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Trends in Pedagogical Research: A Scopus-Based Bibliometric Analysis of Learning Environments (2000–2025)

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ABSTRACT

This study conducts a bibliometric analysis of pedagogical research in learning environments indexed in Scopus between 2000 and 2025. From an initial 5,869 records, 713 articles were identified through the PRISMA protocol and analyzed to map publication trends, thematic clusters, and institutional contributions. Results show a sharp increase in publications after 2016, with a peak in 2023 (67 articles), reflecting the growing interest in digital pedagogy. The United States dominates the field with 351 documents and 3,565 citations, followed by the United Kingdom and Australia. Three major clusters were identified: (1) technology-based environments such as e-learning, blended learning, and virtual reality; (2) pedagogical designs including problem-based learning, educational computing, and human–computer interaction; and (3) human-centered approaches focusing on professional development, students, and socio-emotional aspects. This study highlights the research gap in long-term global mapping of pedagogical studies and contributes by visualizing 25-year trends, leading contributors, and keyword evolution. The findings provide implications for policymakers, educators, and researchers in adopting adaptive, technology-integrated, and inclusive pedagogical practices that promote both academic achievement and student well-being.

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1. Introduction

Education, as the foundation for human resource development and social progress, has continuously evolved in line with technological advances, globalization, and changing societal demands [1], [2], [3], [4], [5], [6], [7]. This transformation has encouraged educators and researchers to design innovative and adaptive pedagogical approaches, shifting from traditional classroom-based learning to technology-enhanced environments that significantly affect teaching and learning processes [6], [8], [9]. Consequently, learning environments have become increasingly complex, encompassing physical spaces, pedagogical approaches, social interactions, and technology integration, extending beyond formal classrooms to include informal, contextual, and virtual settings that enrich students' learning experiences [10].

Several studies highlight that the learning environment plays a crucial role in shaping students' motivation, engagement, and academic outcomes [11], [12], [13]. A well-designed environment fosters active participation, enhances achievement, and can be strengthened through collaborative

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strategies supported by artificial intelligence, which has proven effective in improving engagement and performance [14], [15]. Collaborative, flexible, and technology-based settings also enhance teacher–student interaction, promote active learning, and support the development of 21st-century skills tailored to individual needs [16], [17]. Therefore, pedagogical design must integrate mental and emotional development to ensure more effective and meaningful learning experiences.

Pedagogy is an approach that prioritizes effective teaching strategies and methods to support student development within the learning environment [18], in pedagogical practice, five strategies are commonly employed, namely modeling, guidance, monitoring, scaffolding, and fostering [19], All of these strategies work synergistically to provide continuous support, enhance student engagement, and facilitate independent mastery of subject matter. By integrating these five strategies, teachers can more effectively facilitate adaptive learning processes that are responsive to individual students' needs, thereby enabling pedagogy within the learning environment to improve student engagement, motivation, and academic achievement. However, such achievements also largely depend on a deeper understanding of how teaching methods, strategies, and learning media, as well as students' psychological well-being, interact in creating more effective learning experiences.

Pedagogical research in the context of learning environments is essential to explore how teaching methods, strategies, and media can be optimized to create more effective learning experiences [20]. In addition, psychological and physical well-being also influence students' actions in various learning processes, including their attitudes, engagement, and commitment during learning activities [21]. Research conducted by Boman et al. (2025) concludes the importance for educators and institutions to create a learning environment that supports well-being, teaching strategies, as well as awareness and openness regarding mental health [22]. Horverak (2024) emphasizes the importance of creating an inclusive school environment that supports the psychological well-being of both students and teachers, with the aim of achieving optimal academic outcomes and mental health through a positive and inclusive school climate [23]. A learning environment supported by technology and positive psychological conditions can help students develop resilience, emotional awareness, and a sense of belonging, all of which are essential for their mental health and academic success [24], [25]. Therefore, creating a learning environment that supports students' psychological well-being, takes into account emotional and social aspects, and integrates both technology and positive psychological approaches is of great importance.

As the concept of education continues to evolve, pedagogical research has shifted its focus from traditional approaches toward the integration of digital technology, collaborative learning, and personalization [26], [27]. Given this transformation, pedagogical research has increasingly focused on digital integration, collaborative learning, and human-centered frameworks. However, despite several bibliometric analyses, few studies have systematically mapped a 25-year trajectory (2000–2025) at the global level. This study seeks to fill that gap by identifying publication trends, geographical distributions, institutional contributions, and keyword evolution in pedagogical research.

The bibliometric analysis of articles published between 2000 - 2025 aims to reveal patterns that can deepen the understanding of the effectiveness of various approaches. The study is expected to provide a clearer picture of the contributions of technology, innovative teaching methods, and inclusive policies in creating learning environments that support students' holistic well-being. Ultimately, this research underscores the urgency of understanding how technology and pedagogical approaches contribute to student motivation, engagement, and academic achievement.

