

Blended Learning as a Catalyst for Critical Thinking in Higher Education: A Bibliometric Review (2015–2025)

Nurfitri Ramadana ^{a,1,*}, Ameh Timothy Ojochegbe ^{b,2}, Nadya Viranti Khamsiah ^{c,3}, Yayan Golis Firnando ^{d,4}

^{a,c} Yogyakarta State University, Jl Colombo No.1, Yogyakarta 55281, Indonesia

^b Prince Abubakar Audu University, Anyigba, Nigeria

^d STMIK In Pekanbaru, Jl. Duyung No.34, Pekanbaru, Indonesia

¹ nurfitriramadana.2022@student.uny.ac.id; ² Timothyameh.edu@gmail.com; ³ Nadyaviranti555@gmail.com;

⁴ yayangolisf@gmail.com

* Corresponding Author

ARTICLE INFO

Article history

Received September 20, 2025

Revised October 12, 2025

Accepted Month 19, 2025

Keywords

Blended Learning;

Problem-Based Learning;

Critical Thinking;

Flipped Classroom;

Learning systems

ABSTRACT

The advancement of information technology has driven the implementation of blended learning in higher education as an effective approach to enhance students' critical thinking skills. Therefore, this study aims to conduct a comprehensive bibliometric analysis to map global research trends, identify the most productive authors and institutions, and explore thematic developments in studies related to blended learning and critical thinking. This research employs a bibliometric approach using data retrieved from the Scopus database, covering publications from 2015 to 2025. Data analysis was performed using VOSviewer and R Bibliometrix software to visualize author collaboration networks, keyword co-occurrence, and thematic evolution. A total of 165 documents were analyzed to identify publication trends, collaboration patterns, and dominant research themes in the field. The results show a significant increase in publications on blended learning and critical thinking, with an average annual growth rate of 12.22% during the 2015–2025 period. This study involved 512 authors from 117 publication sources, with an international collaboration rate of 15.15%. Universitas Negeri Padang recorded the highest number of publications, followed by Yogyakarta State University and Indonesia University of Education, while the United States, the United Kingdom, and Indonesia were identified as the main global contributors. Keyword analysis revealed that critical thinking, higher education, flipped classroom, and problem-based learning are dominant themes, reflecting a shift toward the integration of innovative learning approaches. This study implies the importance of international and interdisciplinary collaboration to strengthen both the theoretical understanding and practical implementation of blended learning as an effective strategy for developing critical thinking and 21st-century skills in higher education.

©2025 The Author. This is an open-access article under the [CC-BY](#) license.



1. Introduction

The field of education continues to evolve rapidly with the advancement of information and communication technology, bringing significant changes, especially at the higher education level today. Thanks to technological progress, the transformation of methodologies and historical events has reshaped the objectives and methodologies of contemporary research into various pedagogical methods [1]. Particularly in higher education, which is the final level of education an individual

pursues, and plays a crucial role in the development of academic, social, and technical skills among students [2]. Although higher education has adopted face-to-face approaches, in the past decade, more flexible and technology-based approaches have increasingly developed. One popular innovation is the implementation of blended learning, an instructional model that integrates face-to-face learning with technology-based digital learning [3].

This blended learning model not only provides flexibility in the teaching and learning process but also offers opportunities to create a more interactive, collaborative, and contextual learning experience [4]. Blended learning, also known as hybrid learning, has become a subject in international literature [3]. The goal of blended learning is to provide stability in distance and face-to-face teaching and learning, as well as to open up great opportunities for the development of students' critical thinking skills [5].

In the context of higher education, the skills that must be possessed and the main focus of learning are critical thinking. Blended learning provides various advantages that can be catalysts in the development of critical thinking. By combining direct interaction and the use of technology, students can access various learning resources and actively engage in discussions [6]. This transformation is in line with the goal of higher education to prepare students to face the complexities of professional, social, and academic life in the digital technology era [7].

The blended learning model has emerged as an alternative model for teaching and learning today. This trend has seen significant growth, especially during the COVID-19 pandemic, which has accelerated the adoption of blended learning models in education [8]. In addition to improving accessibility and learning effectiveness, blended learning can enrich pedagogical strategies that focus on the development of Higher Order Thinking Skills (HOTS), namely critical thinking [9].

The world of higher education is increasingly recognizing the importance of blended learning, realizing its potential to optimize learning outcomes and provide a different learning experience for students. It combines the rich flexibility of online platforms with the interpersonal dynamics of face-to-face instruction [10]. Blended learning introduces a unique trend to meet diverse learning styles and needs. It optimizes independent study, collaborative learning, and prepares students for a more modern workplace in today's technological advances. Another significant aspect of blended learning and critical thinking in higher education is that it stimulates the interest of academics from various disciplines, including education, psychology, and sociology [7].

However, some researchers explain that conventional learning approaches tend to emphasize lower cognitive aspects, such as memorization, thereby creating pressure in learning and failing to foster critical thinking skills in students. In addition, the implementation of blended learning has not developed rapidly as a catalyst for critical thinking and still faces challenges, including the readiness of students and lecturers in using technology, as well as limitations in digital infrastructure to achieve transformative educational goals [11].

Specifically, several researchers conducted systematic reviews and meta-analyses focusing on the impact of blended learning on pharmacy education, showing a significant effect on knowledge and skills among pharmacy students compared to conventional learning [12]. In addition, several reviews of blended learning and microcredentials aim to retrain individuals' skills and then assess the integrity of microcredentials in a higher education ecosystem that improves employability and provides broader insights and benefits at both the institutional and individual levels [6].

Analysis of blended learning has been the subject of research and has developed significantly since its inception, influenced by technological transformation. The characteristics of blended learning and critical thinking have resulted in substantial and diverse research, demonstrating its capacity to transform higher education practices worldwide [13]. Student engagement in blended learning and critical thinking leads to more optimal learning outcomes and institutional effectiveness [14]. This blended learning approach serves as a reference for students to enhance their critical thinking skills during the teaching and learning process and shows a significant improvement in knowledge among students compared to conventional teaching approaches [15].

The urgency of this research lies in the need for higher education to comprehensively understand blended learning as a model and the latest trend in the context of higher education, considering the rapid transformation of digital usage in the educational domain [16]. Although the number of publications on blended learning has increased rapidly over the past decade, the existing studies remain fragmented and dispersed across various disciplines. Therefore, a comprehensive bibliometric analysis is needed to map the research development, identify collaborations among authors and institutions, and reveal the dominant themes that shape the future direction of studies in this field.

