

 Review Article

Research on Blended Learning in Secondary Schools: Trends and Patterns (1982–2022)

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Abstract

One of the most popular teaching strategies in modern digital age is blended learning. The purpose of this study to examine the state of blended learning research from 1982 to 2023. Analyzing yearly publications, often used keywords, most referenced papers, most publications, most active sources, most often used institutions, productive, and most contributing countries is the main goal of this study. A total of 567 papers from Scopus database were evaluated. The study's findings indicate (1) a consistent rise in publications between 2018 and 2022, (2) "Students," "blended learning," "teaching," and "e-learning" are the most often utilized terms. (3) The work of Ramadhani et al. (2019) is the most referenced document. (4) Authors that have significantly advanced blended learning research Gomes, A.S., Divayana, D.G.H., Aristovnik, A., Arifani, Y., Umek, L., Tomaževič, N., Ramdani, A., Killian, C.M., Keržič, D., Jatmiko, B. (5) The most recent source is Physics Conference Series publication. (6) Malang State University is the most prolific institution. (7) Indonesia the nation of origin of the institution that made most contribution, followed by China in second place, United States in third place, and Taiwan in fourth. It is intended that the findings of this study will serve as examples in the future.

Keywords: Blended learning, Secondary school, Trend and patterns



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1. INTRODUCTION

There is no doubt that the field of education is greatly impacted by the increasingly quick development of digital technologies. The blended learning paradigm is one that makes use of both traditional and digital learning (Nugraheni, Adita, & Srisawasdi, 2020). Due to its ability to facilitate remote learning, blended learning has supplanted traditional classroom instruction for both educators and students in the wake of the Covid-19 epidemic. After the epidemic strikes the world, it is anticipated that the blended learning trend will continue when education resumes as usual (Tonbuloğlu & Tonbuloğlu, 2023).

Students engage in active learning when they combine traditional classroom instruction with digital learning. Research indicates that blended learning fosters a more pleasant learning environment for students and boosts their sense of collaboration with one another. Accordingly, blended learning is a student-centered learning change (Liu & Wang, 2022). In addition to its numerous advantages, blended learning can have detrimental effects on teachers and students.

One drawback of blended learning for educators is that it might lead to a perception of excessive workloads and challenges in balancing in-person and virtual learning. Enhancing teacher training is necessary to prevent adverse effects, like developing educators' IT skills. Changing the incentives offered by schools is the next actionable item. Through a variety of programs, schools should give instructors more confidence to experiment with blended learning teaching styles. Third, in order to lessen burden, educators can plan lessons and work together with other educators (Chen & Lu, 2013).

In addition to having negative consequences on instructors, blended learning has negative affects on students as well. These effects include those on cognitive load, learning preferences, and student situations. One of the most widespread misunderstandings among instructors regarding blended learning is that it involves a ton of activities that allow pupils to learn more. However, this increases the cognitive load on students. Aside from that, different backgrounds lead to different ways of learning. Some students enjoy utilizing textbooks to deliver and explain content since they have studied them their whole lives. If teachers provide their pupils a lot of reading materials and have them do online coursework, the influence on their learning will be felt. Teachers should tailor their blended learning strategies and media selections to the unique learning styles and attitudes of their pupils, taking into account individual variances. This fact emphasizes the educational objectives, which are to support students' growth in line with their aptitudes (Chen & Lu, 2013).

Chen & Lu (2013) performed bibliometric analysis on 719 papers indexed in the Web of Science core collection between 2013 and 2022 in order to determine the main trends in blended learning research. This suggests that the area of study on blended learning is only now starting to expand considerably. This research use a quantitative technique combined with CiteSpace's visual analytic tools to assess development trends, important articles and concerns in the field, prominent researchers and research institutes, and to guide future developments in the subject. The analysis indicates that during the past 10 years, there has been a discernible increase in the number of publications and citations for BL research.

Additionally, Raman, et.al., (2021) conducted research on bibliometric analysis to track developments in blended learning in higher education. This study uses Harzing's Publish or Perish for metrics and citation analysis, Microsoft Excel for frequency analysis, and VOSviewer for data visualization. 1,064 valid publications were reviewed, based on search results for the terms "blended learning," "perception," "achievement," "engagement," "university," and "bibliometric analysis." This article's descriptive and content analyses focus on document types and source types. The results of the investigation show that the number of publications increased yearly between 2000 and 2018.