Objectives:

1. To map global publication trends in pedagogical research (2000–2025).
2. To identify leading countries, institutions, and authors contributing to the field.
3. To analyze keyword novelty and thematic clusters using bibliometric visualization.
4. To propose recommendations for adaptive and inclusive pedagogy in the digital era.

2. Method

This study employs a bibliometric approach to examine the trends, patterns, and contributions of pedagogical research within learning environments. The dataset was retrieved from the Scopus database using the search string TITLE("Pedagogy") AND TITLE("Learn"), covering publications from 2000 to 2025, and extracted on August 6, 2025. Scopus was selected because of its comprehensive coverage, international reputation, and reliability as one of the largest indexing systems for peer-reviewed literature. By using this database, the study ensures that the analysis captures a wide representation of global research in the field of pedagogy.

The article selection process (Fig. 1) followed the PRISMA guidelines to ensure transparency and rigor. At the identification stage, 5,869 records were retrieved with no duplicates. Screening was then conducted systematically on the basis of predefined inclusion and exclusion criteria to ensure the relevance and quality of the data. This process resulted in the elimination of most records, leaving only the articles that met the criteria for further analysis using a bibliometric approach.

Inclusion:

(1) peer-reviewed journal articles indexed in Scopus,
(2) written in English,
(3) focused on pedagogy within learning environments, (4) available in full text.

Exclusion:

(1) proceedings, editorials, or short notes,
(2) publications not directly related to pedagogy,
(3) articles without full access.

The eligibility stage was conducted to ensure the relevance of the articles to the research focus. At this stage, 714 articles were assessed in detail, and one article was excluded for not meeting the established criteria. This resulted in a final dataset of 713 articles, all of which were analyzed bibliometrically to map publication trends, distribution by year and country, and emerging thematic areas in pedagogical research within learning environments. The analysis was further supported by VOSviewer software, which was used to produce bibliometric visualizations such as co-authorship networks, keyword co-occurrence maps, and thematic cluster diagrams, thereby providing a more comprehensive understanding of structural relationships in the field.

3. Results and Discussion

3.1. Document by Year

Based on Fig. 2, the number of research publications on pedagogy in learning environments shows a significant upward trend from 2000 to 2025. In the early period (2000–2006), the number of publications was still relatively low and fluctuating, with an average of fewer than 15 documents per year. This indicates that the topic of pedagogy in the context of learning had not received much attention in the early 2000s.

During the period 2007–2016, the number of publications consistently increased. Significant surges were observed in 2008 and 2012–2013, with nearly 30 articles published per year. A sharper rise occurred after 2016, when the number of publications reached more than 50 documents per year in 2018–2019. This trend reflects the growing attention of researchers to pedagogical issues, in line with the development of digital learning paradigms and educational innovations.

The peak of publications occurred in 2023 with approximately 67 documents, marking the highest figure throughout the study period. However, in 2025, there was a considerable decline to around 24 publications. This decrease may be attributed to the limitation of data for the ongoing year (not yet fully indexed in Scopus) or a potential shift in research focus to other issues. Overall, the trend

illustrated in the graph indicates a global increase in interest in pedagogical research, particularly during the last decade.

