TURKISH ACADEMIC RESEARCH REVIEW

Trends and Gaps in Learning Space Research: A Systematic Review**

Öğrenme Alanı Araştırmalarındaki Eğilimler ve Boşluklar: Sistematik Bir İnceleme

Nurdan Sezgin Toruk[1,3*] Kunter Manisa[2]

[1] Y. Mimar, Yıldız Teknik Üniversitesi, Mimarlık Fakültesi, Mimarlık Anabilim Dalı, İstanbul, Türkiye, https://ror.org/0547yzj13, https://orcid.org/0000-0002-4358-7847, nsezgin@ticaret.edu.tr
Master Architect, Yıldız Technical University, Faculty of Architecture, Department of Architecture, Department of Architecture, İstanbul, Turkey, https://ror.org/0547yzj13, https://orcid.org/0000-0002-4358-7847 , nsezgin@ticaret.edu.tr

[2] Doç. Dr., Yıldız Teknik Üniversitesi, Mimarlık Fakültesi, Mimarlık Anabilim Dalı, İstanbul, Türkiye, https://ror.org/0547yzj13, https://orcid.org/0000-0002-8209-0905, kunterma@yahoo.com
Assoc. Prof. Dr, Yıldız Technical University, Faculty of Architecture, Department of Architecture, Department of Architecture, İstanbul, Turkey, https://ror.org/0547yzj13, https://orcid.org/0000-0002-8209-0905, kunterma@yahoo.com

[3] Öğr. Gör., İstanbul Ticaret Üniversitesi, Mimarlık ve Tasarım Fakültesi, Mimarlık Anabilim Dalı, İstanbul, Türkiye, https://ror.org/02v3kkq53, https://orcid.org/0000-0002-4358-7847, nsezgin@ticaret.edu.tr
Lecturer, İstanbul Ticaret University, Faculty of Architecture and Design, Department of Architecture, https://ror.org/02v3kkq53, https://orcid.org/0000-0002-4358-7847, nsezgin@ticaret.edu.tr
* Corresponding author

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Etik Bildirim
turkisharr@gmail.com

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Öz

Bu çalışma, öğrenme mekânlarına ilişkin akademik literatürün gelişim eğilimlerini ortaya koymak, kavramsal yapısını analiz etmek ve alandaki disiplinler arası boşlukları belirlemek amacıyla bibliyometrik bir analiz gerçekleştirmektedir. Özellikle fiziksel, dijital ve hibrit öğrenme ortamlarının dönüşümüyle birlikte, öğrenme mekânları üzerine yapılan araştırmalar önem kazanmıştır. Ancak bu alandaki yayınların büyük bölümü eğitim bilimleri perspektifinde şekillenmekte, mekânsal tasarım ve mimarlık gibi alanlar literatürde sınırlı ölçüde temsil edilmektedir. Bu çalışma, öğrenme mekânı araştırmalarını sistematik bir biçimde haritalayarak alana ilişkin güçlü ve zayıf yönleri bütüncül bir çerçevede değerlendirmeyi hedeflemektedir. Araştırmada, Web of Science veri tabanından elde edilen 2.819 yayın analiz edilmiştir. Bibliyometrik analiz sürecinde VOSviewer ve Bibliometrix yazılımları kullanılmış; anahtar kelime eş-oluşumları, tematik kümeler, atıf ilişkileri ve ülke iş birlikleri görselleştirilmiştir. Ayrıca yayın özetlerine uygulanan trigram analizi, yazarların tanımladığı anahtar kelimeler ile makalelerin gerçek içeriği arasında kavramsal tutarlılık olup olmadığını test etmek amacıyla kullanılmıştır. Analizler sonucunda 13 tematik küme belirlenmiş ve bu kümelerin büyük ölçüde pedagojik kuramlar, öğretmen eğitimi, dijital öğrenme ortamları ve öğrenci katılımı gibi konular etrafında yoğunlaştığı tespit edilmiştir. Yazar anahtar kelimelerinde sıklıkla yer alan kavramlar ile makale özetlerinde vurgulanan kavramlar arasında anlamlı farklar bulunmuş; bu durum, alanın kavramsal olarak henüz yeterince bütünleşmediğini göstermektedir. Ayrıca, zaman serisi analizleri öğrenme mekânları araştırmalarının 2020 sonrasında dijitalleşme, hibrit öğrenme ve yapay zekâ gibi kavramlara yöneldiğini ortaya koymuştur. Çalışmanın bulguları, öğrenme mekânlarının pedagojik boyutlarıyla birlikte fiziksel ve mekânsal özelliklerinin de araştırma odağı hâline gelmesi gerektiğine işaret etmektedir. Bu bağlamda, eğitim bilimleri ile mimarlık ve mekân tasarımı arasında daha güçlü iş birlikleri geliştirilmesi önerilmektedir. Bibliyometrik analizler, alandaki yayın eğilimlerini nesnel ve kapsamlı biçimde ortaya koyarak, gelecek araştırmalar için yönlendirici bir çerçeve sunmaktadır.