In order to enhance learning outcomes and student growth, Abuhassna, et.al., (2022) carried out bibliometric analysis study, a methodical examination of the literature that examined effective blended learning methodologies. In order to accomplish this goal, 39 papers from research published between 2011 and 2021 were examined from the literature that was acquired from Scopus and the Web of Science database. Three primary themes emerge from the findings: management course teachers, tailored learning, and digital assistance for learner engagement. It is anticipated that anyone working in blended learning would find value in these findings. It is crucial to understand the publishing patterns of blended learning models in light of this knowledge. This is meant to help researchers in planning investigations for the future.

1.1 Purpose of the Study

The goal of this study is to examine blended learning research from 1982 to 2023. The following are the research questions:

RQ1: From 1982 to 2023, how many papers regarding blended learning were published?

RQ2: When writing on blended learning in secondary schools, what are the most commonly utilized terms by authors?

RQ3: Which studies are researchers citing the most often?

RQ4: Which writers are most frequently quoted in articles concerning blended learning in secondary education?

RQ5: Which sources are the busiest with this kind of research?

RQ6: Over the past ten years, what institution has provided the most publications?

RQ7: Which nations produce the greatest amount of blended learning research?

2. METHODS

The research approach made use of bibliometric analysis. Bibliometric analysis is a method for examining large amounts of scientific data. This bibliometric study makes use of PRISMA to paint a complete picture of the use of blended learning in secondary school. The entire PRISMA-based bibliometric mapping analysis procedure is shown in Figure 1.

2.1 Design

In order to do this analysis, papers from the Scopus database spanning the years 1982 to 2023 are searched for using certain keywords, titles, or abstracts (“Blended Learning” OR “Blended” AND “Blend*” AND “High school” OR “secondary school”). Scopus is used because it links individuals, published theories, and organizations through the use of unique, rigorous information (Raman et al., 2021). September 14, 2023, saw the availability of search activities. 657 publications in all were published in journals with Scopus indexes. In the end, 567 papers—a combination of articles and conference papers—were chosen for this study. Figure 1 depicts the entire publication selection procedure.

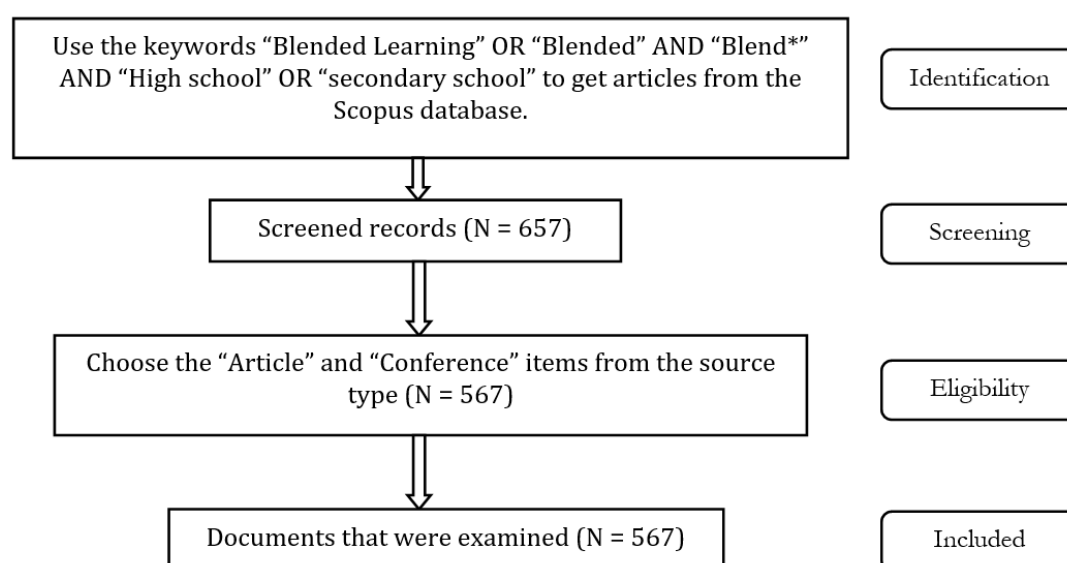


Figure 1. PRISMA Research Flow Diagram

2.2 Data Collection and Analysis

To get pertinent information for the study issues, the papers were thoroughly reviewed. To conduct the study with bibliometric software, data is taken from the Scopus database and saved in a.csv file type. A popular computer application called VOSviewer is used for author and country bibliographic merging, as well as for the development, analysis, and visualization of author keyword occurrences. Additionally, Microsoft Excel was used to display.