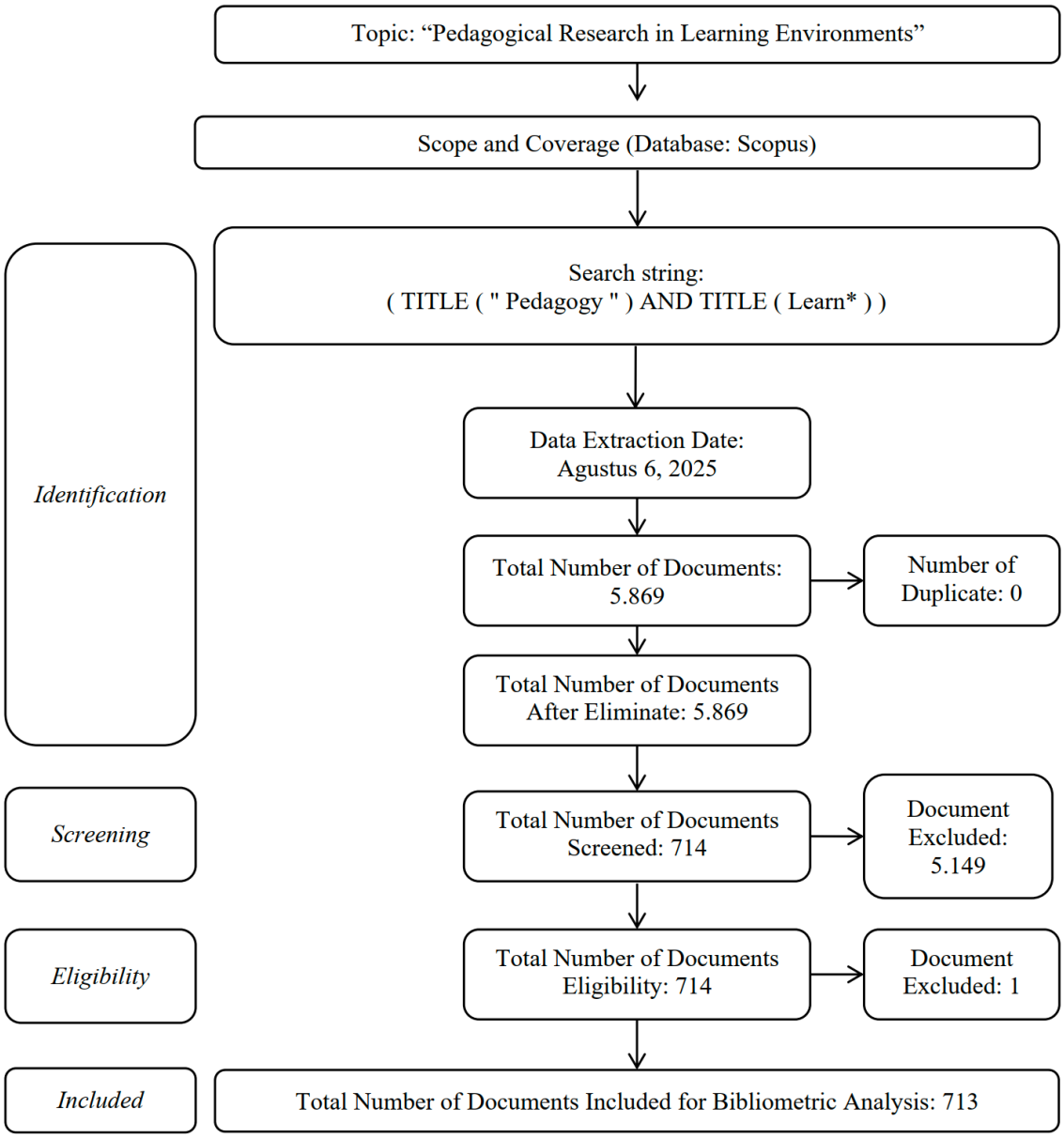


Fig. 1. The proposed method

3.2. Document by Country

Based on Fig. 3 and Table 1, the United States occupies a central position in the publication network of pedagogical research in learning environments. This is reflected in the significantly larger node size compared to other countries, indicating a dominant number of documents and citations. The tabular data supports this visualization, with the United States producing 351 documents and receiving 3,565 citations, making it the main contributor as well as the hub of international collaboration. In addition to the United States, other countries that play an important role are Australia (61 documents, 1,357 citations) and the United Kingdom (68 documents, 1,265 citations). Both countries hold strategic positions with a high level of collaboration, not only with the United States but also with European countries such as Ireland, Finland, the Netherlands, and Spain. This demonstrates the

existence of a strong academic network in the Anglo-Saxon and Western European regions in advancing pedagogical research.