Specifically, this study has three main objectives, namely:

1. To identify the trends and transformations in research related to the effectiveness of blended learning on critical thinking in higher education.
2. To analyze the productivity of authors, institutions, and the most influential publication sources in this field.
3. To explore the keywords, research themes, and potential future research directions for the development of studies on blended learning and critical thinking.

Based on these three objectives, this study is expected to provide significant contributions, both theoretically and practically. Theoretically, the findings enrich the understanding of blended learning as an effective pedagogical approach for fostering critical thinking skills in higher education settings. Practically, the results of this study can serve as a reference for educators, researchers, and policymakers in designing learning strategies that are more adaptive, collaborative, and oriented toward the development of 21st-century skills.

2. Method

This study employs bibliometric analysis (Fig. 1). Bibliometric analysis is a popular and systematic approach used to explore and analyze large volumes of scientific data, aiming to identify patterns, trends, and impacts within a specific field [17], [18]. In this study, the identification phase was carried out by searching data in the Scopus Database using the keywords (TITLE-ABS-KEY (blended AND learning) AND TITLE-ABS-KEY (critical AND thinking)) AND PUBYEAR > 2015 AND PUBYEAR < 2025. From the initial search, 620 documents were found that are potentially relevant to the research topic. The data from Scopus was accessed on August 28, 2025, and the identified results served as the basis for further screening. This process aims to obtain a comprehensive overview of the available literature related to blended learning and critical thinking, which then serves as the foundation for further filtering.

The screening phase was conducted by adjusting the documents based on the relevant research areas. Of the 620 documents, 425 were eliminated due to their limitation to specific fields limited to "computer science, AND social sciences. These documents were excluded as they did not directly support the research objectives. After this process, 195 documents remained for further examination through the eligibility test. At the eligibility stage, 30 documents were excluded for not meeting the inclusion criteria, leaving 165 documents deemed eligible. The inclusion and exclusion criteria are as follows:

Inclusion Criteria

- Articles that contain the keywords (TITLE-ABS-KEY (blended AND learning) AND TITLE-ABS-KEY (critical AND thinking)).
- Publication year between 2015–2025 (PUBYEAR > 2015 AND PUBYEAR < 2025).
- Research field limited to Social Sciences (SOCI) and Computer Science (COMP).
- Articles written in English (LIMIT-TO (LANGUAGE, "English")).
- Articles available as full-text scholarly journals and relevant to the research topic.

Exclusion Criteria

- Articles that are not scholarly research articles (such as editorials, short reviews, non-academic reports, or conference abstracts).
- Articles that are not relevant to the topic of blended learning and critical thinking, even if they appear in the search results.
- Duplicate articles that appear more than once in the database.
- Articles that cannot be accessed in full.

A total of 165 documents that passed the eligibility stage were included in the bibliometric analysis. The analysis was conducted using RStudio (bibliometrix) to calculate research performance indicators, while network visualization and thematic mapping were performed using VOSviewer. This analysis includes publication trends, citation patterns, author collaborations, and the mapping of dominant keywords. With this approach, the study provides a comprehensive overview of the development of research on blended learning and students' critical thinking in an accurate and representative manner.

