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Pro-Metrics

ORIGINAL RESEARCH

Blended learning research: Identifying research output patterns in Scopus (2000-2023)

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ABSTRACT

Objective. This study aims to analyze the bibliometric data on blended learning from 2000 to 2023 in Scopus.

Methodology. This study was designed from a bibliometric perspective using Scopus as a data source. Frequency counts determined the productivity of authors, affiliations, and countries. The co-occurrence of terms was investigated using the author's keywords. Co-authorship and country collaboration networks were also constructed.

Results. 949 authors with at least two publications were identified, 198 with three, 80 with four, 44 with five, and the remaining with more than six. About the co-authorship network, 1,223 authors were included in the map, and only 23 are connected. North America, Europe, and Asia have the highest productivity levels. The emergence of countries such as Indonesia and Malaysia indicated a growing interest in research on the topic addressed here. China and the United States have the strongest relationships. Clustering revealed thematic diversity and current relevance, an emphasis on personalization and accessibility of learning, growing interest in self-efficacy and autonomy, integration of new technologies, the importance of active learning and activity theory, and a focus on adult education.

Conclusion. The field of blended learning lacks extensive collaborative networks. Author communities were notable for autonomy and segregation. The country's productivity data highlighted the necessity of sustained investment in research and development. Emerging nations demonstrated promising growth, while efforts to enhance research capabilities in lower-productivity countries could contribute to a more balanced global research landscape.

Keywords: blended learning; research productivity; bibliometric analysis; educational technology; collaboration networks.

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INTRODUCTION

Blended learning is defined as the integration of traditional, classroom-based instruction with digital learning resources (Castro, 2019). Consequently, information technology assumes a pivotal role in this process. This approach strives to integrate the optimal elements of both traditional and digital learning environments, offering students flexibility and accessibility while maintaining the interpersonal and structured components of the traditional classroom. Blended learning is an educational model in which digital technologies are integrated with traditional teaching methods, providing a more holistic and adaptive learning experience (Garrison & Kanuka, 2004). As Graham (2006) notes, the term "blended learning" encompasses not only the integration of digital tools but also the restructuring of pedagogical practices to enhance learning outcomes.

There has been a notable increase in interest in blended learning due to its demonstrated advantages in enhancing academic performance, facilitating flexibility in learning, and improving student satisfaction (Means *et al.,* 2010). A Vo *et al.* (2017) meta-analysis indicates that students enrolled in blended learning environments tend to demonstrate superior academic performance compared to those who participate exclusively in traditional or fully online modalities. This approach permits the individualization of the pace and style of learning, affording students greater autonomy over their educational process. Despite the advantages associated with blended learning, implementing this approach presents several challenges. Effective integration of digital technologies necessitates providing adequate infrastructure and implementing ongoing professional development for educators (Graham *et al.,* 2013). Furthermore, it is essential to consider pedagogical design to guarantee that the online and face-to-face components are integrated effectively, thus preventing any disruption in the learning continuum (Picciano, 2009).

The implementation of blended learning not only alters the student experience but also the pedagogical approach and the role of the educator. Bonk and Graham (2006) posited that educators must assume new roles as facilitators and guides, providing students with the support they require to navigate online resources and construct knowledge autonomously. This evolution in pedagogical roles highlights the necessity for implementing targeted professional development strategies to realize the full potential of blended learning. The relevance of this topic has resulted in a notable increase in the quantity of literature published over time. This study aims to analyze the bibliometric Scopus data from 2000-2023.

LITERATURE REVIEW

In a recent study, Abuhassna and colleagues (2022) employed a bibliometric analysis to identify effective strategies in blended learning. The authors conducted a review of the literature to identify best practices and areas of focus for improving the implementation of blended learning in various educational contexts. Raman *et al.* (2021) employed a bibliometric analysis to examine the effectiveness of blended learning in higher education, focusing on student perceptions, academic achievement, and engagement. The authors examined the interrelationship between these factors and their impact on the success of blended learning. Omar *et al.* (2021) conducted a bibliometric analysis of the use of blended learning in graduate studies from 1997 to 2021, identifying prominent trends and areas of research in the field. Cruz-Cárdenas *et al.* (2023) oriented on higher education, identifying research trends and providing a knowledge map.