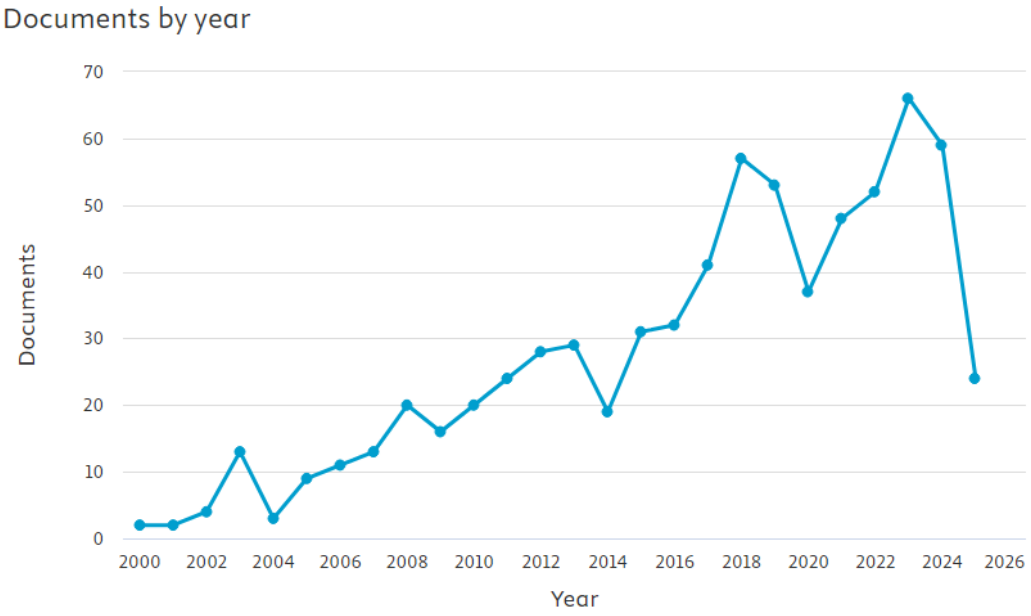


Fig. 2. Visualization Documents by year

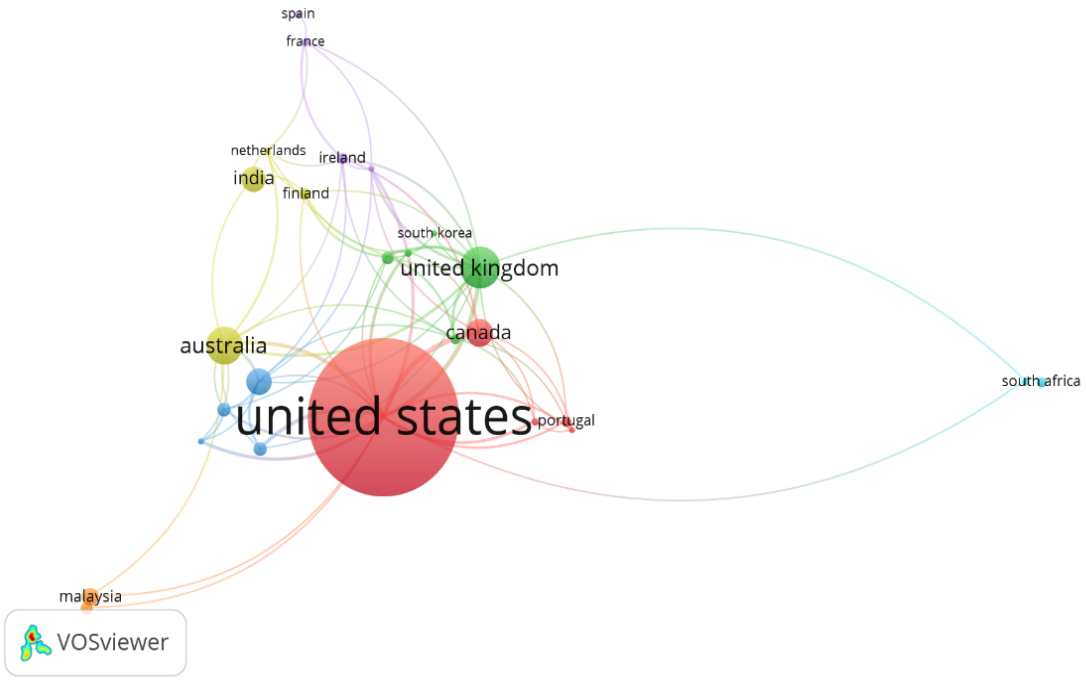


Fig. 3. Visualization Documents by Country

On the other hand, countries such as Sweden, Canada, Hong Kong, Singapore, Finland, Ireland, and Spain have relatively smaller yet still significant contributions in enriching the literature. Although their number of documents is fewer (less than 50), the citations they have received are relatively high for example, Sweden with 16 documents and 536 citations indicating strong publication quality. Meanwhile, several Asian countries such as Malaysia, India, and South Korea have begun to emerge in the collaboration network, although their contributions remain limited. Overall, this visualization map indicates that pedagogical research in learning environments is dominated by developed countries, with the United States serving as the primary hub of global collaboration.

Table 1. The most productive country in publishing research on Pedagogy in Learning Environments

No	Country	document	Citations
1	United States	351	3565
2	Australia	61	1357
3	United Kingdom	68	1265
4	Sweden	16	536
5	Canada	42	448
6	Hongkong	17	447
7	Singapore	17	373
8	Finland	14	314
9	Ireland	14	255
10	Spain	9	174

3.3. Based on Affiliation

Based on Fig. 4 and Table 2, the most productive affiliations in publications related to Pedagogical Research in Learning Environments are dominated by universities in the United States. The University of California, Berkeley and Stanford University occupy the top positions with 11 documents each, followed by the University of Michigan, Ann Arbor (8 documents), Carnegie Mellon University (7 documents), MIT (6 documents), and Purdue University (6 documents). This highlights the central role of the United States as a global research hub in pedagogy, both in terms of publication quantity and the academic networks established.

