.

Table 6. Top 10 Most Cited Institutions

Institution	Country	Number of Publications	Number of Citations	Connection Strength	Citations Per Publication
Brigham Young University	USA	9	716	391	79.5
University of Canterbury	New Zealand	3	361	43	120.3
Pwani University College	Kenya	1	358	41	358
University of Granada	Spain	13	328	28	25.2
Ghent University	Belgium	8	289	62	36.1
The University of Adelaide	Australia	2	267	44	133.5
Deakin University	Australia	14	239	71	17
Vrije University Brussel	Belgium	17	204	129	12
Zayed University	UAE	3	198	128	66
Concordia University	Canada	2	198	119	99

Table 6 shows that "Brigham Young University" (n=716) is far ahead in terms of the number of citations. This institution is followed by "The University of Canterbury" (n=361), "Pwani University College" (n=358), and "The University of Granada" (n=328). It is notable that "The University of Adelaide" (n=133.3) and "The University of Canterbury" (n=120.3) are leading in the number of citations per publication. The table also reflects that the institutions in the top 10 are mainly located in different countries.

In terms of the number of publications of the institutions, it was revealed that the University of Salamanca (n=18), Vrije University Brussel (n=17), and the University of Malaya (n=15) have a large number of studies.

Distribution of Publications by Source

For the research objectives, sources (journal, full-text book) were examined in terms of the number of publications, the number of citations, the strength of connection, and the number of citations per research. In this context, the 10 most cited sources are shown in Table 7. Total link strength shows the total strength of an item's links with other items (Van Eck & Waltman, 2013).

Table 7. Top 10 Most Cited Sources

Source	Number of Publications	Number of Citations	Connection Strength	Citations Per Publication
Computers & Education	18	1687	206	93.7
Internet and Higher Education	21	1157	297	55
British Journal of Educational Technology	16	443	80	27.6
Australasian Journal of Educational Technology	14	352	80	25.1
Teachers College Record	1	305	0	305
International Journal of Educational Technology in Higher Education	15	292	41	19.4
Computers in Human Behavior	7	279	30	39.8
Journal of Computer Assisted Learning	8	267	29	33.3
Higher Education Research & Development	23	236	69	10.2
Journal of Computing in Higher Education	8	232	81	29

In terms of the journals examined regarding the number of citations, "Computers & Education" (n=1687) and "Internet and Higher Education" (n=1157) are far ahead of other journals.

When the number of citations per publication is analyzed, "Teachers College Record" is ahead with 305 citations. However, this journal has only one article on the relevant subject. When this journal is excluded from the scope, it is noteworthy that the journals titled "Computers & Education" (n=93.7), "Internet and Higher Education" (n=55), and "Computers in Human Behavior" (n=39.8) lead.

Table 7 expresses that all 10 most cited sources are international journals. Although there are similar numbers of full-text papers (n=939) and articles (n=986), it is remarkable that the number of citations of journals is higher.

Co-Authorship Analysis (Institution and Country)

Co-authorship analysis provides an overall picture of the authors, institutions, or countries that are linked in the authorship share of academic work. Co-authorship of technical research refers to the involvement of two or more authors or organizations (Newman, 2004).

Co-Authorship Analysis for Institutions

The co-authorship relations of the authors through their institutions were analyzed with regard to the research context. In the bibliometric analysis carried out in this context, "Co-authorship" was chosen as the analysis type and "Institutions" as the unit. Institutions with at least 3 academic studies on the research subject were included in the analysis process. In the analysis, the connections of the institutions and the total connection strength were calculated. The circle size is proportional to the number of publications, while the thickness of the lines is proportional to the frequency of cooperation and connection strength. The institutions related to each other as a result of the co-authorship analysis are shown in Figure 7.