Santos (2022) conducted research with a comparative focus on business, management, and accounting. The authors employed bibliometric analysis and literature reviews to evaluate these approaches' effectiveness and critical differences. For example, Asmawi *et al.* (2024) conducted a study. The transformative impact of blended learning on business English learners in China was examined using a bibliometric analysis of studies conducted between 2012 and 2022. Other bibliometric studies in this regard include Xiao & Zhang (2024), Rosalinda *et al.* (2022), Challco *et al.* (2024), Ibarra-Vargas *et al.* (2023), Sheu (2022), and Chen *et al.* (2023).

METHODOLOGY

This study was designed from a bibliometric perspective to conduct a quantitative analysis of the scientific production of blended learning. The Scopus database was selected for its advantages in quantitative analysis of the academic literature, comprehensive indexing coverage, and multidisciplinary nature. The search equation utilized was as follows:

> TITLE ("blended learning") AND PUBYEAR > 2000 AND PUBYEAR < 2023 AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "cp") OR LIMIT-TO (DOCTYPE, "ch") OR LIMIT-TO (DOCTYPE, "re") OR LIMIT-TO (DOCTYPE, "cr")).

The objective of this equation was to retrieve the most accurate literature on the subject from 2000 to 2023. Therefore, only articles containing the term in their title were considered. The final sample of documents consisted of 4,506 items. The variables of keywords, authors' names, and countries were normalized to the papers above. The calculated indicators were the following:

Output indicators

- Frequency counts were conducted after normalizing author, affiliation, and country entries. This determined the productivity of authors, affiliations, and countries.
- The co-occurrence of terms was investigated using the author's keywords. Networks were constructed using only keywords with a frequency of at least five.

Collaboration indicators

- Co-authorship networks: Maps were constructed based on the authors who had two or more articles.
- Country collaboration networks: Maps were constructed based on all countries included in the sample.

The VOSviewer software was employed to do network mapping and graphical representation.

RESULTS AND DISCUSSION

In the analysis of productivity by authors, 949 authors with at least two publications were identified, 198 with three, 80 with four, 44 with five, and the remainder with more than six. The most productive authors were Chang Zhu, Charles R. Graham, Minoru Nakayama, Hiroh Yamamoto, and Kouichi Muutsura (see Table 1). These authors have a pronounced inclination toward research in e-learning, critical thinking, engineering education, virtual schooling, K-12 education, and other pertinent fields. About the co-authorship network, it can be observed that of the 1,223 authors included in the map, only 23 are connected (see Figure 1). The most significant co-authorship relationships are between Jin Cai and Harrison Hao Yang, who publish predominantly on learning systems, educational technology, and computer-aided systems. Another noteworthy relationship is that between Harrison Hao Yang and Jason McLeod.

As illustrated in Table 2, the United States leads in productivity, with 506 documents published. The United States' high productivity can be attributed to substantial research investments. China, followed by the United States, has a productivity rate of 479 papers. This country has experienced a marked increase in scientific productivity, which can be attributed to government funding of science and technology. Additionally, Indonesia merits mention among the top countries, a distinction attributed to its recent educational reforms. Other countries, such as the United Kingdom (293) and Australia (270), also merit mention.

Conversely, there are countries with average productivity levels, including Germany (220), Malaysia (212), and Spain (190). These countries' robust educational systems and institutions contribute to the observed productivity outcomes. Other countries with medium productivity levels include India, Russia, Canada (112), Turkey (94), and Japan (91). In contrast, countries with lower productivity include South Korea (53 outputs), Brazil (50 outputs), France (49 outputs), and New Zealand (49 outputs). The countries with productivity levels between 20 and 50 papers include Ireland, Austria, Denmark, the Philippines, Norway, Vietnam, Mexico, Sweden, Iran, Poland, Egypt, Nigeria, Ukraine, Colombia, Finland, Pakistan, Romania, Chile, Jordan,