Anahtar Kelimeler: eğitim araştırması, öğrenme ortamları, öğrenme mekanları, bibliyometrik analiz, bibliyometrik haritalama

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No artificial intelligence-based tools or applications were used in the preparation of this study. All content of the study was produced by the author(s) in accordance with scientific research methods and academic ethical principles. Nurdan Sezgin Toruk-Kunter Manisa

Complaints
turkisharr@gmail.com

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Abstract

This study presents a bibliometric analysis to explore the development trends, conceptual structure, and interdisciplinary gaps within the academic literature on learning spaces. As physical, digital, and hybrid learning environments continue to evolve, research on learning spaces has gained prominence. However, most existing literature is shaped predominantly by educational sciences, with limited representation of spatial design and architectural perspectives. This study aims to map the field systematically and provide a comprehensive understanding of both its strengths and limitations. A total of 2,819 publications indexed in the Web of Science database were analyzed. The bibliometric process employed VOSviewer and Bibliometrix software to generate co-authorship networks, keyword co-occurrence maps, thematic clusters, and country-level collaborations. In addition, a trigram analysis was applied to article abstracts to compare the alignment between author-defined keywords and the actual thematic content. The results identified 13 thematic clusters, primarily centered around pedagogical frameworks, teacher education, digital learning environments, and student engagement. A notable discrepancy was found between frequently used keywords and the core themes emerging from article abstracts, indicating conceptual misalignment in the field. Temporal analysis also revealed a recent shift—particularly after 2020—toward topics such as digitalization, hybrid learning, and artificial intelligence. Findings suggest that learning spaces should be explored not only from pedagogical perspectives but also through spatial and architectural lenses. Accordingly, stronger collaboration between educational sciences and spatial design disciplines is recommended. By objectively mapping publication patterns, this bibliometric analysis offers valuable insight and direction for future interdisciplinary research on learning environments.

Keywords: educational research, learning environments, learning spaces, bibliometric analysis, bibliometric mapping

Introduction

Learning spaces encompass physical, digital and social environments where individuals participate in the processes of acquiring, sharing and applying knowledge. While traditional educational environments have been static and unidirectional for many years, changes in education today are transforming approaches to space design (Jamieson et al., 2000; Oblinger, n.d.). Learning spaces are not limited to educational institutions but encompass a wide ecosystem of spaces such as classrooms, libraries, study spaces, cafes and student centers. These spaces are directly related to physical, social and technological factors that affect individuals' learning experiences.

The existing literature indicates that learning spaces are primarily explored within the realm of educational sciences; however, research on the impact of spatial design and physical factors on learning processes remains limited (Woolner & Hall, 2010) Specifically, the impact of space features including adaptability, inclusivity, and technology integration on students' academic performance, motivation, and cognitive growth should be assessed (Scott-Webber, 2004; Temple, 2008)

This study intends to analyze academic research on learning environments via bibliometric analysis. By exposing the publication trends, citation links, scientific networks, and research issues of the academic literature, bibliometric analyses aid in mapping the field's academic evolution (van Eck & Waltman, 2010).

The following questions will be addressed within the parameters of this study:

1. How is the literature on learning spaces doing right now? What types of research have been done in this area?

2. What are the trends and directions of development in the literature on learning spaces?

This study's primary goal is to identify the overall framework of research in the subject of learning spaces and to use bibliometric mapping approaches to uncover academic trends in this area. Finding the most significant articles, authors, organizations, keywords, themes, and subfields in the literature is the main goal of the study.

The results of these analyses can guide the design, development and management of learning spaces by providing insights into the most important academic research on this topic.

The second segment of the study, Literature Review on Learning Spaces, offers a comprehensive overview of academic research in this domain and evaluates existing studies on physical, digital, and social learning settings. The methodology section elucidates the data collection processes, analytical techniques, and software employed for generating bibliometric maps. The Findings section delineates the publication trends in academic research on learning spaces, identifies the most cited publications, conducts author and institutional analyses, and provides conceptual assessments via bibliometric maps. The Discussion and Conclusion section analyzes the results and addresses implications for future research.

1. **Literature on Learning Spaces**

Learning spaces are dynamic environments that influence the processes of knowledge acquisition and exchange among individuals. The notion of learning space, historically confined to classrooms, now encompasses a diverse ecosystem that includes classrooms, libraries, study areas, cafes, student centers, and digital platforms. In addition to the physical confines of educational environments, psychological, cultural, and social influences that individuals engage with are significant determinants of the learning process (A. Y. Kolb & Kolb, 2005).

Upon examining studies on learning environments, it is evident that this domain is approached through physical, digital, and social dimensions. Learning space describes the physical place where learning takes place. 'A rich network of transitional spaces, both inside and outside' can enhance the enjoyment of teaching and learning (Van

Note Chism & Bickford, 2002). Learning space integrates the individual's learning style with the wider institutional learning environment. It extends beyond physical settings, emphasizing the importance of the interaction between individuals and their environment, including psychological, cultural and social factors that influence the learning (A. Y. Kolb & Kolb, 2005). Learning spaces encompass any place where learning/teaching takes place, whether virtual, real, formal, informal, indoor or outdoor, including the concept of a 'classroom' with defined and precise boundaries. The design of learning spaces extends beyond the traditional classroom. This has led to the convergence of physical and digital environments(Davis, n.d.) In contemporary learning environments, resources for data collection, processing and presentation tools can be shaped by the individual's own personalized learning needs in virtual and physical spaces (Pulak, 2016). Studies show that the design and composition of learning spaces have a significant impact on learning outcomes (Ramos et al., 2021). Learning environments should encourage innovative thinking and the changing demands of students in the twenty-first century. Prioritizing flexibility, technological integration, inclusion, and alignment between physical and virtual spaces can help universities create innovative, collaborative, and interactive learning environments (Crabb et al., 2019; Elkington & Bligh, 2019; Harrop & Turpin, 2013; Selvaratnam, 2021).

The necessity to categorize knowledge has arisen due to the current surge in knowledge production. Academic output has significantly accelerated with the expansion of information access brought about by evolving technologies and internet infrastructure (Hilbert & López, 2011; Rowlands et al., 2008). The number of journals, publishers, and scholars in the literature has grown and diversified along with the growing body of knowledge. Additionally, studies have been conducted from a variety of perspectives and by a variety of disciplines, which has made it possible for researchers to approach their subjects from multiple angles.