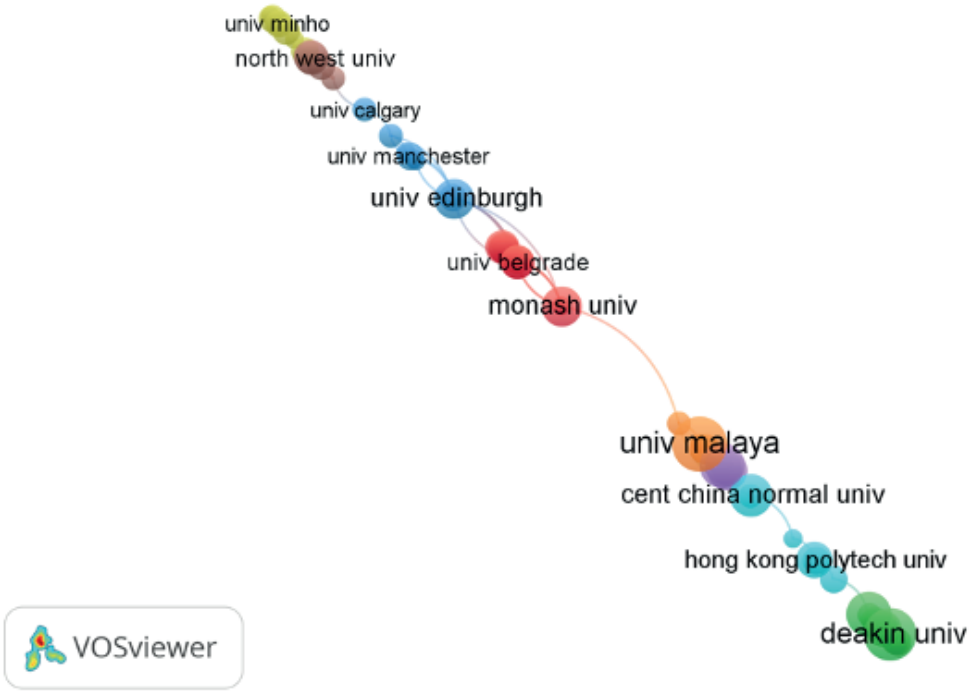

Figure 7. Co-Authorship Analysis for Institutions

As a result of the co-authorship analysis, the most collaborating institutions were found to be the University of Edinburgh (n=12), Pontificia Universidad Catolica de Chile (n=8), Monash University (n=8), and Paul Sabatier University (n=7).

Co-Authorship Analysis for Countries

Within the research scope, the authors' co-authorship relations over their countries were examined. In the analysis performed in this context, "Co-authorship" was chosen as the analysis type, and "Countries" was chosen as the unit. Institutions with at least 1 academic study on the research subject were included in the analysis process. The density map of the institutions that are related to each other as a result of the co-authorship analysis is shown in Figure 8.

When the countries of the co-authors are examined, it is seen that England co-authors with 32 countries, the USA with 26 countries, Spain with 25 countries, Malaysia with 21 countries, Germany with 20 countries, Australia with 20 countries, and France with 18 countries. When evaluated in terms of connection strength, there is a high connection strength between the USA and Spain (n=8), Spain and Chile (n=7), China and the USA (n=6), and England and Scotland (n=5).