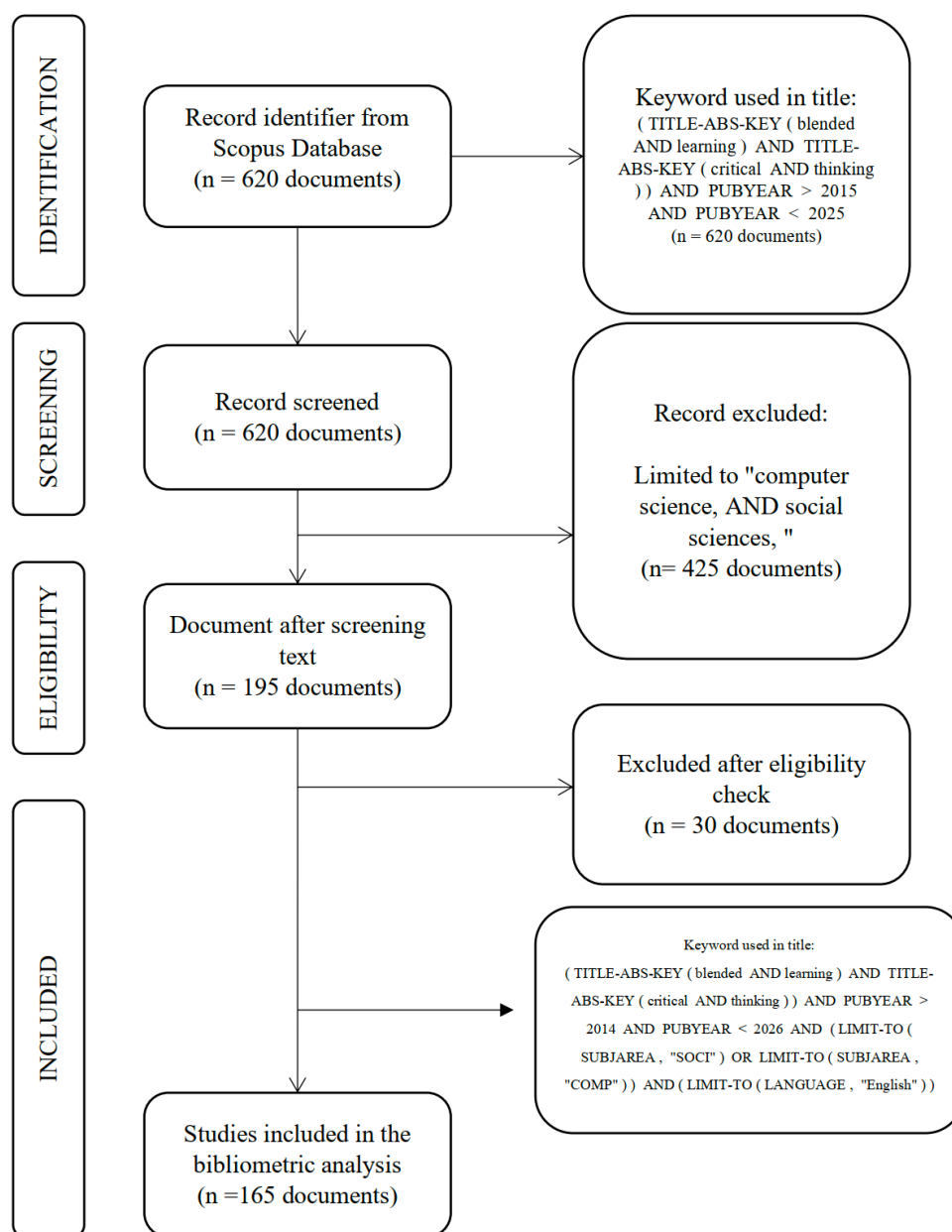


Fig. 1. The proposed method PRISMA

3. Results and Discussion

3.1. Main Information

Fig. 2 provides key information from the bibliometric analysis of publications on the topic Blended Learning as a Catalyst for Critical Thinking in Higher Education during the period 2015–2025, showing a positive development trend with an average annual growth rate of 12.22%. Of the 165 documents published in 117 sources, this research involved 512 authors with a strong collaboration pattern, reflected in the average of 3 - 4 authors per article and an international collaboration rate of 15.15%. The relatively young average document age (3.75 years) indicates that the issue of blended learning in enhancing critical thinking remains a current research focus. With an average of 15.21 citations per document, it is evident that this research has a significant academic impact and is highly relevant in the field of higher education. Additionally, the diversity of keywords, which reached 867, highlights the broad exploration of themes, opening opportunities for further research to strengthen the role of blended learning as a catalyst for enhancing students' critical thinking skills.

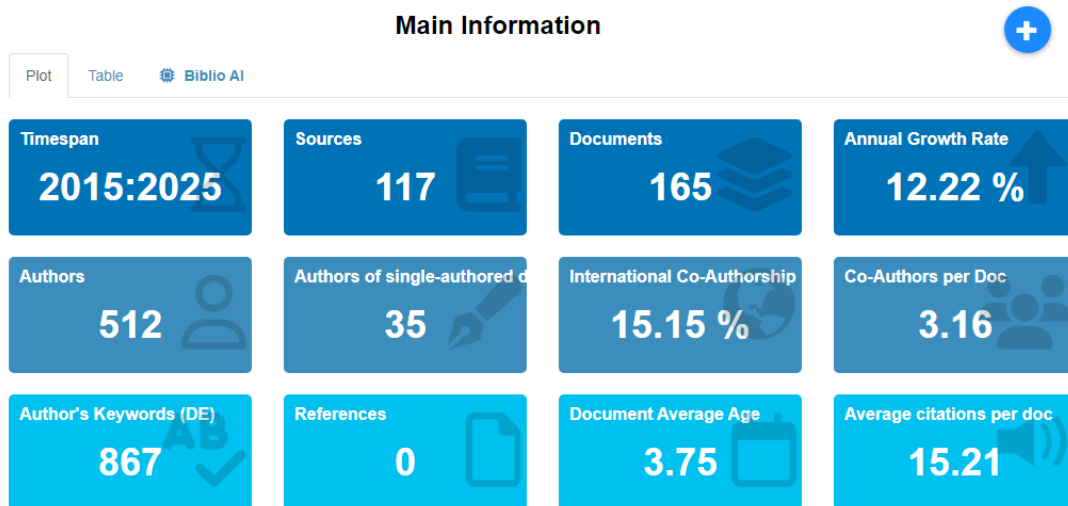


Fig. 2. Main Information to R Studio

3.2. Country-Level Scientific Production

Fig. 3 shows a world map representing the level of adoption and intensity of blended learning implementation across different global regions, with varying shades of blue. The United States, Europe, and Asia are seen as dominant in the development and application of this learning model. The differences in color intensity indicate variations in the use of educational technology, research, and the involvement of higher education institutions in simultaneously integrating face-to-face and online learning. The connecting lines between countries reflect academic collaboration across continents, particularly in knowledge transfer, experience exchange, and the strengthening of research networks aimed at enhancing the quality of education. Scientifically, this distribution illustrates that blended learning is not merely a local trend, but a transnational phenomenon that serves as a catalyst for the transformation of higher education, especially in developing students' critical thinking abilities through a more adaptive, interactive, and collaborative student-centered learning approach.

3.3. Documents by Affiliation in Blended Learning and Critical Thinking Research.

Fig. 4 shows the distribution of document numbers based on institutional affiliations contributing to research on Blended Learning as a Catalyst for Critical Thinking in Higher Education. Universitas Negeri Padang holds the top position with the highest number of publications, totaling five documents. Following closely are Universitas Negeri Yogyakarta and Universitas Pendidikan Indonesia, each with three publications. Meanwhile, several international institutions such as Helsingin Yliopisto,

Vanderbilt University, National University of Singapore, and NUS Yong Loo Lin School of Medicine show more limited contributions, with publication counts ranging from one to two documents. These findings indicate that research contributions on blended learning and critical thinking not only come from higher education institutions in Indonesia but also involve several prestigious global universities, although their contributions are still relatively small compared to domestic institutions.

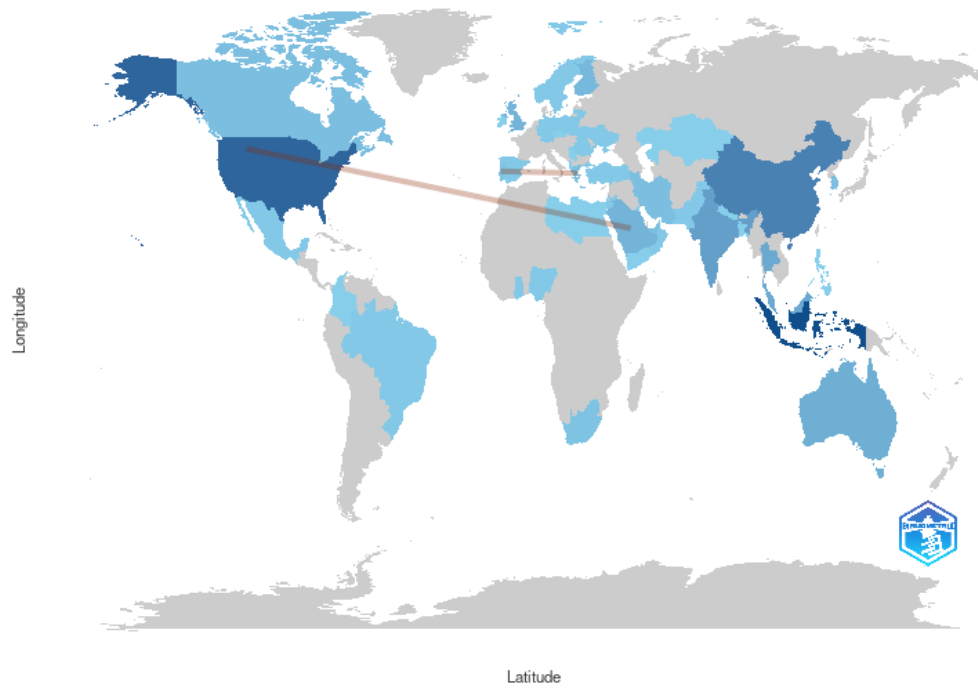


Fig. 3. Country-Level Scientific Production and International Collaboration in Blended Learning and Critical Thinking Research (2015–2025)

Documents by affiliation

Compare the document counts for up to 15 affiliations.