Bibliography, often known as bibliometrics, is a metrology technique that uses statistics and mathematics to evaluate publications (Jing et al., 2023). The literature is analyzed quantitatively and categorized in a number of ways (Diodato & Gellatly, 2013; Donthu et al., 2020). Since its introduction in 1934, the idea of bibliometrics has advanced quickly and, with the use of databases, has become a standard practice (Jing et al., 2023). At the same time, bibliometric research has become easier and more engaging due to the advancement of computer technologies and presenting approaches.

Bibliometrics, the quantitative analysis of publications and citations, has emerged as a fundamental tool for assessing the impact of scientific research(Cobo et al., 2011; Moral-Muñoz et al., 2020). It was the development of various bibliographic databases such as Web of Science and Scopus that significantly shaped the bibliometric analysis landscape. The first bibliometric studies date back to the early 20th century, when researchers began to model statistics of scientific literature (Cremin et al., 2020).

Table 1 Most cited articles

Authors	Article Title	Summary
Kolb, AY; Kolb, DA	Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education	This paper examines the relationship between learning styles, learning spaces, and experiential learning in higher education. It discusses Experiential Learning Theory and its four-stage cycle, advocating learning environments that

		cater to different learning preferences and encouraging active engagement.
McLoughlin, C; Lee, MJW 2010	Personalized And Self-Regulated Learning in The Web 2.0 Era: International Exemplars of Innovative Pedagogy Using Social Software	This paper explores how Web 2.0 technologies can be used to create personalized and self-regulated learning experiences, highlighting international examples of innovative pedagogy using social software. It emphasizes the importance of learner ownership, flexibility, and authentic learning environments.
Baepler, P; Walker, JD; Driessen, M 2014	It's Not About Seat Time: Blending, Flipping, And Efficiency in Active Learning Classrooms	The paper explores the effectiveness of active learning pedagogies in reducing classroom contact hours while maintaining or improving student learning outcomes compared to traditional classroom settings. The authors found that the use of a blended learning approach with active learning strategies led to comparable or better student performance on standardized examinations and improved students' perceptions of the learning environment.
Pather, N; Blyth, P; Chapman, JA; Dayal, MR; et all 2020	Forced Disruption of Anatomy Education in Australia and New Zealand: An Acute Response to the Covid-19 Pandemic	The article notes the challenges for Australian and New Zealand anatomy educators grappling with concerns about the role of human donor material and academic integrity as they transition to online learning and assessments during the COVID-19 pandemic.
Kolb, AY; Kolb, DA 2009	The Learning Way Meta-Cognitive Aspects of Experiential Learning	This paper explores the concept of a 'learning pathway', emphasizing the importance of understanding one's learning style and adopting a meta-cognitive approach to learning. It draws on the ELT model and explores how individuals can increase their learning power by consciously engaging in a cycle

of experiencing, reflecting, thinking, and acting.

Studies on learning spaces have increased rapidly in recent years. Therefore, the complexity of the literature makes it difficult to read the data and view the field.

This study will examine research in the field of learning spaces through bibliometric analysis and visualize the most cited articles, important research areas and main trends in the literature.

2. Methodology

Today, the rapid expansion and diversification of academic literature makes it difficult to conduct a comprehensive literature review with traditional methods. In this context, bibliometric analysis methods facilitate the identification of research trends by providing the opportunity to evaluate the literature in a numerical and visualized form. Bibliometric analyses reveal how scientific knowledge is shaped by examining the citation relationships, collaborative networks, author and journal interactions of publications in a particular field. In this study, bibliometric analysis methods were used to determine the general trends and academic collaborations of academic studies on learning spaces. Bibliometric analysis provides a powerful tool to visualize the development process of the field, key research topics and possible future directions.

This study does not include any data collection process for human participants. The bibliometric analysis was conducted using only open access publications obtained from the Web of Science database. Therefore, ethics committee approval is not required.

2.1. Data sources

Bibliometric studies rely on digital databases to analyze research trends in a given field by collecting quantitative data from academic literature. The two most widely used bibliographic databases in scientific research are Web of Science (WoS) and Scopus. In this study, academic publications on learning spaces were analyzed using the Web of Science database. The selective structure of WoS was preferred in order to obtain more qualified and focused results in the literature review.

2.2. Method of Analysis

In this study, VOSviewer(van Eck & Waltman, 2010) and Bibliometrix(Aria & Cuccurullo, 2017) software were used to visualize bibliometric analyses and identify academic trends. VOSviewer is a software developed to visualize citation networks, co-citation relationships, collaborative research networks and keyword analysis. In this study, co-occurrence analyses of article keywords were performed and thus thematic relationships in the literature were identified. The network maps provided by VOSviewer show the clusters in the literature by revealing how the academic field is structured. Bibliometrix is an open-source R package that provides comprehensive statistical tools for bibliometric analysis and enables a wide range of analyses such as citation analysis, collaboration networks, publication trends and thematic mapping. In this study, the number of publications by year, trending topics, countries, most cited studies and journals were analyzed using the Biblioshiny interface.

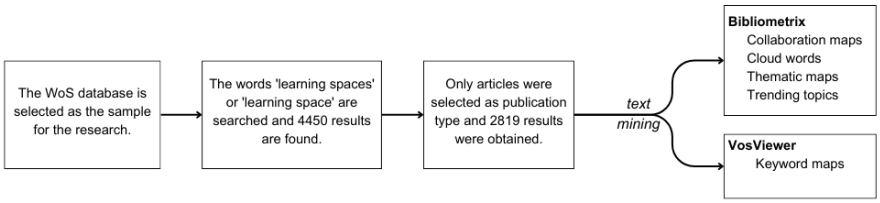

Figure 1 Research process design

Using Bibliometrix, we analyzed which countries collaborate with each other in the learning spaces literature. This analysis was done to visualize scientific collaborations between countries and to understand global interactions in the literature. In the word cloud, trigram analysis (groups of three words) was performed on article abstracts to identify the most frequently used word groups in the literature. This analysis was conducted to reveal the frequently used concepts in article abstracts and to understand the change of these concepts over time. The resulting trigrams were visualized as word clouds. The trending topics analysis was conducted to understand which topics are prominent in the field of learning spaces and how they have changed over time. Thematic maps were used to visualize the themes in the literature and the relationships between these themes. The first quadrant includes the most studied antecedent concepts in the field (motor themes), the second quadrant includes concepts that have developed within the field but are not related to the outside (niche themes), the third quadrant includes emerging or declining themes, and the fourth quadrant includes basic but not very developed concepts (basic themes) (Aydınoğlu et al., 2022). Two different thematic maps were created. The first map was created using keywords identified by the authors. The second map was created using trigrams extracted from publication abstracts.