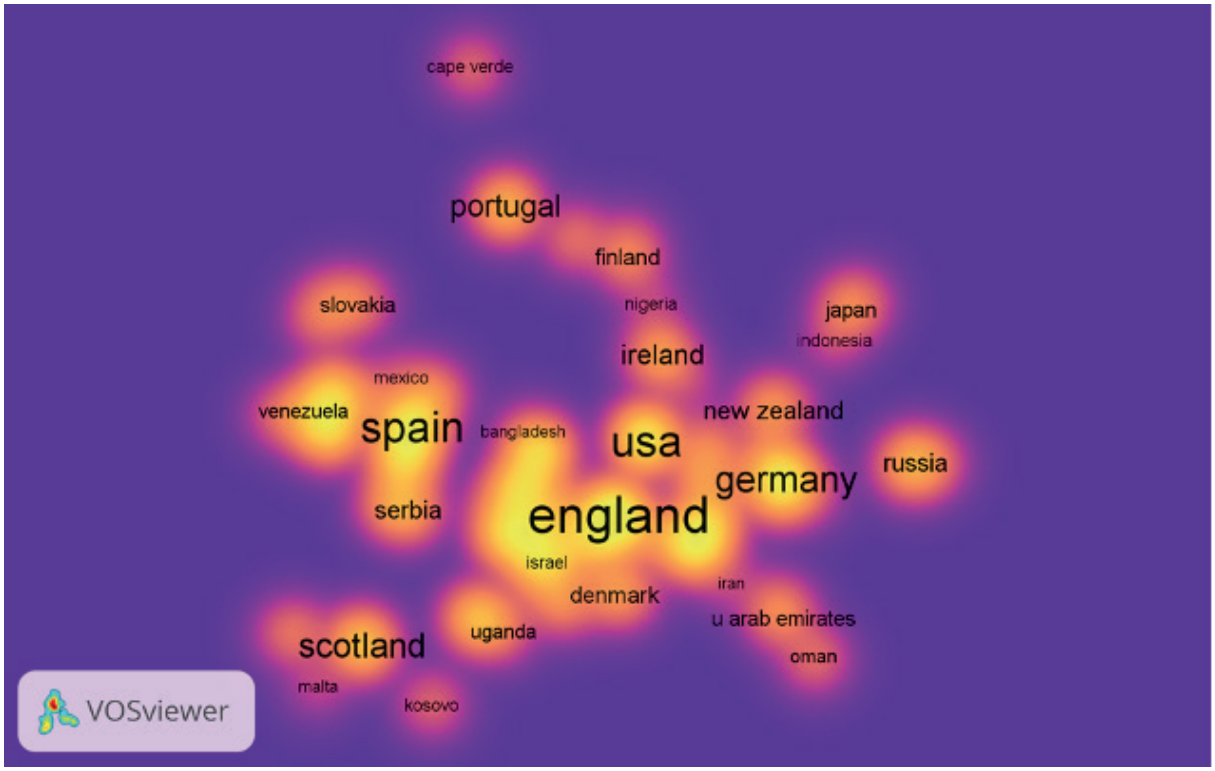

Figure 8. Co-Authorship Analysis for Countries

Co-Citation Analysis (Author)

Co-citation analysis is based on quantifying the relationship between co-cited studies, assuming that more frequently, co-cited studies exhibit greater co-citation strength (Small, 1973). Hence, this analysis was performed to reveal the most cited authors. For analysis, "Co-citation" was chosen as the analysis type, and "cited authors" was selected as the unit. Authors with at least 10 citations on the subject were included in the analysis process. The network structure showing the co-citation analyzes of the publications is shown in Figure 9.