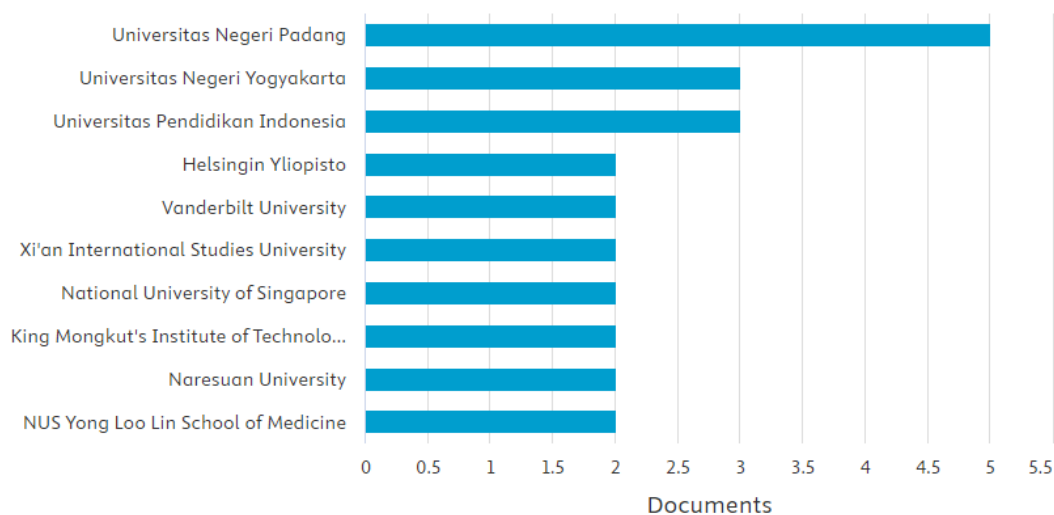


Fig. 4. Documents by Affiliation in Blended Learning and Critical Thinking Research

3.4. Author Productivity and Influential Documents

Fig. 5 and Table 1 show the productivity of authors, indicating that contributions to the research on Blended Learning as a Catalyst for Critical Thinking in Higher Education vary in terms of consistency and citation impact. Some authors, such as Hwang G and Zhang R, have highly cited publications, with Hwang's (2020) article receiving 24 citations and Zhang's (2020) receiving 61 citations, signaling significant influence in the study of blended learning and critical thinking. Meanwhile, Sulisworo D stands out with research from 2020 that examines the implementation of STEM in blended learning, yielding 36 citations. This indicates that publications from 2020 serve as a crucial foundation for the development of research in the following years.

Additionally, there are authors who have contributed consistently in recent years, such as Rahmi U and Azrul A, who have studied the optimization of discussion methods in blended learning to enhance students' higher-order thinking skills. Their publications from 2019–2022 emphasize research on higher-order thinking skills (HOTS) relevant to the context of higher education. Yang L also demonstrates consistency with two publications, in 2020 and 2024, highlighting the relationship between critical thinking and the Community of Inquiry model, as well as blended learning in nursing education. These contributions illustrate that blended learning is applied not only in general education but also in specific professional fields, such as nursing.

Other authors, such as Dumitru DE and Biberman-Shalev L, have started to make new contributions in recent years (2023–2025), focusing on university-industry collaboration and the utilization of digital technologies to support blended learning. Although their citation counts are still limited due to the relatively recent publication dates, their potential impact is considerable, especially with the increasing focus on the integration of AI and inclusive pedagogy. The emergence of these new publications reinforces the idea that blended learning research continues to evolve towards the integration of cutting-edge technologies, while expanding the scope of its application. Thus, the productivity patterns of authors reflect a combination of classic influential research and promising new studies pointing towards future directions of development.

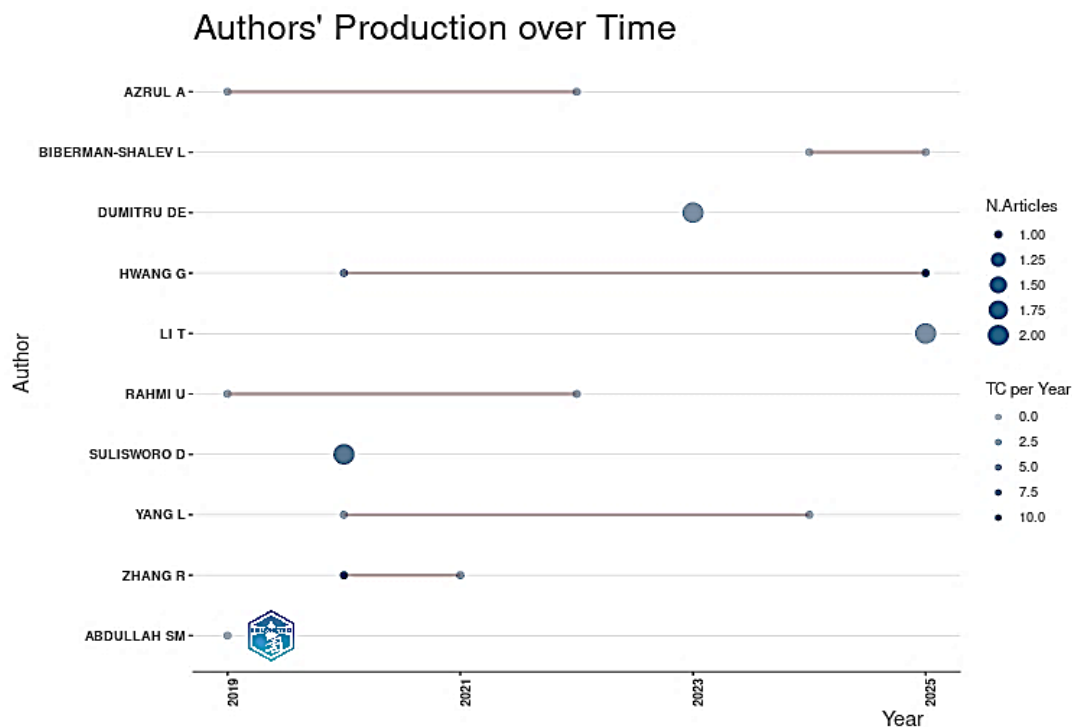


Fig. 5. Authors' Scientific Production and Citation Trends in Blended Learning and Critical Thinking Research (2019–2025)