Network visulization in bibliometric maps consists of nodes and links. Journals, authors, keywords, institutions constitute the nodes; publications constitute the links between these nodes. Map-based representations make the data studied in the field understandable and help the researcher to navigate.

A co-occurrence analysis of the keywords identified by the authors was conducted using VOSviewer. This analysis was carried out to reveal the relationships between keywords and the clusters formed by these words. The resulting network map shows the themes in the literature and the connections between these themes. In this map, publications are divided into various clusters and each cluster is shown with a different rank.

3. Findings

The co-occurrence network visualization of keywords using VOSviewer revealed the main themes in the literature and the relationships between these themes (Figure 2). In this map, it is seen that studies related to learning spaces are gathered in 13 clusters.These clusters can be grouped under the titles of Design of Learning Spaces and Innovation in Education, Digital Learning and Pandemic Impact, Technology Supported Learning, Student Motivation and Social Learning, Active Learning and Experiential Learning, Libraries and Learning Spaces, Language and Culture Based Learning, Social Justice and Diversity, Physical Learning Environments. The six most influential clusters are:

Cluster 1: Design of Learning Spaces and Innovation in Education

Studies in this cluster examine the effects of learning spaces on student engagement. Matthews et al., 2021 reveals that social learning spaces contribute to students' active learning, social interaction and developing a sense of belonging. Bouilheres et al., 2020 states that blended learning increases students' engagement, flexibility and self-confidence, while Beckers et al., 2016 emphasizes that students prefer different learning spaces for individual and group work. Byers et al., 2018 shows that innovative learning environments increase student engagement and

transform teachers' pedagogical approaches. Fisher & Newton, 2014 states that the integration of physical and digital spaces of 21st century campuses increases student engagement, while Holley & Dobson, 2008 reveals that contemporary learning spaces in blended learning environments encourage student engagement.

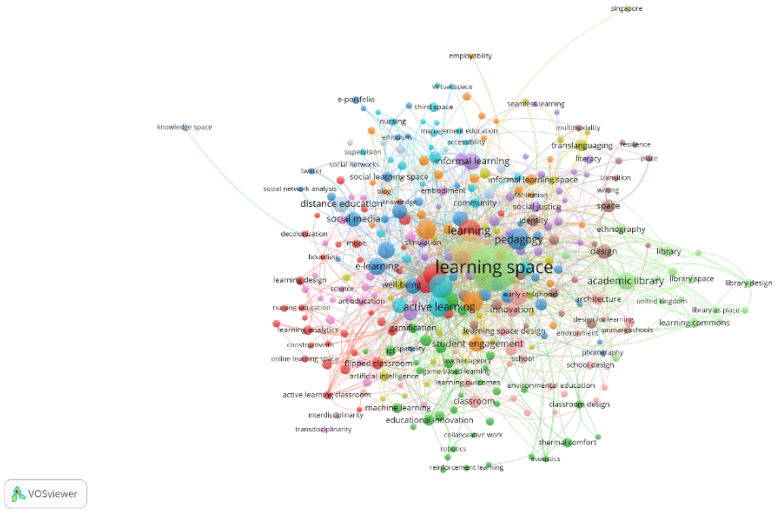

Figure 2 Network visualization of co-occurrence analysis of author keywords

Cluster 2: Digital Learning and Pandemic Impact

The studies in this cluster examine the effects of digital learning tools on student engagement. McLoughlin & Lee, 2010 states that Web 2.0 tools support personalized and self-regulated learning and increase student engagement. Turnbull et al., 2021 emphasizes that the transition to e-learning during the Covid-19 pandemic increased student engagement, but teachers and students need to adapt to these tools. Pegrum et al., 2013 shows that mobile technologies increase students' motivation and enable them to be more actively involved in learning processes.

Cluster 3: Technology Supported Learning

The studies in this cluster examine the effects of blended learning and educational technologies on student engagement and performance. Baepler et al., 2014 states that blended and flipped learning in active learning classrooms increases student engagement, while Norberg et al., 2011 emphasizes that the time-based blended learning model allows students to learn flexibly. Yang et al., 2019 shows that the blended synchronous classroom approach in rural areas improves student performance and encourages engagement.

Cluster 4: Student Motivation and Social Learning

Studies in this cluster examine the effects of social learning and professional development on student engagement. Flecha & Soler, 2013 argues that dialogic learning engages Roma families and students in school and promotes educational equity. Rehm & Notten, 2016 shows that Twitter is used as an informal learning space for teachers and supports professional development. Clement & Vandenberghe, 2000 emphasizes that collaborative learning environments support teachers' professional development and increase student engagement.

Cluster 5: Active Learning and Experiential Learning

The studies in this cluster examine the effects of active and experiential learning on student engagement. A. Kolb & Kolb, 2009 states that the meta-cognitive aspects of experiential learning enable students to be actively involved in learning processes. A. Kolb & Kolb, 2010 shows that game-based learning spaces increase student engagement. Tomkins & Ulus, 2016 emphasizes that Kolb's learning cycle encourages students' active engagement.