On the other hand, several universities outside the United States also make significant contributions. Victoria University Melbourne (Australia) has 7 documents with a relatively high citation count of 156, while The University of Hong Kong recorded the highest citation count (264) despite producing only 6 documents. Contributions from Canadian universities such as the University of British Columbia (6 documents, 90 citations) and the University of Toronto (6 documents, 76 citations) are also noteworthy. These findings demonstrate that, beyond the dominance of the United States, there are other research centers in Asia and Australia with significant impact, indicating that the quality of research is not solely determined by the number of publications but also by the influence generated through citations.

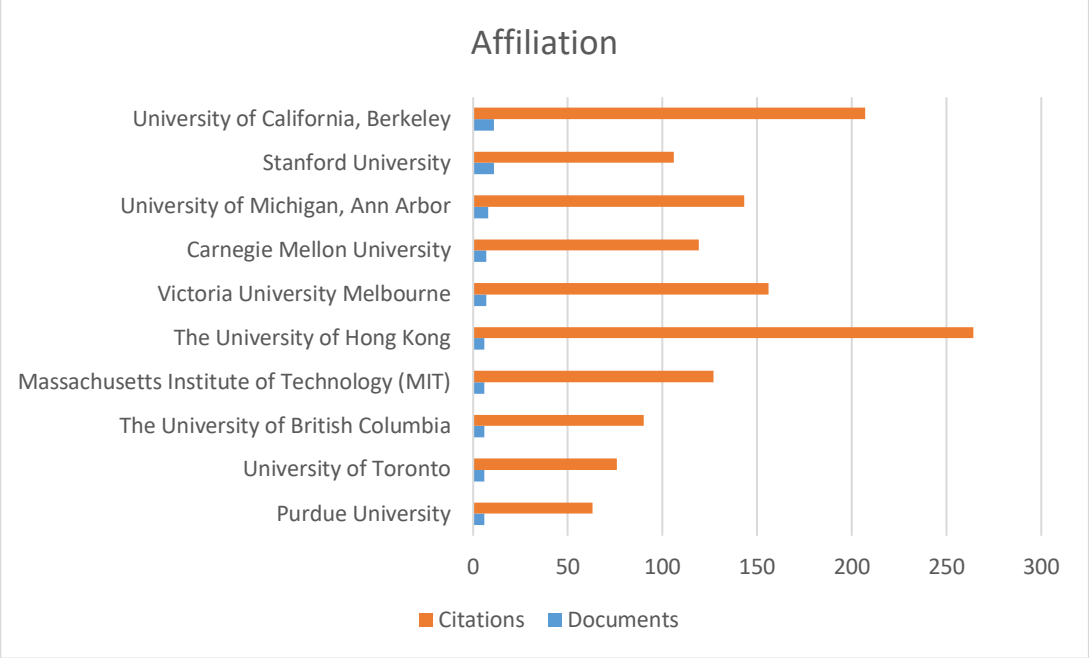


Fig. 4. Bar chart of the most productive affiliations in pedagogical research (2000–2025) based on Scopus data, showing number of documents and citations

Table 2. The Most Productive Affiliations in Publications on Pedagogy in Learning Environments

No	Organization	Country	Documents	Citations
1	University of California, Berkeley	United States	11	207
2	Stanford University	United States	11	106
3	University of Michigan, Ann Arbor	United States	8	143
4	Carnegie Mellon University	United States	7	119
5	Victoria University Melbourne	Australia	7	156
6	The University of Hong Kong	Hong Kong	6	264
7	Massachusetts Institute of Technology (MIT)	United States	6	127
8	The University of British Columbia	Canada	6	90
9	University of Toronto	Canada	6	76
10	Purdue University	United States	6	63

3.4. Based on Authors

Based on Table 3, it is evident that research contributions on Pedagogical Learning Environments are dominated by several key authors with a substantial number of publications and citations. The author with the highest number of publications is Carla Luguetti, with 5 documents and a total of 109 citations. Although the number of documents produced is not significantly different from other authors, her position underscores consistency in producing scholarly works in the field of pedagogy. Meanwhile, Patrick Shafto stands out with the highest number of citations, namely 239 from 4 documents, indicating that his works have a greater academic impact despite having fewer publications compared to Luguetti.

In addition, authors such as Samuel Kai Wah Chu and Tsz Kit Davy Ng each produced 4 publications with identical citation counts (208), suggesting strong collaboration or overlapping research themes between the two. Other names such as Arnold Neville Pears, Cynthia Putnam, and Emma J. Rose are also noted as productive authors with relatively high citations, reflecting the diversity of focus and academic influence in this field. Meanwhile, authors such as Ní Chróinín, Déirdre, Ann Macphail, and Elizabeth Baraff Bonawitz, although having relatively lower citation counts, still demonstrate important contributions through consistent publications. Overall, this table illustrates that pedagogical research in learning environments has not only grown in quantity but also reflects significant quality and academic impact from several leading scholars.