Table 1. Selected Authors' Publications on Blended Learning and Critical Thinking (2019–2025)

Author	Year	TI	SO	DOI	TC	Tepy
Hwang G	2025	Developing Students' Creative Problem-Solving Strategies In The Context Of Blended Sports Education	British Journal Of Educational Technology	https://doi.org/10.1111/Bjet.13495	11	0
Zhang R	2020	Exploring Blended Learning Experiences Through The Community Of Inquiry Framework	Language Learning And Technology	https://doi.org/10.125/44707	61	2
Hwang G	2020	Effects Of The Group Leadership Promotion Approach On Students' Higher Order Thinking Awareness And Online Interactive Behavioral Patterns In A Blended Learning Environment	Interactive Learning Environments	https://doi.org/10.1080/10494820.2019.1636075	24	2
Sulisworo D	2020	The Impact Of The Use Of Stem Education Approach On The Blended Learning To Improve Student's Critical Thinking Skills	Universal Journal Of Educational Research	https://doi.org/10.13189/Ujer.2020.081503	36	11
Li T	2025	Exploring Human And Ai Collaboration In Inclusive Stem Teacher Training: A Synergistic Approach Based On Self-Determination Theory	Internet And Higher Education	https://doi.org/10.1016/J.lheduc.2025.101003	2	71
Li T	2025	Exploring Human And Ai Collaboration In Inclusive Stem Teacher Training: A Synergistic Approach Based On Self-Determination Theory	Internet And Higher Education	https://doi.org/10.1016/J.lheduc.2025.101003	2	71
Zhang R	2021	Blended Course Evaluation In The Context Of English For Specific Purposes: Accountability And Development	Sage Open	https://doi.org/10.1177/21582440211054502	11	80.5
Dumitru De	2023	University–Business Collaboration For The Design, Development, And Delivery Of Critical Thinking Blended Apprenticeships Curricula: Lessons Learned From A Three-Year Project	Education Sciences	https://doi.org/10.3390/Educsci13101041	6	90.5
Dumitru De	2023	Experimental Programs Of Critical Thinking Enhancement: A Worked-Based, Blended Learning Higher Education Curriculum For Economics	Education Sciences	https://doi.org/10.3390/Educsci13101031	6	277
Sulisworo D	2020	The Analysis Of The Critical Thinking Skills Between Blended Learning Implementation: Google Classroom And Schoology	Universal Journal Of Educational Research	https://doi.org/10.13189/Ujer.2020.081504	10	277

3.5. Collaboration Author

The visualization in Fig. 6 aims to demonstrate the collaboration patterns among authors in research on Blended Learning as a Catalyst for Critical Thinking in Higher Education. This visualization is used to map the scientific collaboration network, identify the most productive authors, and assess the extent of interconnectedness among research groups. It is evident that Rahmatul A occupies the most central position with the largest node size, indicating a high level of publication productivity and a dominant contribution to the research network. Several collaborations are formed in small pairs (dyads), such as Sulisworo D Ardianti S, Ariswan A Agphin Ramadhan MA, and Ameen M Alhebaishi S, showing the existence of research networks, although they remain limited to a small scope. The low interconnectedness between groups highlights that author collaborations are still fragmented and have not yet been widely integrated on an international scale. These findings suggest that, while the topics of blended learning and critical thinking continue to develop, research collaboration remains focused on local networks, leaving significant opportunities to strengthen cross-institutional and international collaborations.

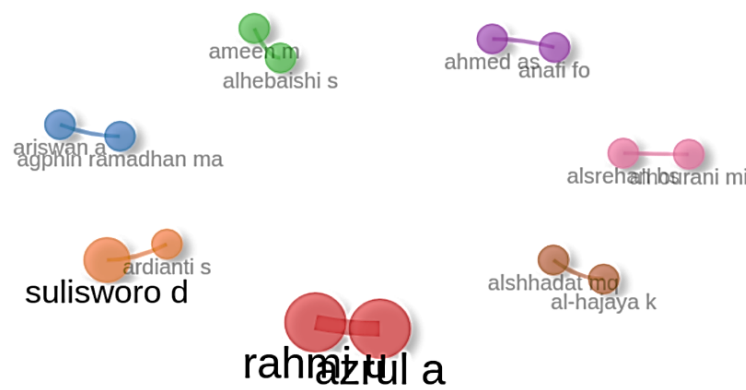


Fig. 6. Collaboration Patterns among Authors in Blended Learning and Critical Thinking

3.6. Thematic and Authorial Trends in Blended Learning and Critical Thinking

Fig. 7 shows the thematic map results, where the research themes are divided into four quadrants. In the Motor Themes quadrant (top right), the keywords 'students' and 'human learning' appear, indicating that research on blended learning is highly relevant and rapidly developing in the context of student learning. In the Basic Themes quadrant (bottom right), keywords such as 'blended learning,' 'education,' 'computing,' and 'learning systems' form the core of studies in this field but still require strengthening in theoretical and methodological development. Meanwhile, in the Niche Themes quadrant (top left), topics like adversarial machine learning, contrastive learning, and federated learning emerge, which are relevant in the context of advanced technologies but have not yet been strongly connected with the issue of blended learning in higher education. In the Emerging or Declining Themes quadrant (bottom left), there is a relative absence of topics, indicating that no new topics have truly emerged or old themes have been left behind in this field. Overall, this map shows that blended learning plays a key foundational role, while the primary focus of current research is shifting toward how this strategy supports student learning and the development of critical thinking skills.