Author	Documents	Author	Documents
Zhu, Chang	29	Bervell, Brandford	7
Graham, Charles R.	21	Mahmud, Malissa Maria	7
Nakayama, Minoru	19	Anthony, Bokolo	6
Yamamoto, Hiroh	19	Antwi-Boampong, Ahmed	6
Mutsuura, Kouichi	12	Chew, Esyin	6
Ellis, Robert A.	11	Dias, Sofia B.	6
Divayana, Dewa Gede Hendra	10	Diniz, José A.	6
Hew, Khe Foon	10	Gerbic, Philippa	6
Martín-García, Antonio V.	10	Han, Feifei	6
Tondeur, Jo	10	Han, Xibin	6
Yang, Harrison Hao	10	Jones, Norah	6
Hernández-Leo, Davinia	9	Lam, Jeanne	6
Ololube, Nwachukwu Prince	9	Luaran, Johan Eddy	6
Picciano, Anthony G.	9	Moreira, António	6
Pynoo, Bram	9	Nguyen, Viet Anh	6
Simonova, Ivana	9	Philipsen, Brent	6
Cheung, Wing Sum	8	Spring, Kristian J.	6
Klimova, Blanka	8	Tamim, Rana M.	6
Macaruso, Paul	8	Usagawa, Tsuyoshi	6
Moskal, Patsy D.	8	Álvarez, Ainhoa	6
Struyven, Katrien	8		

Table 1. Distribution of most productive authors on blended learning.

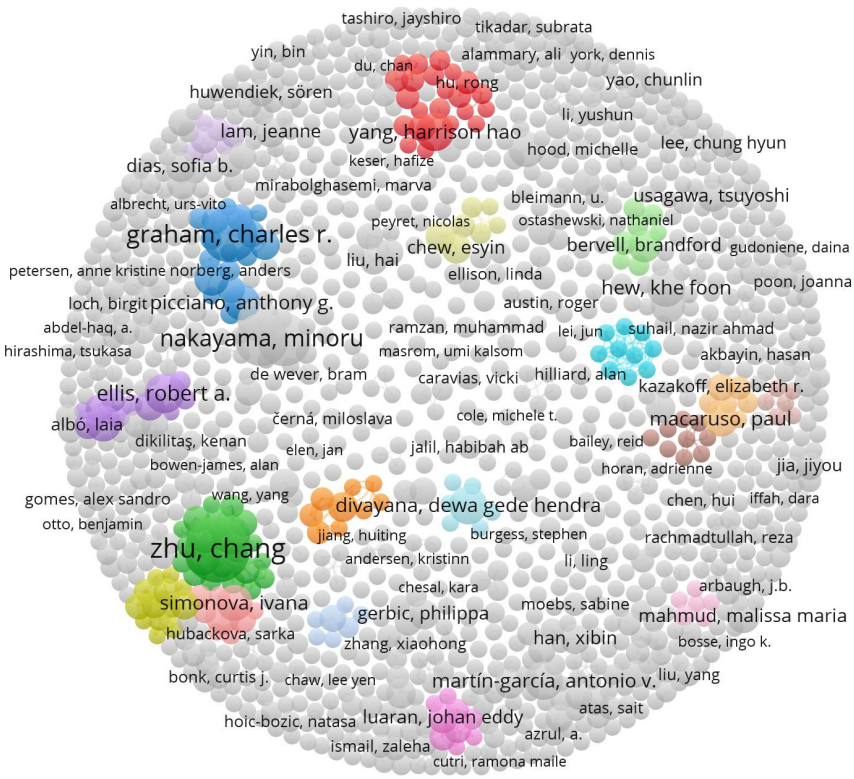

Figure 1. Co-authorship network on blending learning in Scopus: 2000-2023.

