

Assessing learning effectiveness through Learning Management Systems: Trends from the last five years

Moza Nindy Rahmadani,¹ Teguh Arie Sandy,² Noorma Khoirun Ni'mah,³ Wafa Lauhatur Rohmania,⁴ Setyaisah Nurmala Sari⁵

^{1, 2, 3, 4, 5} Faculty of Education and Psychology, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia.

Abstract

This study analyses the influence of the Learning Management System (LMS) on learning effectiveness through bibliometric analysis over the past 5 years. Using Scopus and VOSViewer data, this study explores publication trends, journal and author contributions, and key topics in LMS research. Results show increased publications, with a peak of 219 documents in 2023. IEEE Access is the leading journal, and Computer Science dominates with 23.1% of publications. Two main clusters with 15 topics were identified, "Learning System" being the focus. This research provides a comprehensive insight into the development of LMS in modern education and potential directions for future studies, contributing to the understanding of the role of LMS in improving the quality of education in the digital era.

ARTICLE HISTORY

Received 23 February 2024

Accepted 26 April 2024

KEY WORDS

Learning Management System (LMS), learning effectiveness, bibliometric analysis

INTRODUCTION

Digital transformation has reshaped numerous fields, with education experiencing profound changes in recent years. As technology advances, educational systems are increasingly compelled to innovate, shifting from traditional to digital modes of learning that accommodate modern educational needs (Animashaun *et al.*, 2024). At the forefront of this transition, Learning Management Systems (LMS) have emerged as essential tools that provide centralised platforms for educational content, streamline course administration, and foster student engagement within virtual and blended learning environments (Pedro & Teixeira, 2021). LMS platforms allow institutions to move beyond the physical constraints of traditional classrooms, extending learning opportunities in flexible, scalable ways that enhance access, participation, and the overall quality of instruction (Abad-Segura *et al.*, 2020).

The swift evolution of information and communication technologies (ICT) has transformed educational practices worldwide. As highlighted by studies such as from Anastasopoulou *et al.* (2024), the increasing pervasiveness of ICT in educational systems has prompted institutions to adapt by adopting digital tools to support, enhance, and expand their instructional quality. This shift has supported the inclusion of digital content in curricula and required educators and administrators to reconsider pedagogical approaches and content delivery. Integrating LMS into educational settings has become essential for maximising learning potential, fostering interactivity, and advancing educational digitalisation (Ratnaningsih *et al.*, 2024).

LMS are software applications designed to manage, deliver, and track e-learning and blended courses, addressing the growing demand for flexible and accessible learning options (Holmes *et al.*, 2018). These highly adaptable systems support various instructional methodologies that allow students to engage in asynchronous learning activities from diverse locations and at their own pace (Abdullahi *et al.*, 2019). This flexibility is particularly valuable in accommodating learners with differing needs, geographic limitations, or scheduling conflicts, thereby democratising access to quality education. According to Mostafa and Alghamdi (2022), LMS foster critical thinking and personal expression by providing

✉Corresponding author: teguhariesandy@uny.ac.id

environments where learners can interact, collaborate, and innovate. The COVID-19 pandemic notably accelerated this shift, as institutions worldwide rapidly adopted LMS to sustain educational continuity during lockdowns, underscoring LMS's pivotal role in modern education (Mishra *et al.*, 2020).

LMS platforms are generally equipped with tools for course management, content delivery, interactive communication (e.g., chat, forums), and assessment. These features make LMS indispensable for enhancing engagement, providing structured and meaningful feedback, and enabling collaborative learning experiences that bridge the gap between in-person and remote learning environments. Studies (Sanusi *et al.*, 2019) have shown that LMS can positively impact student engagement, with interactive tools encouraging greater participation and collaboration. Furthermore, LMS improve accessibility by enabling students with diverse learning needs to engage with course material without restrictions, thereby fostering an inclusive learning environment. Such capabilities make LMS an essential component of modern education, especially as institutions shift towards hybrid and flexible learning models.

Adopting LMS has numerous advantages, including enhanced student engagement, greater accessibility, and the incorporation of multimedia elements that aid comprehension and retention (Mostafa & Alghamdi, 2022). Additionally, LMS offer features for collaborative learning, such as discussion forums, assignment modules, and group project tools, which facilitate communication between students and instructors (Muhisn *et al.*, 2022). However, implementing LMS also presents challenges, such as the time-intensive nature of creating and managing digital content, which can place additional demands on educators. Technical challenges, including device compatibility issues and variable internet connectivity, can also affect students' equitable access to LMS, posing barriers particularly for learners in regions with limited digital infrastructure (Ratnaningsih *et al.*, 2024; Saroia & Gao, 2019).

While extensive research has explored the benefits and implementation of LMS, significant gaps remain in understanding LMS effectiveness, especially in the context of post-2019 developments shaped by the COVID-19 pandemic. Earlier research, such as Prahani *et al.* (2022), provides broad overviews of LMS applications in e-learning, online education, and distance learning. However, there is a need for updated analyses that examine recent trends in LMS adoption, usage patterns, and impact on learning outcomes. Furthermore, studies that identify best practices for LMS implementation across hybrid, remote, and personalised learning models are limited, highlighting an essential area for continued exploration in LMS research.