3.7. Thematic Clusters and Keyword Co-Occurrence

Fig. 8 shows that Blended Learning appears as the focal point in the word cloud, emphasizing its crucial role as an educational approach that combines face-to-face interaction with online learning. Blended learning has been shown to enhance students' academic, behavioral, cognitive, and affective engagement from moderate to high levels [18]. According to Dumitru et al. (2023), the development of critical thinking skills through the implementation of a work-based blended learning curriculum in economics education significantly enhances students' critical thinking abilities [19], not only in the

field of economics, but in nursing as well, it has been found that blended learning in case-based problem solving effectively enhances students' critical thinking skills, confidence, and academic performance [20].

The emergence of terms such as 'critical thinking,' 'students,' and 'higher education' in the word cloud highlights the direct relationship between this teaching strategy and the development of critical thinking capacity. Effective teaching strategies have been shown to enhance critical thinking skills by engaging students actively through problem-based approaches, discussions, and inquiry-based learning [21], [22]. Furthermore, the enhancement of critical thinking in the context of higher education also requires structured instructional design, technological support, and self-directed learning capabilities, enabling students to manage the learning process independently and reflectively, which are key factors for the success of blended learning [23], [24]. Moreover, in higher education, the blended learning approach is highly effective in bridging the gap between theory and practice, providing flexible access to learning materials, and enhancing collaboration among students as well as between students and instructors [25], [26]. Thus, blended learning not only functions as a modern learning medium but also serves as a catalyst in developing 21st-century skills, particularly critical thinking, communication, and self-directed learning.

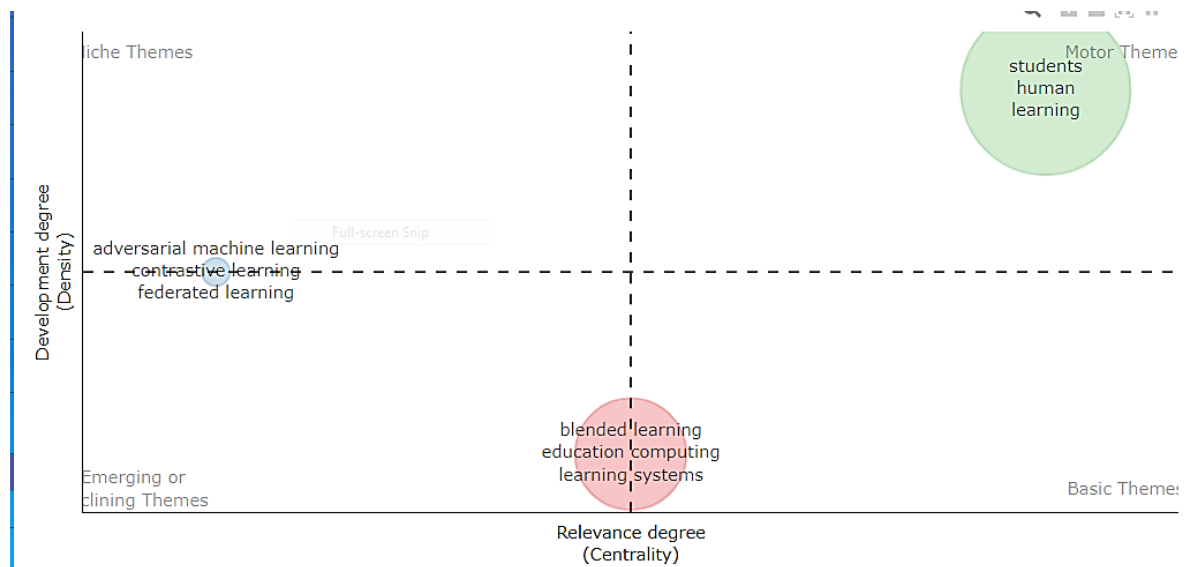


Fig. 7. Thematic Map of Blended Learning and Critical Thinking Research (2015–2025)



Fig. 8. Word Cloud of Keywords in Blended Learning and Critical Thinking Research

3.8. Keyword Novelty and Future Research Trajectories

"The emergence of the keyword 'problem-based learning' (PBL) in the most recent research from 2022 indicates an innovation in the blended learning approach, where this strategy is no longer standalone but integrated with a hybrid approach to encourage students to learn actively, collaboratively, and reflectively through real-world problem solving. Previous research on the implementation of the PBL model with high-quality blended learning methods shows that this strategy significantly enhances creativity, openness to experience, and critical thinking skills, although the retention effects remain unclear [30]. Furthermore, according to Houghton (2023), both PBL (problem-based learning) and blended learning (BL) have advantages in enhancing student engagement and understanding [31]. It can therefore be said that the integration of these two methods not only enhances the quality of learning but also strengthens students' critical thinking and collaboration skills.

Furthermore, the keyword 'Flipped Classroom' has become increasingly used in online and hybrid learning, as technology advances and the dynamics of higher education evolve. This model allows students to independently study materials through digital resources before face-to-face sessions, enabling class time to be focused on interactive discussions, case analysis, and problem-solving. According to Govindan & Kamath (2022), the flipped classroom, when scheduled appropriately, can motivate students and improve their learning outcomes [32]. Additionally, according to Baig and Yadegaridehkordi (2023), they highlight the role of technology and tools supporting the flipped classroom, with video creation tools, learning management systems, and collaborative platforms being crucial elements in its effectiveness [33]. Moreover, the flipped classroom teaching model can create a more dynamic learning environment and significantly increase student engagement in the learning process [34], [35]. Therefore, the implementation of the flipped classroom in higher education becomes an effective solution to improve the quality of learning, foster critical thinking skills, and facilitate more flexible and collaborative learning.

Learning systems and curricula are interconnected in the context of higher education, particularly in blended learning. Learning systems, such as Learning Management Systems (LMS), enable students to access materials flexibly and collaborate online. On the other hand, curricula need to be designed to integrate technology and support the development of critical thinking skills. As explained by Min (2023), an effective curriculum design in blended learning prioritizes technology to support active learning [36]. Research by Cannaos (2024) also highlights the importance of using learning systems to create a more flexible and dynamic learning experience [37]. Thus, the integration of learning systems and curricula, when designed effectively, is crucial for enhancing the quality of learning and developing students' critical thinking skills.

The novelty of these keywords is expected to enhance the understanding of the application of blended learning, PBL, and flipped classroom, which are increasingly integrated with technology in higher education. By utilizing learning systems, it is hoped that learning will become more flexible, collaborative, and support the development of students' critical thinking skills. The integration of technology and an appropriately designed curriculum can create a more dynamic and effective learning experience.