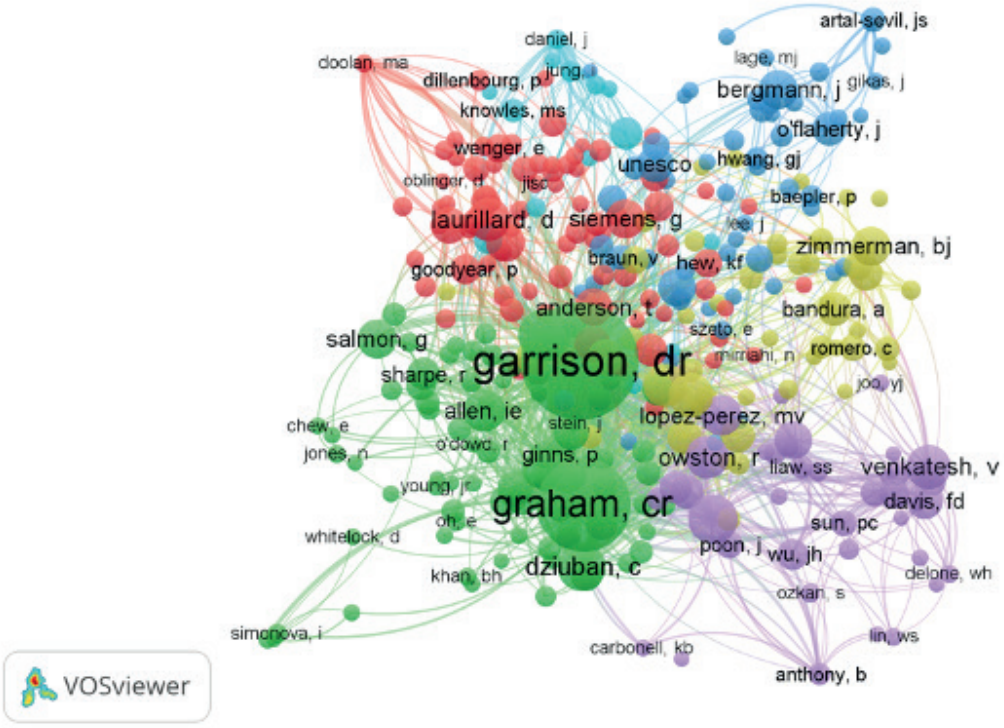

Figure 9. Co-Citation Analysis of Authors

Figure 9 indicates that the authors are categorized under different clusters. Elements that are close to each other form clusters. Large circles reflect that cited publications dominate the others. The circles in the center of the clusters indicate that it is quoted from different areas and has more detailed links to other clusters. Garrison, D. R. (578), Graham, C. R. (385), Bonk, C. J. (131), Porter, W. W. (117), and Dziuban, C. (111) are the most cited authors with more links to other clusters.

Co-Occurrence Analysis

Thanks to the co-occurrence analysis, the strength of the relationship between the words is determined, and the general trends towards a specific field are revealed (Ozturk, 2021). This analysis was carried out to analyze the most used keywords within the scope of the research. In this context, "co-occurrence" was chosen as the analysis type, and "Author keywords" were chosen as the unit. Among the 3552 terms used in the keywords section of 1700 documents obtained from the analysis, 402 keywords that were repeated at least 3 times were identified. The network structure for the relationships between keywords is shown in Figure 10. The size of the circles in the image represents the frequency of using the keywords, and the color of the circles represents the publication years of the studies in which the words were used.

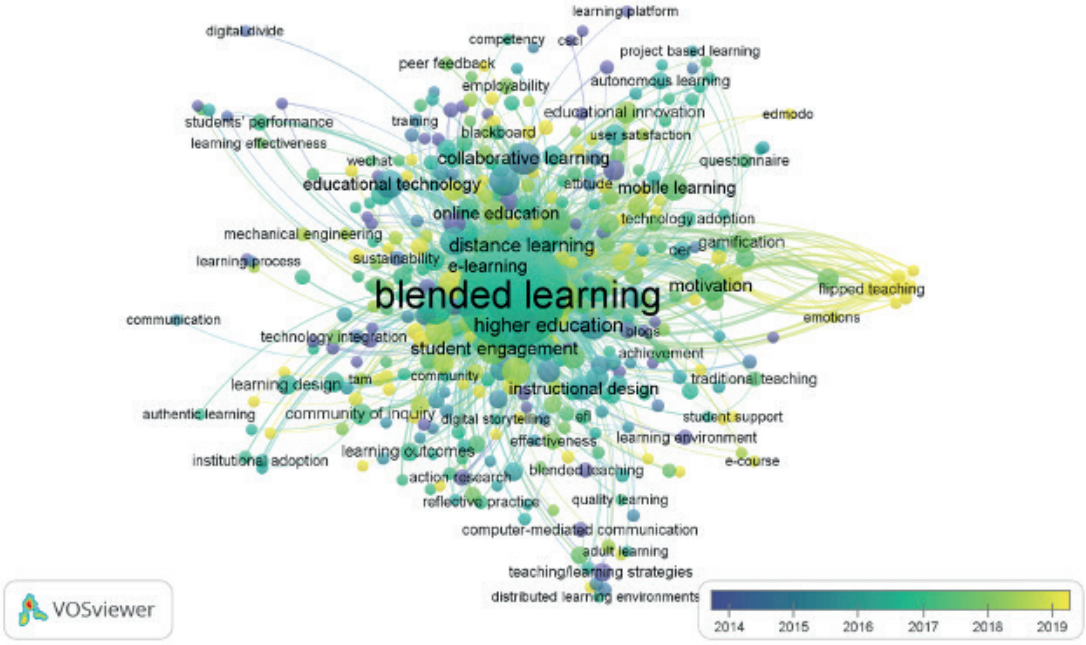

Figure 10. Layer Map of the Most Used Terms in Keywords

Figure 10 demonstrates the layer visualization results in which the most used keywords are hierarchically categorized on the basis of publication year criteria. The figure also reflects that the concepts of blended learning, higher education, and e-learning are frequently used. While it was seen that standard concepts were preferred between 2016 and 2018, it is notable that after 2019, current topics such as flipped teaching, COVID-19, flipped classroom, e-course, and machine learning were introduced.