Ghana, Israel, Kazakhstan, Slovakia, Slovenia, Croatia, Ecuador, and Serbia. These countries consistently commit to enhancing their research capabilities in this field. Finally, among the countries with emerging research capacity and low productivity (less than 20 papers), we find Estonia, Lithuania, Oman, Tanzania, Bangladesh, Latvia, Morocco, Peru, Sri Lanka, Kuwait, Qatar, Kenya, Bahrain, Bulgaria, Cuba, Hungary, Iraq, Uganda, Algeria, Argentina, Bosnia and Herzegovina, Botswana, Cyprus, Ethiopia, Palestine, Trinidad and Tobago, Tunisia, Albania, Brunei Darussalam, Lebanon, and so on. Additionally, Libya, Macao, Malawi, North Macedonia, Venezuela, Cambodia, Costa Rica, Fiji, Guinea, Iceland, Montenegro, Namibia, Rwanda, Uzbekistan, Zimbabwe, Afghanistan, Angola, Azerbaijan, Cape Verde, the Democratic Republic of the Congo, the Dominican Republic, El Salvador, Jamaica, Liechtenstein, the Maldives, Mongolia, Mozambique, Nepal, Niger, Puerto Rico, Sudan, the Syrian Arab Republic, Uruguay, and Yemen are also included in last group.

The highest productivity levels are generally observed in North America, Europe, and Asia. These countries are characterized by robust governmental support and well-established research centers, which frequently demonstrate a high level of relevance in the global scientific landscape. The emergence of countries such as Indonesia and Malaysia indicates a growing interest in research on the topic addressed here. Conversely, low productivity in specific regions may be attributed to economic constraints, limited funding, or the continued development of nascent or evolving educational systems.

An examination of the patterns of collaboration (Figure 2) reveals that China and the United States have the strongest relationships, followed by Australia and the United Kingdom, China and Malaysia, Canada and the United States, Egypt and Saudi Arabia, Malaysia and Indonesia, and Germany and Switzerland, among others. Generally, the countries with the greatest collaborative relationships have the highest productivity, such as the United States, China, Malaysia, Australia, the United Kingdom, and Indonesia.

The co-occurrence map of terms reveals the presence of ten distinct clusters (See Table 3 and Figure 3). Cluster 1 is concerned with the concept of academic self-efficacy, which may be defined as students' belief in their ability to perform academic tasks successfully. Furthermore, acceptance represents a pivotal element, potentially linked to social and emotional acceptance within the academic setting. Cluster 2 examines the concept of acceptance, which may include accepting new educational methodologies and students' emotional and social acceptance. Action research is a research approach included in this cluster, which indicates studies that seek to improve practices through active intervention. Cluster 3 is concerned with the specific requirements of adult learners and the means of providing them with adequate support for their educational and professional advancement. Cluster 4 is concerned with adaptive learning, a methodology that employs technology to personalize learning based on the individual needs of learners. Accessibility is also crucial in this context, as it ensures that all students can reap the benefits of these adaptive approaches.

Country	Productivity
United States	506
China	479
Indonesia	382
United Kingdom	293
Australia	270
Germany	220
Malaysia	212
Spain	190
India	114
Canada	112
Russian Federation	112
Turkey	94
Japan	91
Taiwan	87
Hong Kong	74
Italy	74
South Africa	73
Thailand	70
Belgium	66
Switzerland	56
Czech Republic	55
Netherlands	53
Saudi Arabia	53
Singapore	53
South Korea	53
Brazil	50
Portugal	50

Table 2. Country output on blended learning in Scopus: 2000-2023.