4. Conclusion

This study demonstrates that Blended Learning (BL) has proven to be an effective approach in enhancing students' critical thinking skills in higher education, showing a significant growth trend in related publications from 2015 to 2025. The integration of face-to-face and digital technologies in Blended Learning positively impacts student engagement and the development of higher-order thinking skills, although challenges related to technology readiness and infrastructure persist. The analysis underscores the importance of international collaboration and the development of innovative pedagogical approaches, such as flipped classrooms and problem-based learning, which are expected to strengthen the effectiveness of Blended Learning in addressing educational challenges in the digital age. Furthermore, the research highlights the need for continued exploration into the integration of emerging technologies and the adaptation of curricula to foster a more flexible, collaborative, and student-centered learning environment. These efforts will ultimately contribute to shaping the future of higher education and the continued advancement of critical thinking skills among students.

Future research is encouraged to expand bibliometric analysis by using databases other than Scopus, such as Web of Science or Google Scholar, to gain a more comprehensive overview of pedagogical research trends in learning environments. The use of a broader range of databases will allow researchers to identify more publications from various disciplines and international sources.

Declarations

Supplementary Materials: Supplementary materials of this study include the full dataset retrieved from Scopus and visualizations generated using VOSviewer and RStudio.

Author Contribution: Conceptualization, Writing - Initial Draft, Editing and Visualization, Methodology and Review & Editing, MFFA & NGAAR: Conceptualization, Formal analysis, Methodology and Review & Editing; SR: Validation and Monitoring. All authors have read and approved the published version of the manuscript.

Funding: This research received no external funding

Acknowledgment: The authors would like to thank Yogyakarta State University for the support and facilities provided during the research process. In particular, we appreciate the access provided to conduct a comprehensive data analysis.

Conflicts of Interest: The authors declare no conflict of interest

References

- [1] M. A. Ashraf, S. Mollah, S. Perveen, N. Shabnam, and L. Nahar, "Pedagogical Applications, Prospects, and Challenges of Blended Learning in Chinese Higher Education: A Systematic Review," *Front. Psychol.*, vol. 12, no. January, pp. 1–13, 2022, <https://doi.org/10.3389/fpsyg.2021.772322>.
- [2] O. T. Adigun, N. Mpofu, and M. C. Maphalala, "Fostering self-directed learning in blended learning environments: A constructivist perspective in Higher Education," *High. Educ. Q.*, vol. 79, no. 1, pp. 1–16, 2025, <https://doi.org/10.1111/hequ.12572>.
- [3] A. M. Haftador, B. Tehranineshat, Z. Keshtkaran, and Z. Mohebbi, "A study of the effects of blended learning on university students' critical thinking: A systematic review," *J. Educ. Health Promot.*, vol. 1, no. 12, p. 95, 2023, https://doi.org/10.4103/jehp.jehp_665_22.
- [4] L. Suna, A. Asmawib, X. Zhang, and H. Donga, "Exploring the transformative power of blended learning for Business English majors in China (2012–2022) – A bibliometric voyage," *Heliyon*, vol. 10, no. 2, 2024, <https://doi.org/10.1016/j.heliyon.2024.e24276>.
- [5] B. Mandal, "Blended Learning in Higher Education: A Comprehensive Review," *Global Dimensions of Multidisciplinary Research*, Oct. 2020, <https://doi.org/10.25215/8198963413.05>.
- [6] H. Sharma, V. Jain, E. Mogaji, and A. S. Babbilid, "Blended learning and augmented employability: a multi-stakeholder perspective of the micro-credentialing ecosystem in higher education," *Int. J. Educ. Manag.*, vol. 4, no. 38, 2024, <https://doi.org/10.1108/IJEM-12-2022-0497>.
- [7] Asrowi, I. Maulana, M. K. Budiarto, and T. S. Qodr, "Assessing critical thinking skills in vocational school students during hybrid learning," *J. Educ. Learn.*, vol. 19, no. 1, pp. 232–240, 2025, <https://doi.org/10.11591/edulearn.v19i1.21754>.
- [8] N. Megahed and A. Hassan, "A blended learning strategy: reimagining the post-Covid-19 architectural education," *Archnet-IJAR Int. J. Archit. Res.*, vol. 1, no. 16, pp. 184–202, 2022, <https://doi.org/10.1108/ARCH-04-2021-0081>.
- [9] S. Cacciamani, V. Perrucci, and N. Fujita, "Promoting Students' Collective Cognitive Responsibility through Concurrent, Embedded and Transformative Assessment in Blended Higher Education Courses," *Tech Know Learn*, vol. 26, 2021, <https://doi.org/10.1007/s10758-021-09535-0>.
- [10] D. Lu, "Students' Perceptions of a Blended Learning Environment to Promote Critical Thinking," *Front. Psychol.*, vol. 12, no. June, pp. 1–9, 2021, <https://doi.org/10.3389/fpsyg.2021.696845>.
- [11] R. Ali, "Drivers and Barriers for Institutional Adoption and Diffusion of Blended Learning in Higher Education," *Springer*, pp. 79–92, 2024, https://doi.org/10.1007/978-981-97-9388-4_5.
- [12] A. Balakrishnan *et al.*, "Effectiveness of blended learning in pharmacy education: A systematic review and meta-analysis," *PLoS One*, vol. 6, no. 16, 2021, <https://doi.org/10.1371/journal.pone.0252461>.
- [13] A. Kumar, R. Krishnamurthi, S. Bhatia, K. Kaushik, N. J. Ahuja, and A. Nayyar, "Blended Learning Tools and Practices: A Comprehensive Analysis," *IEEE Access*, vol. 9, pp. 85151–85197, 2021, <https://doi.org/10.1109/ACCESS.2021.3085844>.
- [14] R. Ali, "Drivers and Barriers for Institutional Adoption and Diffusion of Blended Learning in Higher Education," *Case Studies on Blended Learning in Higher Education: Policy, Planning and Quality Assurance*, pp. 73–92, 2024, https://doi.org/10.1007/978-981-97-9388-4_5.