3. RESULTS

3.1 Data Collection and Analysis

To get pertinent information for the study issues, the papers were thoroughly reviewed. To conduct the study with bibliometric software, data is taken from the Scopus database and saved in a.csv file type. A popular computer application called VOSviewer is used for author and country bibliographic merging, as well as for the development, analysis, and visualization of author keyword occurrences. Additionally, Microsoft Excel was used to display.

3.2 An annual Edition

The depiction of annual scientific output in blended learning was done in order to respond to the first research question (RQ1). The number of publications and outputs mentioned between 1982 and 2023 is summarized in Figure 2. The findings demonstrate that throughout time, there is variation in both the quantity of publications and outputs referenced. It is evident that the quantity of publications generated remained constant between 1982 and 2002. The number of publications increased steadily from 2018 and 2022, but in 2023 it sharply declined. In terms of total articles referenced, the year 2015 had the most (513), while the lowest number was 1 in 1982. John R. Mergendoller, Donald W. Swarthout, and Martin J. Packer's work was the first on blended learning to be published and the first to be referenced. Its extremely good applicability is demonstrated by the determination value (R) of 0.9556 that is obtained from the process. It is clear that, in the upcoming year, the blended learning trend will continue to grow, but not rapidly enough.

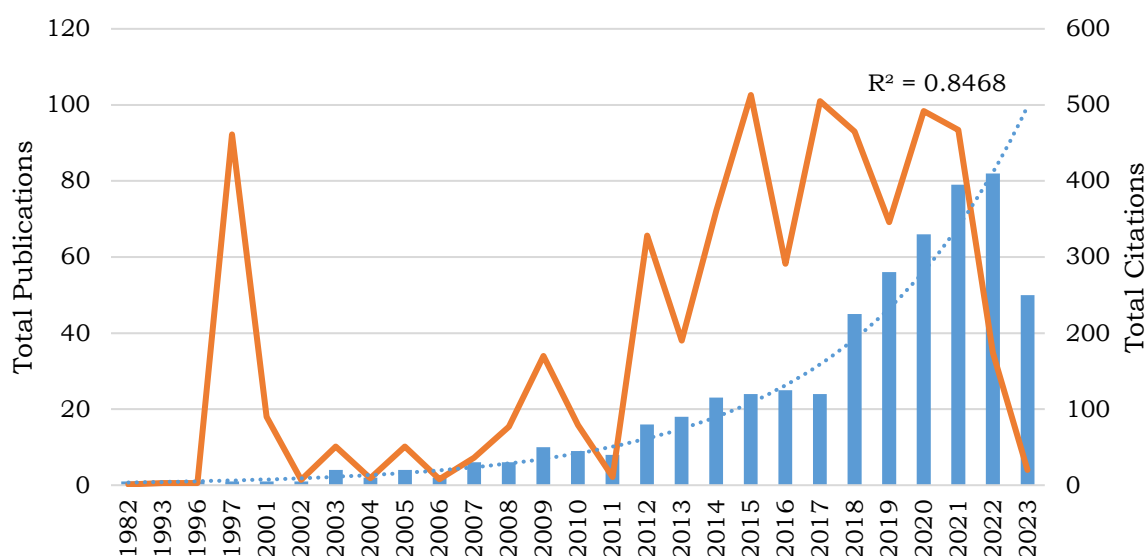


Figure 2. Publications and Citations Over Time (1982 - 2023)

3.3 The Most Popular Terms

In response to the second formulation of the query (RQ2), Figure 3 displays the quantity of terms that writers most commonly use when discussing blended learning in secondary schools. The keyword occurrence threshold is set at five. VOSviewer is used to identify keyword occurrences. Limiting quantity The automated selection of the keywords, 137, was employed. According to the analysis results, “e-learning” (117 occurrences, total link strength 687), “teaching” (100 occurrences, total link strength 688), “blended learning” (242 occurrences, total link strength 947), and “students” (170 occurrences, total link strength 1071) were the most frequently used keywords. Figure 3 shows the date of publication of the evaluated document where the term occurs in different colors. Words that are relatively new to the publication are shown in yellow. According to the image, “blended learning,” “students,” “e-learning,” and “education” are the terms most commonly used in publications. We may infer that the term “blended learning” is most frequently used in research on blended learning in secondary education.