Cluster 6: Library and Learning Spaces

Studies in this cluster examine the effects of library and learning spaces on student engagement. Bryant et al., 2009 states that the use of academic libraries as social and learning spaces increases student engagement. Bennett, 2007 emphasizes that the design of higher education learning spaces plays an important role in increasing student engagement. Montgomery, 2014 shows that library spaces have positive effects on student learning behaviors.

In the VOSviewer analysis, 15% of the author keywords were missing, leading to data loss in the network maps. Due to this deficiency, meaningful word clusters were created by applying trigram analysis on article titles. In the word cloud in Figure 3, while informal learning spaces stand out as the most common concept, concepts such as social learning spaces, innovative learning spaces, virtual learning spaces and physical learning spaces are also among the important topics.

Figure 3 Wordcloud generated from abstracts of publications.

The Trend Topics visualization in Figure 4 shows which topics have been prominent in the academic literature over time. The graph represents the year each concept first emerged, the duration of its influence and how often it is used. It is seen that Artificial Intelligence, Hybrid Learning and STEAM & Task Analysis approaches gain more importance in 2020 and beyond in the light of Covid-19 impact and new technological developments as emerging concepts. It is seen that topics such as Learning Space, Higher Education, Pedagogy and Collaborative Learning are included in the academic core. It is seen that topics such as Web 2.0, Blog, Wiki, Second Life, Seamless Learning, Digital Literacy were popular in the 2010s and not used at all in the 2020s. Topics such as COVID-19, Distance Education reached their peak during the pandemic but declined after 2023.

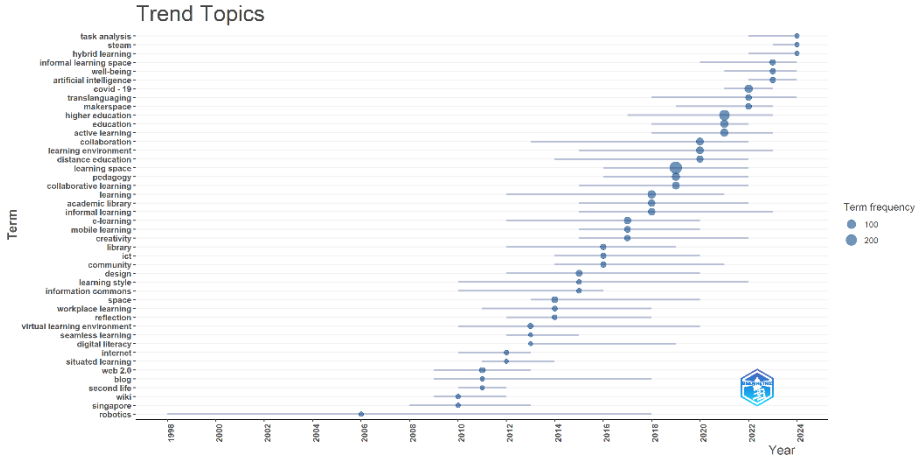

Figure 4 Trend Topics

In this study, two thematic maps were comparatively analyzed to explore the conceptual structure of the learning spaces literature from different methodological perspectives. The left-side map, based on author-defined

keywords, reflects how researchers conceptualize the field and which terminologies are most commonly employed. In contrast, the right-side map, created through trigram analysis of article abstracts, illustrates themes derived directly from the content of the publications. This comparison reveals whether a conceptual alignment exists between the keywords selected by authors and the actual focus of their studies. In the keyword-based thematic map, teacher education, professional development, and identity emerge as motor themes, while more general terms such as higher education, education, and learning are situated in the core themes. Niche themes highlight topics such as social context and gamification in learning environments. On the other hand, the content-based thematic map emphasizes the physical and flexible design of learning spaces as motor themes, including concepts such as flexible learning space, physical learning environment, and innovative learning space. Core themes in this map include virtual learning space, digital learning environment, and collaborative learning space, while inclusive and language-based learning environments stand out as niche themes. This comparative analysis highlights both the terminological diversity and the conceptual fragmentation that characterize the learning space literature.

Figure 5 Comparative thematic maps generated through bibliometric analysis: the left map is based on author-defined keywords, and the right map is created using trigram analysis of article abstracts.

The countries with the highest number of publications on learning domains are the USA, Australia, the UK, China and Canada. When the international collaboration map in the WoS database is examined, it is seen that there are 21 collaborations between the USA and China, 19 between Australia and the UK, 18 between Australia and New Zealand, 16 between Australia and China and 15 between the USA and Australia.

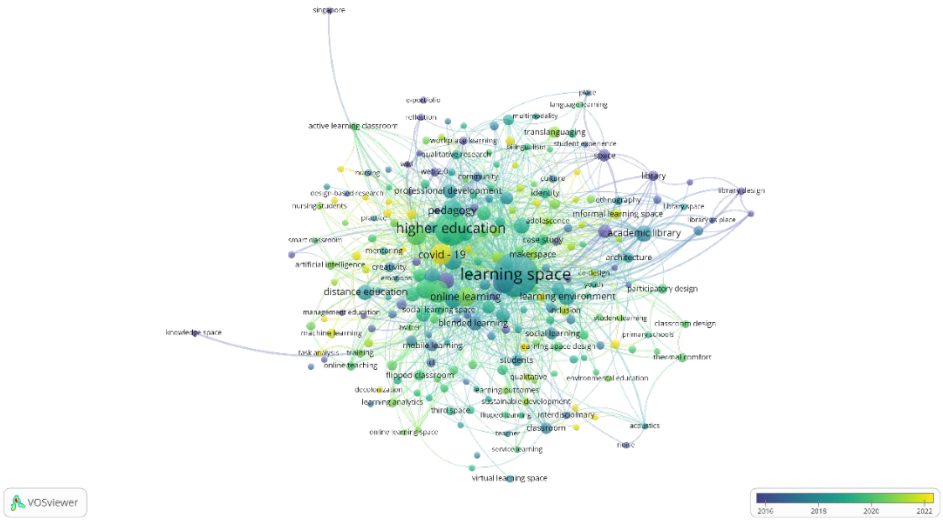

Figure 6 Overlay visualization of co-occurrence analysis of author keywords.