- [15] M. De Bruijn-Smolters and F. R. Prinsen, "Effective student engagement with blended learning: A systematic review," *Heliyon*, vol. 10, no. 23, 2024, <https://doi.org/10.1016/j.heliyon.2024.e39439>.
- [16] C. Korson, "A place-based approach to blended learning," *J. Geogr. High. Educ.*, vol. 4, no. 47, pp. 569–588, 2022, <https://doi.org/10.1080/03098265.2022.2122032>.
- [17] I. Passas, "Bibliometric Analysis: The Main Steps," *Encyclopedia*, vol. 4, no. 2, pp. 1014–1025, 2024, <https://doi.org/10.3390/encyclopedia4020065>.
- [18] N. Donthu, S. Kumar, D. Mukherjee, N. Pandey, and W. M. Lim, "How to conduct a bibliometric analysis: An overview and guidelines," *J. Bus. Res.*, vol. 133, no. March, pp. 285–296, 2021, <https://doi.org/10.1016/j.jbusres.2021.04.070>.
- [19] D. Dumitru, M. Minciu, R. A. Mihaila, R. Livinti, and M. E. Paduraru, "Experimental Programs of Critical Thinking Enhancement: A Worked-Based, Blended Learning Higher Education Curriculum for Economics," *Educ. Sci.*, vol. 13, no. 10, 2023, <https://doi.org/10.3390/educsci13101031>.
- [20] Z. Yu *et al.*, "Effects of blended versus offline case-centred learning on the academic performance and critical thinking ability of undergraduate nursing students: A cluster randomised controlled trial," *Nurse Educ. Pract.*, vol. 53, no. May, p. 103080, 2021, <https://doi.org/10.1016/j.nepr.2021.103080>.
- [21] M. A. Almula, "Constructivism learning theory: A paradigm for students' critical thinking, creativity, and problem solving to affect academic performance in higher education," *Cogent Educ.*, vol. 10, no. 1, 2023, <https://doi.org/10.1080/2331186X.2023.2172929>.
- [22] M. V. López-Pérez, M. C. Pérez-López, and L. Rodríguez-Ariza, "Blended learning in higher education: Students' perceptions and their relation to outcomes," *Comput. Educ.*, vol. 56, no. 3, pp. 818–826, 2011, <https://doi.org/10.1016/j.compedu.2010.10.023>.
- [23] Z. Yu, W. XU, and P. Sukjairungwattana, "Meta-analyses of differences in blended and traditional learning outcomes and students' attitudes," *Front. Psychol.*, vol. 13, 2022, <https://doi.org/10.3389/fpsyg.2022.926947>.
- [24] C. Dziuban, C. R. Graham, P. D. Moskal, A. Norberg, and N. Sicilia, "Blended learning: the new normal and emerging technologies," *Int. J. Educ. Technol. High. Educ.*, vol. 15, no. 1, pp. 1–16, 2018, <https://doi.org/10.1186/s41239-017-0087-5>.
- [25] A. Anton, S. Ravazzani, G. Baquerizo-Neira, C. A. Carbone, and D. Mukiza, "Bridging practice and academia: Global insights on the role and future of public relations education," *Public Relat. Rev.*, vol. 51, no. 5, p. 102620, 2025, <https://doi.org/10.1016/j.pubrev.2025.102620>.
- [26] C. Müller and T. Mildenerberger, "Facilitating flexible learning by replacing classroom time with an online learning environment: A systematic review of blended learning in higher education," *Educ. Res. Rev.*, vol. 34, no. April, p. 100394, 2021, <https://doi.org/10.1016/j.edurev.2021.100394>.
- [27] H. Y. Kang and H. R. Kim, "Impact of blended learning on learning outcomes in the public healthcare education course: a review of flipped classroom with team-based learning," *BMC Med. Educ.*, vol. 21, no. 1, pp. 1–8, 2021, <https://doi.org/10.1186/s12909-021-02508-y>.
- [28] F. Kilipiris, S. Avdimiotis, E. Christou, A. Tragouda, and I. Konstantinidis, "Bloom's Taxonomy Student Persona Responses to Blended Learning Methods Employing the Metaverse and Flipped Classroom Tools," *Educ. Sci.*, vol. 14, no. 4, 2024, <https://doi.org/10.3390/educsci14040418>.
- [29] V. Chuts-Pérez, R. P. Esteve-Faubel, M. P. Aparicio-Flores, and J. M. Esteve-Faubel, "Enhancing visual and plastic education training: a blended learning and flipped classroom approach," *J. New Approaches Educ. Res.*, vol. 13, no. 1, 2024, <https://doi.org/10.1007/s44322-024-00011-y>.
- [30] X. Wang, T. Ratanaolarn, and J. Sitthiworachart, "Integrating project-based blended learning and design thinking to enhance creativity and openness to experience," *Cogent Educ.*, vol. 12, no. 1, p., 2025, <https://doi.org/10.1080/2331186X.2025.2500760>.
- [31] J. Houghton, "Learning modules: problem-based learning, blended learning and flipping the classroom," *Law Teach.*, vol. 57, no. 3, pp. 271–294, 2023, <https://doi.org/10.1080/03069400.2023.2208017>.
- [32] S. Govindan and M. G. Kamath, "Flipped Classrooms with Proper Scheduling Improve Learning Engagement," *Educ. Heal. Chang. Learn. Pract.*, vol. 35, no. 3, pp. 113–114, 2022,

https://doi.org/10.4103/efh.EfH_57_19.

- [33] M. I. Baig and E. Yadegaridehkordi, "Flipped classroom in higher education: a systematic literature review and research challenges," *Int. J. Educ. Technol. High. Educ.*, vol. 20, no. 1, 2023, <https://doi.org/10.1186/s41239-023-00430-5>.
- [34] S. Stajić *et al.*, "How the Flipped Classroom Affects Year Seven Students in Geography Test Results: A Case Study of Two Primary Schools in Serbia," *Sustain.*, vol. 17, no. 6, pp. 1–21, 2025, <https://doi.org/10.3390/su17062464>.
- [35] Q. Zhou and H. Zhang, "Flipped Classroom Teaching and ARCS Motivation Model: Impact on College Students' Deep Learning," *Educ. Sci.*, vol. 15, no. 4, 2025, <https://doi.org/10.3390/educsci15040517>.
- [36] W. M. and Z. Yu, "A Systematic Review of Critical Success Factors in Blended Learning," *Educ. Sci.*, vol. 13, no. 5, p. 469, 2023, <https://doi.org/10.3390/educsci13050469>.
- [37] C. Cannaos, G. Onni, and A. Casu, "Blended Learning: What Changes?," *Sustain.*, vol. 16, no. 20, 2024, <https://doi.org/10.3390/su16208988>.