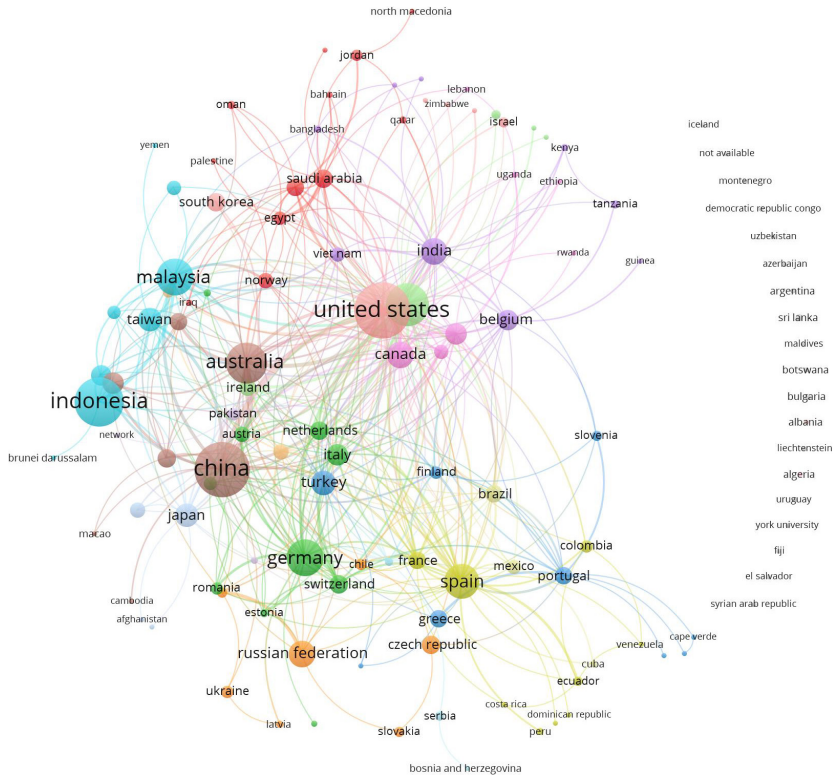

Figure 2. Country collaboration on blending learning research. Scopus: 2000-2023.

Cluster	Keywords	Average Year of Publication	Average Citations
1. Academic Self-Efficacy	academic self-efficacy, acceptance	2020	11
2. Acceptance	acceptance, action research	2019	12
3. Adult Education	adult education, adult learners	2017	14
4. Adaptive Learning	adaptive learning, accessibility	2018	17
5. Academic Performance	academic performance, achievement	2018	8
6 Activity Theory	activity theory, active learning	2015	9
7. Active Learning	active learning, accessibility	2017	12
8. Academic Achievement	academic achievement, autonomy	2018	23
9. Augmented Reality	augmented reality, authentic learning	2019	13
10. Anatomy	anatomy, academic achievement	2018	17

Tabla 3. Main clusters on blended learning based on Scopus data: 2000-2023.

Cluster 5 is concerned with the analysis of academic performance and achievement. Academic performance can be defined as how students engage with and demonstrate their knowledge and abilities in an educational setting. Achievement, on the other hand, refers to quantifiable successes within the context of education. The objective of studies in this field is to identify methodologies for enhancing performance, ascertain the factors that influence it, and develop metrics for measuring it. Cluster 6 examines activity theory, which posits that learning is a social activity mediated by cultural tools and historical contexts. This is connected to the concept of active learning, which emphasizes the potential of structured activities to facilitate learning. Cluster 7 is concerned with the methodology of active learning, which involves students directly in the learning process, thus making them active participants rather than