Figure 6 shows which topics the studies have focused on over the years. In the early 2010s, research focused on design, by 2015 it had shifted to sustainability and urban studies, and by 2020 it focused on the relationship between pandemic, technology and space.

Discussion and Conclusion

In this study, bibliometric analyses on learning spaces have been conducted to evaluate how this field has been shaped in academic literature. The bibliometric findings show that studies on learning spaces are largely concentrated in the field of Educational Sciences and are much less represented in disciplines directly related to space design, such as Architecture (Table 2). This situation reveals that learning spaces are addressed within the pedagogical framework, but research on the design and organization of the physical space is relatively limited.

The multidisciplinary nature of learning spaces makes it difficult to read the literature in this field. The complexity of the literature is limited by the Web of Science categories, the boundaries of which are sharply delineated in this study. Research on learning space was categorized according to Web of Science categories and listed in Table 2. As seen in Table 2, 54.230% of the publications in the field were made in the category of Educational Research. Only 1.563% of all studies were conducted in the Architecture category.

Table 2 Publications by WoS categories

Web of Science Categories	Record Count	%
Education Educational Research	1,421	50,41%
Information Science Library Science	162	5,75%
Education Scientific Disciplines	117	4,15%
Linguistics	87	3,09%
Social Sciences Interdisciplinary	76	2,70%
Language Linguistics	71	2,52%
Management	69	2,45%
Computer Science Information Systems	66	2,34%
Environmental Studies	65	2,31%
Computer Science Interdisciplinary Applications	64	2,27%
Environmental Sciences	63	2,24%
Computer Science Artificial Intelligence	59	2,09%
Green Sustainable Science Technology	57	2,02%
Engineering Multidisciplinary	53	1,88%
Engineering Electrical Electronic	48	1,70%
Nursing	48	1,70%
Construction Building Technology	46	1,63%
Geography	43	1,53%
Public Environmental Occupational Health	42	1,49%
Health Care Sciences Services	41	1,45%
Architecture	37	1,31%
Engineering Civil	37	1,31%
Humanities Multidisciplinary	36	1,28%
Multidisciplinary Sciences	35	1,24%
Computer Science Theory Methods	34	1,21%

This study aims to identify the scientific orientations and existing research gaps in the field by conducting a bibliometric analysis of academic research on learning spaces. The findings show that studies on learning spaces are largely concentrated in the field of Educational Sciences, whereas they are quite limited in disciplines directly related to space design such as Architecture. Although learning spaces are one of the basic components of education, it is seen that spatial design and physical organization in this field are not sufficiently integrated with pedagogical approaches.

The Web of Science (WoS) categorization analysis conducted in the study reveals that learning spaces research has largely focused on educational policies, teacher education and academic theories. However, there is a need to consider space in terms of flexibility, inclusiveness, technological integration and students' interaction with space. In this context, stronger collaborations between educational sciences and the disciplines of architecture and spatial design will enable learning spaces to be addressed in a more holistic framework, both pedagogically and spatially.

The trigram analysis conducted within the scope of bibliometric analysis shows that there are significant differences between the keywords used in the academic literature and the actual content of the studies. In particular, it has been determined that keywords are largely based on the perspective of educational sciences, whereas topics such as physical learning spaces, digital learning environments and pedagogical spatial factors are more frequently addressed in article abstracts. This reveals a disconnect between theoretical frameworks and applied studies in learning spaces research.

The role of technology in the transformation of learning spaces is increasing. Especially digital learning environments and hybrid education models create new research areas by expanding the physical boundaries of educational spaces. However, the results of the bibliometric analysis show that there are still limited studies that address digital and physical spaces in an integrated manner. This suggests that future research should focus on spatial flexibility, hybrid learning models and technology-supported learning spaces.

The methodological limitations of the study should also be considered. First, the analyses are based only on publications in the Web of Science database. This poses the risk of not fully reflecting the academic diversity in the field due to the exclusion of studies in independent literature indexes. Furthermore, due to the nature of bibliometric analyses, the methodologies or conceptual frameworks used in the studies were not examined in detail, only citation relationships and research trends were assessed. Therefore, supplementing bibliometric analyses with qualitative methods such as content analysis will provide a more in-depth understanding of learning spaces research.

As a result, this study has identified the main trends, scientific gaps and interdisciplinary gaps in the field by mapping the bibliometric map of academic research on learning spaces. The findings emphasize that learning spaces should be considered not only from a pedagogical perspective, but also from spatial design and physical organization dimensions. In the future, a greater focus on topics such as flexible learning environments, inclusive spaces, and hybrid education models will provide a more holistic approach to studies on learning spaces.

While this study demonstrates the contribution of bibliometric analyses in understanding the literature on learning spaces, it also shows that such analyses should be supported by content-oriented methods. Thus, academic research on learning spaces can be handled in a more comprehensive and interdisciplinary framework, and scientific developments in the field can be directed in a healthier way.