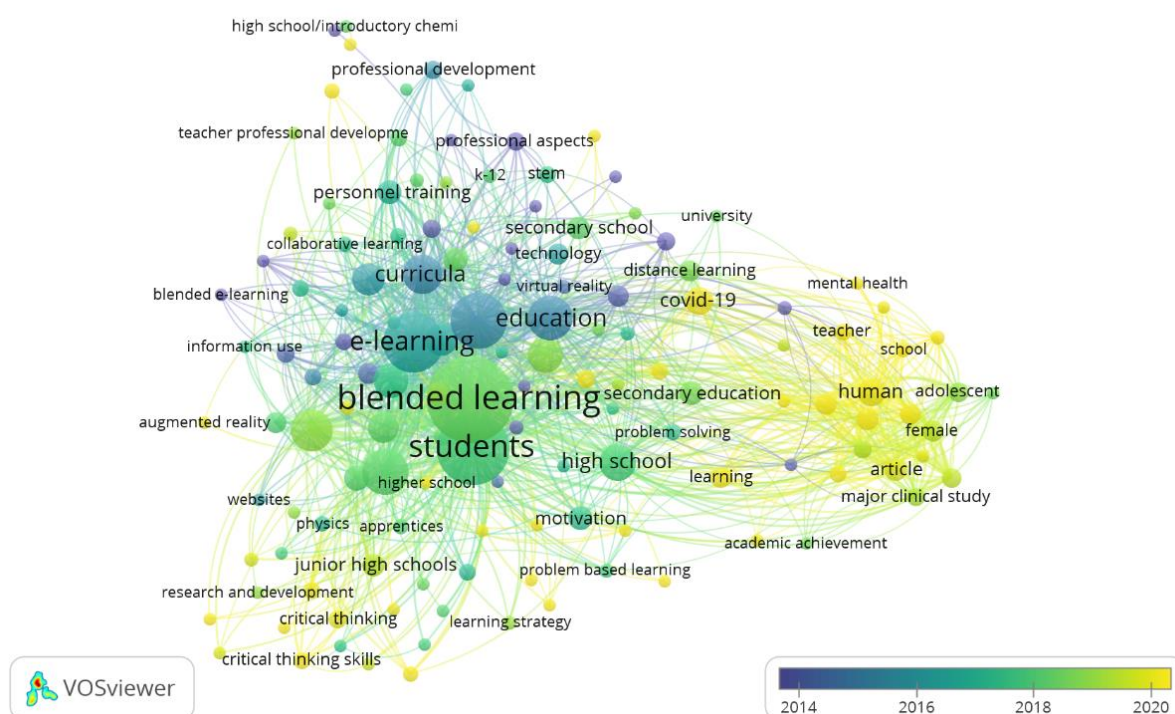


Figure 3. Keyword Occurrences on a Bibliometric Map

3.4 Most Referenced Papers

With regard to the third issue formulation (RQ3), Table 1 lists the works that have received the most citations. This chart lists the journals and conference proceedings that were most often cited in 1997. According to Tonbuloğlu & Tonbuloğlu (2023), blended learning was widely utilized during the beginning of the Covid-19 pandemic and is expected to continue to increase in 2020. This is the reason why the number of publications that are most referred yearly in 2019 is so high.