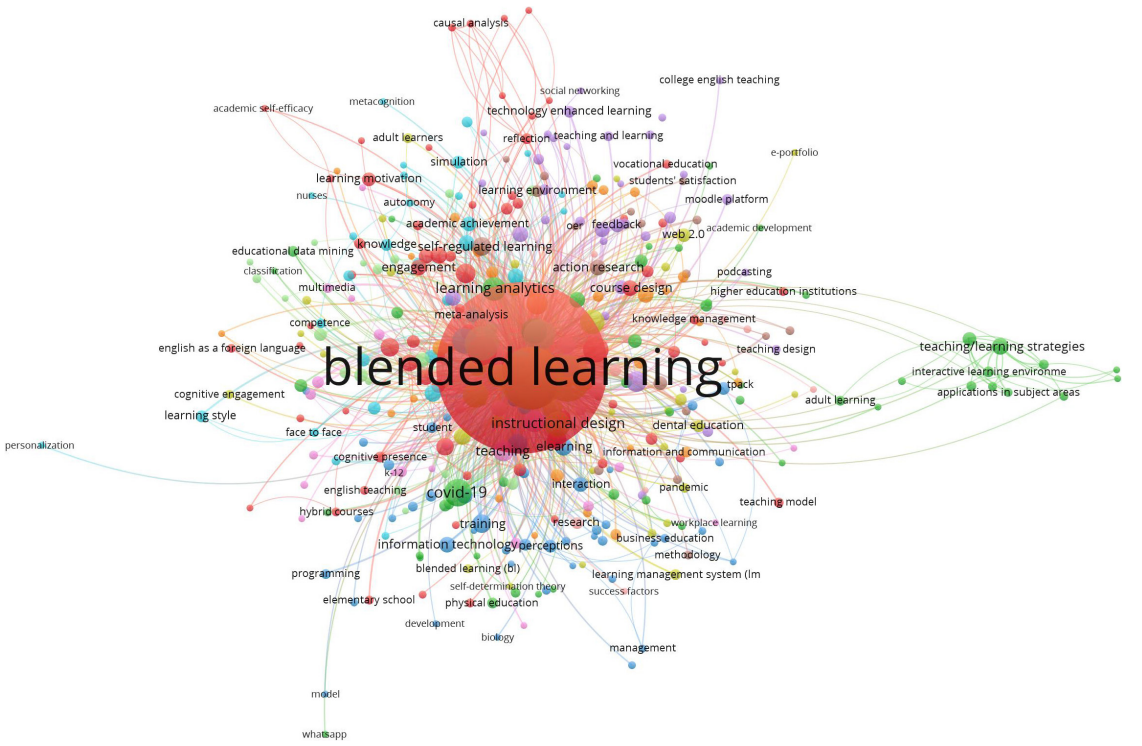

Figure 3. Clustering derived from the keywords on blended learning literature: Scopus, 2000-2023.

mere recipients of information. Accessibility is also a crucial element in this context. Cluster 8 examines the factors that contribute to a student's academic success. The inclusion of autonomy suggests that studies within this cluster focus on the influence of independence and self-regulation on academic achievement. Cluster 9 is concerned with integrating augmented reality technologies into authentic learning environments to enhance the learning experience and make it more meaningful. Finally, cluster 10 is concerned with teaching anatomy and its relationship to academic achievement. It explores the impact of teaching methodologies in anatomy on student performance in this area. Table 3 provides a brief overview of the clusters, indicating the associated keywords, their position in the analysis space, the link weight, the average year, and the average citations.

CONCLUSION

In conclusion, blended learning is characterized by a need for more extensive collaborative networks. This study's findings demonstrate a notable degree of autonomy and segregation among the communities of authors. There needs to be more robust and pervasive connections between authors. The country's productivity data highlight the necessity of sustained investment in research and development. The most productive countries benefit from a combination of robust funding, robust education systems, and strategic research initiatives. Emerging nations demonstrate promising growth, while efforts to enhance research capabilities in lower-productivity countries could contribute to a more balanced global research landscape.

Finally, the analysis of word co-occurrences provided a comprehensive understanding of the current trends and approaches in blended learning research. Clustering revealed thematic diversity and current relevance, an emphasis on personalization and accessibility of learning, growing interest in self-efficacy and autonomy, integration of new technologies, the importance of active learning and activity theory, and a focus on adult education.

Conflict of interests

The authors declare that there are no conflicts of interest.

Contribution statement

Abrahán Cesar Neri Ayala, Daniel Alberto Oswaldo Valenzuela Narváez: Conceptualization, formal analysis, methodology, writing - original draft.

Data curation, software, visualization: Abrahán Cesar Neri Ayala, Sergio La Cruz Orbe, Alexander Jorge Torres Anaya.

Validation, writing - review and editing: Gabriel Alberto Manes Cangana, Ender Ayala Huaynatte.

Statement of data consent

The data generated during the study have been included in the article. ●

REFERENCES

Castro, R. (2019). Blended learning in higher education: Trends and capabilities. *Education and Information Technologies, 24*(4), 2523-2546. DOI: 10.1007/s10639-019-09886-3.

Abuhassna, H., Van, N. T., Yahaya, N., Zakaria, M. A. Z. M., Awae, F., Al Zitawi, D. U. D., & Bayoumi, K. (2022). Strategies for Successful Blended Learning-A Bibliometric Analysis and Reviews. *Int. J. Interact. Mob. Technol., 16*(13), 66-80.