Bibliography | References

Aria, M., & Cuccurullo, C. (2017). Bibliometrix: An R-Tool for Comprehensive Science Mapping Analysis. Journal of Informetrics, 11(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007

Aydınoğlu, A. U., İlhan, A., & Özer, Ö. K. (2022). Bir Sosyal Bilimler Araştırma Yöntemi Olarak Bibliyometri: Akademik Girişimcilik Örneği. Pamukkale University Journal of Social Sciences Institute. https://doi.org/10.30794/pausbed.1124926

Baepler, P., Walker, J., & Driessen, M. (2014). It's Not About Seat Time: Blending, Flipping, and Efficiency in Active Learning Classrooms. Computers & Education, 78, 227–236. https://doi.org/10.1016/j.compedu.2014.06.006

Beckers, R., van der Voordt, T., & Dewulf, G. (2016). Learning Space Preferences of Higher Education Students. Building and Environment, 104, 243–252. https://doi.org/10.1016/j.buildenv.2016.05.013

Bennett, S. (2007). Designing for Uncertainty: Three Approaches. Journal of Academic Librarianship, 33(2), 165–179. https://doi.org/10.1016/j.acalib.2006.12.005

Bouilheres, F., Le, L., McDonald, S., Nkhoma, C., & Jandug-Montera, L. (2020). Defining Student Learning Experience Through Blended Learning. Education and Information Technologies, 25(4), 3049–3069. https://doi.org/10.1007/s10639-020-10100-y

Bryant, J., Matthews, G., & Walton, G. (2009). Academic Libraries and Social and Learning Space: A Case Study of Loughborough University Library, Uk. Journal of Librarianship and Information Science, 41(1), 7–18. https://doi.org/10.1177/0961000608099895

Byers, T., Hartnell-Young, E., & Imms, W. (2018). Empirical Evaluation of Different Classroom Spaces on Students' Perceptions of the Use and Effectiveness of 1-to-1 Technology. In British Journal of Educational Technology (Vol. 49, Issue 1, pp. 153–164). WILEY. https://doi.org/10.1111/bjet.12518

Clement, M., & Vandenberghe, R. (2000). Teachers' Professional Development: A Solitary or Collegial (ad)venture? Teaching and Teacher Education, 16(1), 81–101. https://doi.org/10.1016/S0742-051X(99)00051-7

Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2011). Science Mapping Software Tools: Review, Analysis, and Cooperative Study Among Tools. Journal of the American Society for Information Science and Technology, 62(7), 1382–1402. https://doi.org/10.1002/asi.21525

Crabb, M., Clarke, D., Al Waer, H., Heron, M. J., & Laing, R. (2019). Inclusive Design for Immersive Spaces. Routledge, 22(sup1), 2105–2118. https://doi.org/10.1080/14606925.2019.1594934

Cremin, T., Myhill, D., Eyres, I., Nash, T., Wilson, A., & Oliver, L. (2020). Teachers as Writers: Learning Together with Others. Literacy, 54(2), 49–59. https://doi.org/10.1111/lit.12201

Davis, J. C. (n.d.). Learning spaces implementation: Operationalized theory in bidding documents [Ed.D.]. Retrieved March 30, 2025, from https://www.proquest.com/docview/305311604/abstract/CAB1478A03974D23PQ/1

Diodato, V. P., & Gellatly, P. (2013). Dictionary of Bibliometrics. Routledge. https://doi.org/10.4324/9780203714133

Donthu, N., Kumar, S., & Pattnaik, D. (2020). Forty-Five Years of Journal of Business Research: A Bibliometric Analysis. Journal of Business Research, 109, 1–14. https://doi.org/10.1016/j.jbusres.2019.10.039.

Elkington, S., & Bligh, B. (2019). Future Learning Spaces: Space, Technology and Pedagogy. The Higher Education Academy. https://research.tees.ac.uk/ws/portalfiles/portal/6770557/Future_Learning_Spaces.pdf

Fisher, K., & Newton, C. (2014). Transforming the Twenty-First-Century Campus to Enhance the Net-Generation Student Learning Experience: Using Evidence-Based Design to Determine What Works and Why in Virtual/Physical Teaching Spaces. Higher Education Research & Development, 33(5), 903–920. https://doi.org/10.1080/07294360.2014.890566

Flecha, R., & Soler, M. (2013). Turning Difficulties into Possibilities: Engaging Roma Families and Students in School Through Dialogic Learning. Cambridge Journal of Education, 43(4), 451–465. https://doi.org/10.1080/0305764X.2013.819068

Harrop, D., & Turpin, B. (2013). A Study Exploring Learners' Informal Learning Space Behaviors, Attitudes, and Preferences. Taylor & Francis, 19(1), 58–77. https://doi.org/10.1080/13614533.2013.740961

Hilbert, M., & López, P. (2011). The World's Technological Capacity to Store, Communicate, and Compute Information. Science, 332(6025), 60–65. https://doi.org/10.1126/science.1200970

Holley, D., & Dobson, C. (2008). Encouraging Student Engagement in a Blended Learning Environment: The Use of Contemporary Learning Spaces. Learning Media and Technology, 33(2), 139–150. https://doi.org/10.1080/17439880802097683

Jamieson, P., Fisher, K., Gilding, T., Taylor, P. G., & Trevitt, A. C. F. (2000). Place and Space in the Design of New Learning Environments. Higher Education Research & Development, 19(2), 221–236. https://doi.org/10.1080/072943600445664

Jing, Y., Zhao, L., Zhu, K., Wang, H., Wang, C., & Xia, Q. (2023). Research Landscape of Adaptive Learning in Education: A Bibliometric Study on Research Publications from 2000 to 2022. Sustainability, 15(4), 3115. https://doi.org/10.3390/su15043115

Kolb, A., & Kolb, D. (2009). The Learning Way Meta-cognitive Aspects of Experiential Learning. Simulation & Gaming, 40(3), 297–327. https://doi.org/10.1177/1046878108325713

Kolb, A., & Kolb, D. (2010). Learning to Play, Playing to Learn a Case Study of a Ludic Learning Space. Journal of Organizational Change Management, 23(1), 26–50. https://doi.org/10.1108/09534811011017199

Kolb, A. Y., & Kolb, D. A. (2005). Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education. Academy of Management Learning & Education, 4(2), 193–212. https://doi.org/10.5465/amle.2005.17268566