Table 1. Top 10 Citations for Documents

Authors	Title	Source title	Cited
(Phinney et al., 1997)	Variations in bicultural identification among African American and Mexican American adolescents	Journal of Research on Adolescence	441
(Pinkard, Erete, Martin, & McKinney de Royston, 2017)	Digital Youth Divas: Exploring Narrative-Driven Curriculum to Spark Middle School Girls' Interest in Computational Activities	Journal of the Learning Sciences	150
(Brahimi & Sarirete, 2015)	Learning outside the classroom through MOOCs	Computers in Human Behavior	133
(Chao, Chen, & Chuang, 2015)	Exploring students' learning attitude and achievement in flipped learning supported computer aided design curriculum: A study in high school engineering education	Computer Applications in Engineering Education	127
(Pane, Griffin, McCaffrey, & Karam, 2014)	Effectiveness of Cognitive Tutor Algebra I at Scale	Educational Evaluation and Policy Analysis	124
(Lee & Chen, 2009)	A computer game as a context for non-routine mathematical problem solving: The effects of type of question prompt and level of prior knowledge	Computers and Education	112
(Arndt, Schools, & Healey, 2001)	Concomitant disorders in school-age children who stutter	Language, Speech, and Hearing Services in Schools	90
(Lam, Hew, & Chiu, 2018)	Improving argumentative writing: Effects of a blended learning approach and gamification	Language Learning and Technology	82
(Ramadhani, Umam, Abdurrahman, & Syazali, 2019)	The effect of flipped-problem based learning model integrated with LMS-google classroom for senior high school students	Journal for the Education of Gifted Young Scientists	81
(Code, Ralph, & Forde, 2020)	Pandemic designs for the future: perspectives of technology education teachers during COVID-19	Information and Learning Science	78

3.5 The Author with the Most Publications

Regarding the fourth version of the issue (RQ4), it is clear that the 10 authors with the highest number of publications—each having four articles—have the same total number of publications. The author's VOSviewer collaboration network is also analyzed in this section. The minimal number of documents for a particular author is two, and the minimum number of citations is zero.

Table 2. The Number of Articles Written by the Top 10 Authors

Authors	Institution	Country	N	H-Index
Umek, L	University of Ljubljana	Slovenia	4	13
Tomažević, N.	University of Ljubljana	Slovenia	4	13
Ramdani, A.	Universitas Mataram	Indonesia	4	3
Killian, C.M.	Georgia State University	US	4	10
Keržič, D.	University of Ljubljana	Slovenia	4	9

Authors	Institution	Country	N	H-Index
Jatmiko, B.	Universitas Negeri Surabaya	Indonesia	4	9
Gomes, A.S.	Universidade Federal Rural de Pernambuco	Brazil	4	11
Divayana, D.G.H.	Universitas Pendidikan Ganesha	Indonesia	4	11
Aristovnik, A.	University of Ljubljana	Slovenia	4	20
Arifani, Y.	Universitas Muhammadiyah Gresik	Indonesia	4	8

Figure 4 shows the cooperation network of 559 writers. It is clear that the authors do not know one another personally. This implies that the writers did not collaborate on any written works.



Figure 4. Author Collaboration Relationships

3.6 The Most Recent Sources

In the meanwhile, the ten most prolific journals are listed in order of publication count, h-index, Scopus quartile (Q), SCImago Journal Rank (SJR) in 2022, and publisher in order to address the fifth problem formulation (RQ5). The Physics Conference Series journal has 40 documents, making it the most active source, as seen in Table 3. Additional pertinent sources are the ACM International Conference Proceedings Series (containing 17 documents) and the Aip Conference Proceedings (containing 22 documents). Table 3 illustrates the findings from Lecture Notes in Computer Science Including Subseries With the highest research h-index (446), Computers and Education (215), Lecture Notes in Artificial Intelligence and Bioinformatics, and ACM International Conference Proceedings Series (137) were the next three journals in order of importance for blended learning research. The highest Scopus rankings are held by Elsevier and Kluwer Academic Publisher (Q1), followed by MDPI AG, the American Chemical Society, and the International Association of Online Engineering (Q2), and the Eurasian Society of Educational Research and Springer Verlag (Q3), according to publisher data.

Table 3. The 10 Most Recent and Active Sources

Journal	N	H-Index	Q	SJR 2022	Publisher
Journal of Physics Conference Series	40	91	-	0.18	IOP Publishing Ltd.
AIP Conference Proceedings	22	80	-	0.16	AIP
ACM International Conference Proceeding Series	17	137	-	0.21	Association for Computing Machinery (ACM)
Lecture Notes in Computer Science	15	446	Q3	0.32	Springer Verlag
Computers and Education	11	215	Q1	3.68	Elsevier Ltd.
Education and Information Technologies	10	61	Q1	1.25	Kluwer Academic Publishers
Education Sciences	7	40	Q2	0.61	MDPI AG
Journal of Chemical Education	6	95	Q2	0.56	American Chemical Society
International Journal of Emerging Technologies in Learning	6	39	Q2	0.54	International Association of Online Engineering
European Journal of Educational Research	6	18	Q3	0.34	Eurasian Society of Educational Research

3.7 Most Prolific Institutions

In relation to the sixth problem formulation (RQ6), Table 4 displays the distribution of countries, types of institutions, and publications from the top 10 generating institutions.