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.

Omar, R., Kaliappen, N., Khamis, K. A., & Sulisworo, D. (2021). Blended learning approach in graduate studies: A bibliometric analysis from 1997-2021. *International Journal of Information and Education Technology, 11*(11), 546-552.

Cruz-Cárdenas, J., Parra-Domínguez, J., Zabelina, E., Deyneka, O., & Ramos-Galarza, C. (2023, June). Blended learning and higher education: A bibliometric analysis. In *International Conference on Human-Computer Interaction* (pp. 456-465). Cham: Springer Nature Switzerland.

Santos, M. R. (2022). Blended learning compared to online learning in business, management, and accounting education: A bibliometric analysis and literature review. *Interdisciplinary and Practical Approaches to Managerial Education and Training,* 46-55.

Xiao, G., & Zhang, M. (2024). Knowledge Mapping of Blended Learning Classroom Environment Studies (1996-2023): A Bibliometric Analysis. *International Journal of Emerging Technologies in Learning (Online), 19*(1), 68.

Rosalinda, C., Budiwati, N., & Ramadhan, I. A. (2022). Blended Learning In Higher Education: A Bibliometric Analysis. *Pedagonal: Jurnal Ilmiah Pendidikan, 6*(2), 238-252.

Challco, G. C., da Silva, W. V., Gonçalves, B. S., de Almeida Levino, N., Bittencourt, I. M., Kaczam, F., ... & Paiva, R. O. A. (2024). Blended learning and media centers: A bibliometric analysis. *Social Sciences & Humanities Open, 10,* 100919.

Ibarra-Vargas, S. B., Awad, G., & Velásquez, J. D. (2023). A Bibliometric and Cluster Analysis of Blended Learning Literature. IEEE *Revista Iberoamericana de Tecnologias del Aprendizaje, 18*(1), 86-99.

Sheu, J. J. (2022). A Bibliometric Analysis on Blended Learning (2003-2021). *Journal of Education Research,* (339), 87-106.

Chen, H., Sun, D., Yang, Y., Looi, C. K., & Jia, F. (2023). Detecting and visualizing research trends of blended learning: A bibliometric analysis of studies from 2013-2022. *Eurasia Journal of Mathematics, Science and Technology Education, 19*(10), em2336.

Asmawi, A., Dong, H., Zhang, X., & Sun, L. (2024). Exploring the transformative power of blended learning for Business English majors in China (2012-2022) – A bibliometric voyage. *Heliyon*.

Eryanti, I., & Soebagyo, J. (2021). Bibliometric Analysis of Blended learning Mathematics in Scientific Publications Indexed by Scopus. Numerical: *Jurnal Matematika Dan Pendidikan Matematika,* 91-102.

Chi, J. (2021). Knowledge Mapping of Research on Blended Learning During 2000-2021 – Bibliometric Analysis Based on CiteSpace. *International Journal of Social Science and Education Research, 4*(9), 506-515.

Bonk, C. J., & Graham, C. R. (2006). *The Handbook of Blended Learning: Global Perspectives, Local Designs*. Pfeiffer.

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The Internet and Higher Education, 7*(2), 95-105.

Graham, C. R. (2006). Blended learning systems: Definition, current trends, and future directions. In C. J. Bonk & C. R. Graham (Eds.), *The Handbook of Blended Learning: Global Perspectives, Local Designs* (pp. 3-21). Pfeiffer.

Graham, C. R., Woodfield, W., & Harrison, J. B. (2013). A framework for institutional adoption and implementation of blended learning in higher education. *The Internet and Higher Education, 18,* 4-14.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2010). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*. U.S. Department of Education.

Picciano, A. G. (2009). Blending with purpose: The multimodal model. *Journal of Asynchronous Learning Networks, 13*(1), 7-18.

Vo, H. M., Zhu, C., & Diep, A. N. (2017). The effect of blended learning on student performance at course-level in higher education: A meta-analysis. *Studies in Educational Evaluation, 53,* 17-28.