Matthews, L. E., Jessup, N. A., & Sears, R. (2021). Looking for "Us": Power Reimagined in Mathematics Learning for Black Communities in the Pandemic. In Educational Studies in Mathematics (Vol. 108, Issues 1–2, SI, pp. 333–350). SPRINGER. https://doi.org/10.1007/s10649-021-10106-4

McLoughlin, C., & Lee, M. (2010). Personalised and Self Regulated Learning in the Web 2.0 Era: International Exemplars of Innovative Pedagogy Using Social Software. Australasian Journal of Educational Technology, 26(1), 28–43. https://doi.org/10.14742/ajet.1100

Montgomery, S. (2014). Library Space Assessment: User Learning Behaviors in the Library. Journal of Academic Librarianship, 40(1), 70–75. https://doi.org/10.1016/j.acalib.2013.11.003

Moral-Muñoz, J. A., Herrera-Viedma, E., Santisteban-Espejo, A., & Cobo, M. J. (2020). Software Tools for Conducting Bibliometric Analysis in Science: An up-to-Date Review. Profesional de La Información, 29(1). https://doi.org/10.3145/epi.2020.ene.03

Norberg, A., Dziuban, C., & Moskal, P. (2011). A Time-Based Blended Learning Model. On the Horizon, 19(3), 207-+. https://doi.org/10.1108/10748121111163913

Oblinger, D. (n.d.). Leading the Transition from Classrooms to Learning Spaces. Educause Review. Retrieved February 12, 2025, from https://er.educause.edu/articles/2005/1/leading-the-transition-from-classrooms-to-learning-spaces

Pegrum, M., Oakley, G., & Faulkner, R. (2013). Schools Going Mobile: A Study of the Adoption of Mobile Handheld Technologies in Western Australian Independent Schools. Australasian Journal of Educational Technology, 29(1), 66–81. https://doi.org/10.14742/ajet.64.

Pulak, I. (2016). Traditional and Digital Personal Learning Environment in Experiences of University Students. Inderscience Publishers, 26(4), 419–419. https://doi.org/10.1504/ijceell.2016.10001921

Ramos, S. A. M., Rodríguez-Reséndiz, J., Gutiérrez, A. F., Sevilla-Camacho, P. Y., & Mendiola-Santibañez, J. D. (2021). The Learning Space as Support to Sustainable Development: A Revision of Uses and Design Processes. Multidisciplinary Digital Publishing Institute, 13(21), 11609–11609. https://doi.org/10.3390/su132111609

Rehm, M., & Notten, A. (2016). Twitter as an Informal Learning Space for Teachers!? The Role of Social Capital in Twitter Conversations Among Teachers. Teaching and Teacher Education, 60, 215–223. https://doi.org/10.1016/j.tate.2016.08.015

Rowlands, I., Nicholas, D., Williams, P., Huntington, P., Fieldhouse, M., Gunter, B., Withey, R., Jamali, H. R., Dobrowolski, T., & Tenopir, C. (2008). The Google Generation: The Information Behaviour of the Researcher of the Future. Aslib Proceedings, 60(4), 290–310. https://doi.org/10.1108/00012530810887953

Scott-Webber, L. (2004). In Sync: Environmental Behavior Research and the Design of Learning Spaces. the Society for College and University Planning. https://api.semanticscholar.org/CorpusID:60432168

Selvaratnam, R. (2021). The Link Between Learning Spaces and Employability Outcomes. University of North Carolina at Greensboro, 10(2), 48–53.

Temple, P. (2008). Learning Spaces in Higher Education: An Under-Researched Topic. London Review of Education, 6(3), 229–241. https://doi.org/10.1080/14748460802489363

Tomkins, L., & Ulus, E. (2016). "Oh, Was That “Experiential Learning”?!’ Spaces, Synergies and Surprises with Kolb’s Learning Cycle. Management Learning, 47(2), 158–178. https://doi.org/10.1177/1350507615587451

Turnbull, D., Chugh, R., & Luck, J. (2021). Transitioning to E-Learning During the Covid-19 Pandemic: How Have Higher Education Institutions Responded to the Challenge? Education and Information Technologies, 26(5), 6401–6419. https://doi.org/10.1007/s10639-021-10633-w

van Eck, N. J., & Waltman, L. (2010). Software Survey: VOSviewer, a Computer Program for Bibliometric Mapping. Scientometrics, 84(2), 523–538. https://doi.org/10.1007/s11192-009-0146-3

Van Note Chism, N., & Bickford, D. J. (2002). Improving the Environment for Learning: An Expanded Agenda. New Directions for Teaching and Learning, 2002(92), 91–98. https://doi.org/10.1002/tl.83

Woolner, P., & Hall, E. (2010). Noise in Schools: A Holistic Approach to the Issue. International Journal of Environmental Research and Public Health, 7(8), 3255–3269. https://doi.org/10.3390/ijerph7083255

Yang, J., Yu, H., & Chen, N. (2019). Using Blended Synchronous Classroom Approach to Promote Learning Performance in Rural Area. Computers & Education, 141. https://doi.org/10.1016/j.compedu.2019.103619

Ethical Statement

* This study is based on the doctoral dissertation prepared under the supervision of Assoc. Prof. Dr. Kunter Manisa

Ethics committee approval

The article does not require ethics committee approval.

Author Contributions

Conceptualization (CRediT 1)	Author-1 (60%)-Author-2 (40%)
Data Curation (CRediT 2)	Author-1 (60%)-Author-2 (40%)
Investigation - Analysis - Validation (CRediT 3-4-6-11)	Author-1 (60%)-Author-2 (40%)
Writing (CRediT 12-13)	Author-1 (60%)-Author-2 (40%)
Writing – Review & Editing (CRediT 14)	Author-1 (60%)-Author-2 (40%)

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