Table 4. The Top 10 Most Prolific Institutions

Institution	Country	Types	Documents
Universitas Negeri Malang	Indonesia	Public	18
Universitas Negeri Yogyakarta	Indonesia	Public	15
Universitas Pendidikan Indonesia	Indonesia	Public	13
Universitas Negeri Jakarta	Indonesia	Public	11
University of Illinois Urbana-Champaign	US	Public	9
Universitas Negeri Surabaya	Indonesia	Public	7
Peking University	China	Public	7
Beijing Normal University	China	Public	5
National Taiwan University of Science and Technology	Taiwan	Public	5
Universitas Muhammadiyah Gresik	Indonesia	Private	5

Table 4 shows that, with 18 articles, Malang State University is the most productive institution in this subject. Yogyakarta State University comes in second with 15 publications, followed by the Indonesian Education University with 13 papers. We might infer that state universities are all of the institutions that contribute to this field of study. The institution that made the largest contribution was originally from Indonesia; China came in second, followed by Taiwan and the United States in third.

3.8 Most Significant Nations

Table 5 lists the ten nations that have contributed the most in order to address the seventh issue formulation (RQ7).

According to Table 5, Indonesia has the most publications ($n = 136$; 23.98%) when compared to other countries. America acquired the second-highest number of papers (15.87%), with 90, while China came in third place with thirty documents (5.29%). The combined bibliographies of these countries are then shown via VOSviewer. To be deemed complete, a nation has to have two citations and at least five papers. Eighty-five nations will be selected automatically.

Table 5. List of the Top 10 Prolific Nations

Country	N of Paper	%
Indonesia	136	23.98
United States	90	15.87
China	30	5.29
Australia	23	4.05
Taiwan	19	3.35
United Kingdom	18	3.17
Malaysia	18	3.17
Thailand	17	2.99
Spain	15	2.64
South Africa	15	2.64

The findings of the analysis are shown in Figure 5. The author is divided into seven clusters if you look at the image. The United States, the United Kingdom, and Indonesia are the three biggest groupings. Aside from that, the second cluster includes China, Thailand, and Japan. Various groupings are shown by various colors. For instance, the red line in Cluster 1 illustrates the connections between China, Thailand, and Japan.



Figure 5. Compilation of the Most Productive Nations' Bibliographies

4. DISCUSSION AND CONCLUSION

The study concludes that a picture of blended learning research from 1982 to 2022 may be obtained using bibliometric analysis. In this bibliometric investigation, 567 documents were examined. On the basis of the analysis that was done, it is possible to determine how many publications and outputs were mentioned between 1982 and 2023. The findings demonstrate that throughout time, there is variation in both the quantity of publications and outputs referenced. It is evident that the quantity of publications generated remained constant between 1982 and 2002. The number of publications rises steadily between 2018 and 2022 before sharply declining in 2023. The terms “students,” “blended learning,” “teaching,” and “e-learning” are most often employed. The study conducted by Ramadhani et al. (2019) has received the most number of citations, followed by Phinney et al. (1997) and Brahimi & Sarirete (2015).

Umek, L., Tomažević, N., Ramdani, A., Killian, C.M., Keržič, D., Jatmiko, B., Gomes, A.S., Divayana, D.G.H., Aristovnik, A., and Arifani, Y. are among the writers

who have made significant contributions to blended learning research. Each of the ten authors that contributed the most authored four documents in total publishing. With forty papers, the Physics Conference Series journal publishing volume is the most active source, followed by the Aip Conference Proceedings with twenty-two and the ACM International Conference Proceedings Series with seventeen. With eighteen publications, Yogyakarta State University is second most productive in this subject, followed by Malang State University with fifteen, and the Indonesian Education University with thirteen. The institution that made the largest contribution was originally from Indonesia; China came in second, followed by Taiwan and the United States in third.