DISCUSSIONS

The research findings deduce that the number of studies on blended learning in higher education generally increased between 2002 and 2020. This trend was high between 2016-2019, and the number of studies, especially between 2018-2020, rose to prominence. This result is consistent with the study's findings that blended learning practices increased in developed countries between 2018 and 2020 (Anthony et al., 2020). The phases of staying home with the COVID-19 process have resulted in distance education becoming a global norm in 2020 (Williamson et al., 2020). Bibliometric analyses of studies in distance education also show that the number of studies conducted in 2020 has increased (Das, 2021; Sweileh, 2021; Yavuz et al., 2021). In this context, the pandemic has been influential in increasing distance education research trends in different education fields compared to other learning models in 2020. The "Horizon Report" project (Pelletier et al., 2021), which presents the trends in the use of technology in learning and teaching processes, states that the new emerging trend in educational institutions is blended learning. The impact of political and environmental factors is experienced in the increase in research on blended learning (Hu & Song, 2020). This case can be interpreted as the field created by the compulsory use of distance education has left its place in the normalization processes to blended learning practices.

The results of the analysis of the publications by the document type point out that the articles stand out in the studies on blended learning, followed by full-text paper studies. To this end, similar studies are supporting this result in the literature (Arifin, 2021; Omar et al., 2021). The examination of publications in terms of language suggests that English is dominant, followed by Spanish. It is an expected outcome that English is so dominant. Other bibliometric analysis findings also support this result (Omar et al., 2021; Raman et al., 2021). As a matter of fact, the researchers preferred English as the publication language for the widespread effect in their articles. The fact that Spanish is ahead of other languages can be explained by the fact that most of the publications are of Spanish origin.

The distribution of publications by country shows that Spain is the most productive country with 261 publications. This situation can be interpreted as Spain, which is among the top five countries in other surveying studies in the field of blended learning (Castro-Rodriguez, 2021; Raman et al., 2021), tends to come forward in blended learning studies in higher education compared to other countries. It is inferred that the database with the most publications by the WoS indexes of the publications is Conference Proceedings Citation Index – Social Science & Humanities. Besides, the CPCI database, which comes first in the field of social sciences, is one of the most used indexes (Lu et al., 2020).

The journal that stands out in terms of the number of citations regarding blended learning studies is "Computers & Education" (94 citations per publication). As a well-established academic journal dating back to the first years of computer use in the field of education, "Computers & Education" has much valuable content and research community on educational technology (Chen et al., 2020; Zawacki Richter & Latchem, 2018). According to the findings obtained in the study, it is seen that the "Computers & Education" journal maintains its prestige and is a primary resource that is also referenced in blended learning studies.

Brigham Young University is prominent in the citation analysis of the institutions of researchers working in the field of blended learning. The university is an influential institution among the universities of the most cited researchers and the number of publications per institution from the field of blended learning (Castro-Rodriguez et al., 2021; Raman et al., 2021).

Among the studies, the most cited one is Gikandi et al. (2011), with 358 citations titled "Online formative assessment in higher education: A review of the literature." Especially the subject of assessment comes to the fore in the field of online learning (Chen et al., 2020). This situation can be interpreted in the context of the importance of assessment and evaluation in educational research and the importance of formative assessment in online learning environments. In this context, the subject of assessment is one of the most popular topics in the field of blended learning.

According to the findings of the co-author analysis, it is understood that England leads the distribution of co-authors in the field of blended learning in terms of countries and "The University of Edinburgh" in the distribution of institutions. This can be explained in the context of England's investment in academic cooperation within and outside the institution in higher education. In addition to supporting research skills, collaborative academic studies are significant in targeting joint development rather than individual competitive understanding (Tynan & Garbett, 2007). In this regard, the University of Edinburgh stands out as a university that supports cooperation in terms of strategy and institutional policies and aims to realize entrepreneurial and academic cooperation in many fields (Guerrero et al., 2015; Macdonald & Martinez-Uribe, 2010). Collaborations by field experts result in an increase in the number of publications (Sweileh, 2021). It can be argued that the investments made in this context have resulted in efficiency both in the number of publications and in collaborative studies. However, this approach of the university is also reflected in blended learning research among many research areas.