Table 3. The Most Prolific Authors in Publications on Pedagogical Learning Environments

No	Author	Documents	Citations
1	Luguetti, Carla	5	109
2	Shafto, Patrick	4	239
3	Chu, Samuel Kai Wah	4	208
4	Ng, Tsz Kit Davy	4	208
5	Pears, Arnold Neville	4	195
6	Putnam, Cynthia	3	128
7	Rose, Emma J.	3	122
8	Ní Chróinín, Déirdre	3	110
9	Macphail, Ann	3	93
10	Bonawitz, Elizabeth Baraff	3	75

3.5. Research Focus on Pedagogy in Learning Environments

The researchers also analyzed the research focus and the novelty of keywords using VOSviewer. This analysis aimed to identify current research trends and ensure that the keywords employed reflect innovation and recent developments in the field of Pedagogy in Learning Environments. As shown in Fig. 5, the visualization results reveal three main clusters in pedagogical research within learning environments. The red cluster focuses on the use of digital technologies such as e-learning, learning systems, virtual reality, and blended learning. The green cluster emphasizes pedagogical design through educational computing, problem-based learning, problem solving, and human computer

interaction to create adaptive learning models. Meanwhile, the blue cluster highlights the human dimension, including aspects such as students, professional development, communication, child, and adult, which are related to teacher professional development and learner characteristics.

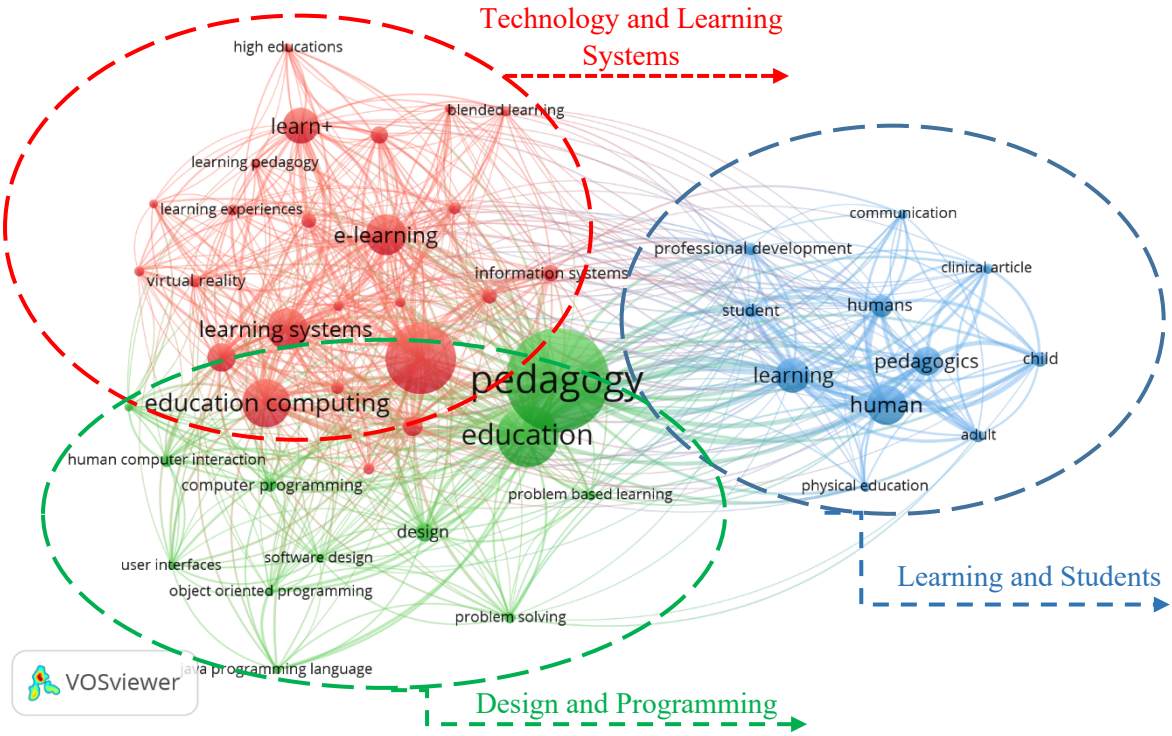


Fig. 5. Visualization of Research Focus on Pedagogical Research in Learning Environments

The first cluster, marked in red, focuses on aspects of technology and learning systems, such as e-learning, learning systems, virtual reality, and blended learning. This cluster highlights the significant role of digital technology in transforming learning models, particularly in the context of distance education and the integration of information technology. The application of blended learning has proven to be more effective, making the integration of hybrid models a dominant direction in the transformation of pedagogy [28]. Virtual reality and immersive environments are effective when learning requires active engagement and practical application, as immersive technologies contribute to more meaningful learning experiences [29], The framework of the Pillars of Online Pedagogy positions relationships, active learning, student agency, mastery learning, and personalization as the core pillars to guide the use of technology toward meaningful learning goals, emphasizing that pedagogical design remains the key determinant of the quality of technology implementation [30]. Thus, this cluster emphasizes the importance of balancing theoretical approaches and practical applications in the development of innovative, interactive, and goal-oriented learning environments.