Among its many shortcomings is the fact that this study only used one database, Scopus. Because of this, it is anticipated that future researchers would draw from a variety of databases and sources. In addition, a more thorough examination of the kinds of blended learning models and learning techniques that are frequently employed in education is required.

Conflict of Interest

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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REFERENCES

- Abuhassna, H., Van, N. T., Yahaya, N., Zakaria, M. A. Z. M., & Awae, F. (2022). Strategies for Successful Blended Learning— A Bibliometric Analysis and Reviews. *International Journal of Interactive Mobile Technologies*, 16(13), 66–80. <https://doi.org/10.3991/ijim.v16i13.30739>
- Arndt, J., Schools, A. P., & Healey, E. C. (2001). School-Age Children Who Stutter. *Language, Speech, and Hearing Services in Schools*, 32(April), 68–78.
- Brahimi, T., & Sarirete, A. (2015). Learning outside the classroom through MOOCs. *Computers in Human Behavior*, 51, 604–609. <https://doi.org/10.1016/j.chb.2015.03.013>
- Chao, C. Y., Chen, Y. T., & Chuang, K. Y. (2015). Exploring students' learning attitude and achievement in flipped learning supported computer aided design curriculum: A study in high school engineering education. *Computer Applications in Engineering Education*, 23(4), 514–526. <https://doi.org/10.1002/cae.21622>
- Chen, S., & Lu, Y. (2013). *The Negative Effects and Control of Blended Learning in University*. (Icetis), 28–31. <https://doi.org/10.2991/icetis-13.2013.7>
- Code, J., Ralph, R., & Forde, K. (2020). Pandemic designs for the future: perspectives of technology education teachers during COVID-19. *Information and Learning Science*, 121(5–6), 409–421. <https://doi.org/10.1108/ILS-04-2020-0112>
- Lam, Y. W., Hew, K. F., & Chiu, K. F. (2018). Improving argumentative writing: Effects of a blended learning approach and gamification. *Language Learning and Technology*, 22(1), 97–118.
- Lee, C. Y., & Chen, M. P. (2009). A computer game as a context for non-routine mathematical problem solving: The effects of type of question prompt and level of prior knowledge. *Computers and Education*, 52(3), 530–542. <https://doi.org/10.1016/j.compedu.2008.10.008>

- Liu, Y., & Wang, S. (2022). The influence of students' ability on the continuous intention of blended learning. *SN Social Sciences*, 2(10), 1–22. <https://doi.org/10.1007/s43545-022-00499-1>
- Nugraheni, A. R. E., Adita, A., & Srisawasdi, N. (2020). Blended learning supported chemistry course: A systematic review from 2010 to 2019. *ICCE 2020 - 28th International Conference on Computers in Education, Proceedings*, 2(2), 444–450. <https://doi.org/10.14456/edkkuj.2020.x>
- Pane, J. F., Griffin, B. A., McCaffrey, D. F., & Karam, R. (2014). Effectiveness of Cognitive Tutor Algebra I at Scale. *Educational Evaluation and Policy Analysis*, 36(2), 127–144. <https://doi.org/10.3102/0162373713507480>
- Pinkard, N., Erete, S., Martin, C. K., & McKinney de Royston, M. (2017). Digital Youth Divas: Exploring Narrative-Driven Curriculum to Spark Middle School Girls' Interest in Computational Activities. *Journal of the Learning Sciences*, 26(3), 477–516. <https://doi.org/10.1080/10508406.2017.1307199>
- Ramadhani, R., Umam, R., Abdurrahman, A., & Syazali, M. (2019). The effect of flipped-problem based learning model integrated with LMS-google classroom for senior high school students. *Journal for the Education of Gifted Young Scientists*, 7(2), 137–158. <https://doi.org/10.17478/jegys.548350>
- Raman, A., Thannimalai, R., Don, Y., & Rathakrishnan, M. (2021). A bibliometric analysis of blended learning in higher education: perception, achievement and engagement. *International Journal of Learning, Teaching and Educational Research*, 20(6), 126–151. <https://doi.org/10.26803/IJLTER.20.6.7>
- Tonbuloglu, B., & Tonbuloglu, I. (2023). Trends and patterns in blended learning research (1965–2022). *Education and Information Technologies*. <https://doi.org/10.1007/s10639-023-11754-0>