According to the findings of the co-citation analysis, Garrison stands out with 587 co-citations. The author has different studies that provide the basic framework for the use of blended learning in higher education and distance education systems. In addition to these studies, the author is one of the leading researchers who revealed the research community model (2000) and that his studies on questioning communities and cognitive presence in blended learning increase the citation potential.

Technological systems are also social systems (Fuchs et al., 2010). To this end, a good understanding is required to use these systems in learning environments. Especially in systems such as blended learning that require skillful use of technical and pedagogical skills related to both distance education and face-to-face teaching, the functions of flexibility and supporting social and individual differences are remarkable. The keywords used in blended learning research tend towards these specific functions. Especially in the studies conducted in the first years, concepts such as online learning, higher education, student participation, success, and collaborative learning stand out, while in the following years, concepts such as flipped classrooms, Edmodo, sustainability, gamification, mobile learning, and emotions are given more importance. The development of mobile technologies can explain this with their function supporting ubiquitous learning and taking into account personalized features such as sustainability and emotion. In this context, it is possible to assert that research on blended learning in higher education is affected by technological and social developments.

CONCLUSIONS

Blended learning distinguishes itself in terms of its potential for personalized learning in online environments. Blended learning in higher education requires technology and digital skills, as well as face-to-face teaching skills. This case, especially in the process of COVID-19, has made distance education compulsory, and blended learning applications have been experienced as one of the most important alternatives in the pandemic process. It is essential to use the space provided by these experiences to increase the quality of teaching practices, especially after the pandemic. In this matter, the need to determine the framework, trends, prominent studies, and institutions regarding higher education in blended learning arises. In this study, which was conducted in this direction, bibliometric and descriptive analysis methods were used to analyze academic studies in the field of blended learning in higher education between 2002 and 2021. As a result of the analyses, the prominent researches, researchers, institutions, and countries in blended learning research in higher education were identified and analyzed.

Suggestions

In line with the results obtained from the research findings and the information obtained from the literature, some suggestions are presented below for researchers planning to work with a bibliometric perspective in the field of blended learning:

- This study was based on the WoS database. A more comprehensive study can be conducted by including data from important databases such as Scopus and ERIC (Education Resources Information Center).
- Data can be compared using different analysis techniques (Meta-analysis, thematic analysis etc.).
- More detailed results can be obtained by examining more specific areas.
- This research includes studies in higher education. In other studies, different education levels can be investigated.
- Personalized learning experiences on blended learning and pedagogy and technology-oriented studies for the use of new technologies can be carried out for researchers.
- Support should be given to the instructors, and transition strategies should be created to increase the institutions' knowledge and skills related to blended learning.
- Considering the year 2020 and after, when the importance of distance education becomes more evident, the research to be prepared in this context can be increased in terms of quality and quantity.
- Bibliometric analyses covering different time periods can be made. For example, studies after COVID-19 can be examined.
- The VOSviewer program was used for data analysis in this study. Different programs can be used in other studies.

Limitations

This research has some limitations. These limitations can be listed as follows:

- The publications examined in this study were obtained from the WoS database due to the coexistence of qualified peer-reviewed journals. Therefore, the obtained publications were obtained only from a specific database.
- The VOSviewer program, which can work in harmony with WoS database, has an open source structure and can evaluate a lot of data together, was used in the research.
- Research data include studies before October 2021.
- The data is limited to the query sentence made in the topic field on the advanced search page: TS=((“blended learn*” or “blended teach*” or “hybrid learn*” or “hybrid teach*” or “blended edu*” or “hybrid edu*”) and (“higher edu*”))

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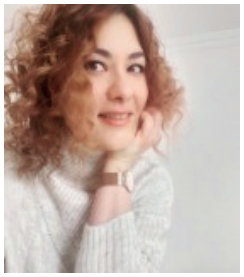

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