The second cluster, represented in green, highlights the core concepts of education, pedagogy, and instructional design. Keywords such as pedagogy, education, problem solving, and problem-based learning underscore the importance of pedagogical foundations in guiding technological innovations to remain aligned with educational objectives. Problem-based learning fosters critical thinking, problem-solving skills, and student collaboration [31]. Within learning environments, this approach encourages active engagement and greater learning responsibility, thereby enhancing the quality of the learning experience while strengthening the relevance between theory and practice [32]. Furthermore, problem solving as a teaching approach has been proven to enhance both cognitive and non-cognitive aspects, while also deepening students' computational abilities [33], [34]. The close relationship between pedagogy and education demonstrates that the success of learning innovations can be achieved through a strong pedagogical foundation that directs the use of technology to remain aligned with educational objective

The third cluster, marked in blue, highlights the human dimension in pedagogical research with keywords such as human, student, child, adult, and professional development. This focus indicates a paradigm shift toward more contextual and personalized human-centered learning approaches. The emergence of related keywords, such as communication and physical education, suggests efforts to integrate social and physical aspects into modern instructional design. Although digital technologies and AI are becoming increasingly dominant, learning must remain human-centered by positioning students as active subjects, while teachers serve as architects of learning experiences that foster creativity and student agency [35], [36], [37]. Thus, it can be concluded that technology-based educational transformation can only succeed if the human dimension remains at the core of pedagogical design

3.6. Keyword Novelty

The analysis also examines the novelty of keywords to identify emerging research themes and ensure that the terms used reflect the latest innovations and developments in pedagogical research within learning environments. Based on the VOSviewer visualization results (Fig. 6), the most recent keywords that have emerged indicate the direction of pedagogical development becoming increasingly adaptive to contemporary needs. The keyword "learn+" signifies innovations in learning technologies that are more interactive and intelligent. Research by Alam (2025) demonstrates that the integration of artificial intelligence (AI) in education enables the creation of adaptive learning systems capable of adjusting content and feedback in real time, thereby enhancing student engagement and motivation [38]. The study conducted by Stoumpos (2025) highlights the importance of technologies such as augmented reality (AR) and virtual reality (VR) in creating immersive and collaborative learning environments, supporting more dynamic and contextual pedagogical approaches [39]. In addition, the study by Cabanillas-García (2025) identifies international trends in the integration of artificial intelligence (AI) in education, which influence pedagogical design, academic integrity, and student engagement, reflecting a shift from tool-based approaches to a focus on learner needs and experiences [40]. Thus, the integration of advanced technologies in education not only enhances the effectiveness of learning but also strengthens the relevance of pedagogy in addressing contemporary challenges and demands, while creating more adaptive and innovative learning environments.

Blended learning underscores the trend of integrating face-to-face and online learning as a response to the increasingly dynamic needs of education. This approach combines the flexibility and accessibility of online learning with the direct interaction characteristic of traditional face-to-face learning, creating a more holistic and adaptive learning experience. Research by Zitha et al. (2023) shows that blended learning is effective in meeting the diverse demands of students, although challenges such as limited infrastructure and difficulties in navigating online platforms still need to be addressed. In addition, a study by Alammary et al. (2024) emphasizes the importance of selecting appropriate learning components in the design of blended learning to enhance student engagement and academic success. This approach further enriches the learning environment, making it more adaptive, interactive, and supportive of various effective teaching methods [41], [42].

In addition, keywords such as humans, child, adult, and physical education reflect a focus on the human dimension in the learning process. In pedagogical research within learning environments, there is an emphasis on the human dimension that encompasses various stages of individual development. Research by Valle-Muñoz (2025) shows that physical literacy, as a pedagogical model, can promote holistic and inclusive learning, supporting students' development across physical, cognitive, affective, and social domains, while also encouraging active participation in physical activities throughout life [43]. The study conducted by Howley et al. (2022) emphasizes the importance of social and emotional learning (SEL) in physical education, which can be achieved through democratic and reflective pedagogy, enabling students to reflect on and discuss how movement experiences influence their active lives [44]. In addition, research by Dixon et al. (2025) reveals that educators' racial and pedagogical experiences can influence the application of social justice principles in physical education, highlighting the importance of teacher competence within diverse social and cultural contexts [45]. Thus, modern pedagogical approaches are moving toward more holistic and inclusive

human-centered learning, integrating various dimensions of individual development within the learning environment.

The novelty of these keywords is expected to illustrate the direction of pedagogical development that is increasingly integrated and responsive to the dynamic needs of learners, both in cognitive, social, emotional, and physical contexts. Such innovations are anticipated to enrich students' learning experiences, create more inclusive and adaptive environments, and enhance the effectiveness of learning that is more individualized and sustainable throughout life.

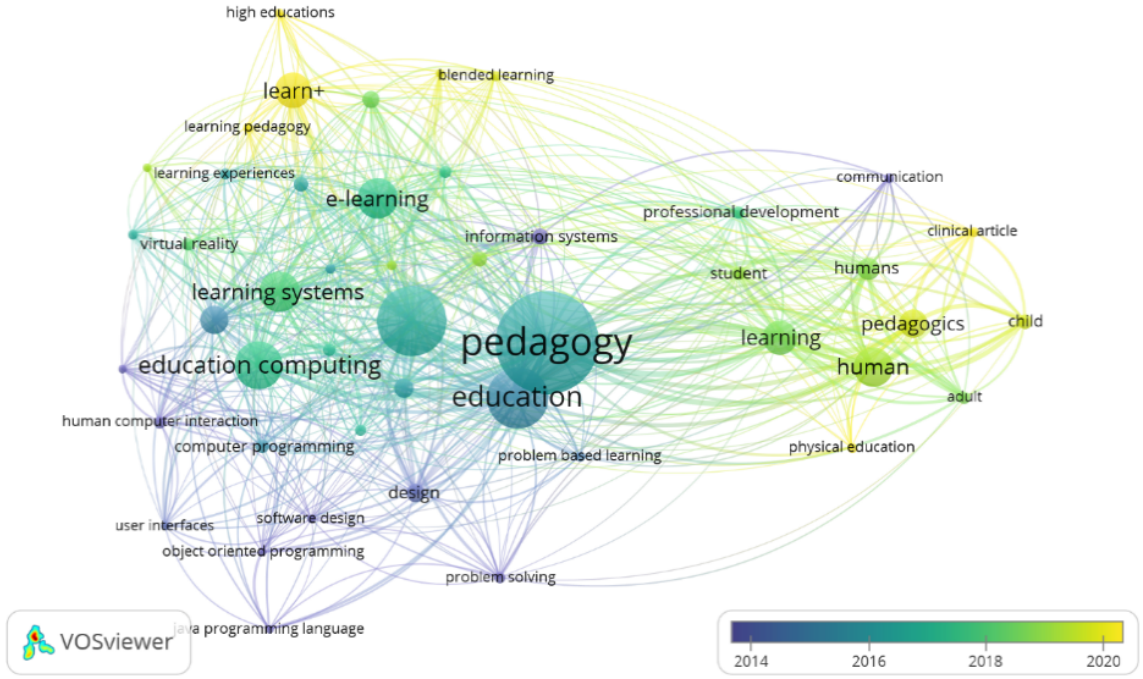


Fig. 6. Visualization of Keyword Novelty on the Topic of Pedagogy in Learning Environments

4. Conclusion

The findings of this study indicate that pedagogical research in learning environments has experienced significant growth from 2000 to 2025, with a sharp increase after 2016. Three main clusters were identified: the utilization of technology in learning, such as e-learning, blended learning, and virtual reality; problem-based pedagogical design and human–computer interaction; and approaches focusing on the human dimension, including professional development and students' socio-emotional aspects. This study also emphasizes the importance of integrating psychological and emotional well-being in creating effective learning environments. Publications in this field are largely dominated by developed countries, particularly the United States, with significant contributions from leading universities such as the University of California and Stanford University. These findings highlight the importance of adaptive and inclusive pedagogical approaches that integrate technology, promote collaborative learning, and focus on the holistic development of learners. The study provides guidance for educators and educational institutions to develop learning strategies that are responsive to students' needs in the digital era, while ensuring their academic and emotional well-being. Such approaches are expected to enrich learning experiences and enhance more meaningful and sustainable educational outcomes.

Future research is recommended to expand the bibliometric analysis by incorporating databases beyond Scopus, such as Web of Science or Google Scholar, in order to gain a more comprehensive picture of trends in pedagogical research in learning environments. Broader database utilization will

enable researchers to identify a wider range of publications across 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**.**

Author Contribution: NF: 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**.**

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