This study conducts a bibliometric analysis of Learning Management System (LMS)-focused research from 2019 to 2024 using Scopus and VOSviewer databases, examining publication trends, key journals, authors, thematic clusters, and emerging areas within LMS research to provide a comprehensive understanding of LMS's role in enhancing learning outcomes. It specifically addresses how the adoption of LMS has impacted learning effectiveness in recent years, identifying trends, challenges, and best practices while uncovering critical factors contributing to LMS effectiveness, evolving needs in digital education, and potential areas for optimisation and innovation in LMS utilisation.

By focusing on recent trends that may not have been explored in earlier analyses, the study contributes to understanding contemporary LMS strategies and their role in addressing digital education challenges. The findings will benefit educators and administrators in aligning LMS implementations with evolving post-pandemic educational strategies. Additionally, insights from this study can guide policymakers and technology developers in identifying critical factors for successful LMS design and deployment, supporting innovations that further integrate LMS into the digital educational landscape (Gavinolla *et al.*, 2022).

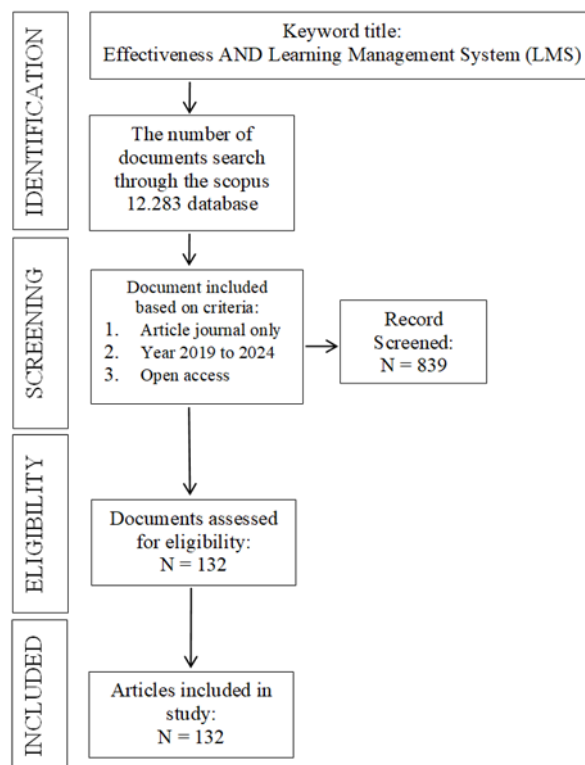
METHOD

This study utilises a dual methodological approach, combining PRISMA guidelines for systematic literature reviews with bibliometric analysis to identify and interpret key LMS research

trends. PRISMA's structured selection criteria ensure a rigorous and transparent review process, while bibliometric analysis highlights thematic clusters and publication trends, providing a comprehensive overview of LMS research. However, relying exclusively on the Scopus database may limit the generalizability of findings, as studies from other databases are excluded. Additionally, the study's emphasis on citation counts could bias the dataset toward more widely recognised studies, potentially overlooking recent but lower-cited research that may offer valuable insights (Sumardi *et al.*, 2021).

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) seen in Figure 1 as guidelines were followed to ensure a structured, transparent, and reproducible process in identifying, screening, and analysing relevant studies on Learning Management Systems (LMS) effectiveness (Liberati *et al.*, 2009). This systematic approach allowed for a rigorous evaluation of recent literature to provide insights into LMS's role in enhancing educational outcomes over the past five years.

Figure 1 Research methods - PRISMA



Data were primarily sourced from the Scopus database, known for its extensive coverage of peer-reviewed literature, particularly in educational technology and LMS studies (Kraleva *et al.*, 2019). Using the keywords "Learning Management System (LMS)" and "Effectiveness," the search captured studies that directly address the impact of LMS on learning outcomes. The search parameters were limited to articles published between 2019 and 2024 to ensure that the analysis reflects recent developments in LMS research (Mostafa & Alghamdi, 2022). This scope aimed to capture trends, challenges, and innovations in LMS use, mainly as education increasingly relies on digital learning tools.

Inclusion and exclusion criteria were set to ensure the relevance and quality of the selected studies, aligning with systematic review guidelines (Higgins & Green, 2011). Inclusion Criteria include studies from 2019 to 2024 to ensure the relevance of the findings. The document type is limited to peer-reviewed journal articles to guarantee the rigour of the research. Accessibility is prioritised for open-access articles, allowing unrestricted access to the details and results of the studies (Saputro *et al.*, 2021). Exclusion Criteria are set to omit conference proceedings, book chapters, and non-peer-reviewed sources, focusing solely on high-quality, rigorously vetted re-

search (Rahmi *et al.*, 2024).

The study selection process involved three phases to filter and narrow down the literature systematically. During the Identification phase, the initial Scopus search yielded 12,283 articles, providing a comprehensive overview of the potential literature on LMS effectiveness (Prahani *et al.*, 2022). In the Screening phase, by applying the defined inclusion and exclusion criteria, the dataset was reduced to 839 articles, ensuring a focus on the most relevant studies (Peirats Chacón *et al.*, 2019). Finally, the Eligibility Check involved a manual selection that refined the dataset by selecting articles with at least 20 citations to ensure a focus on influential research, resulting in 132 articles that formed the basis for the analysis (Mishra *et al.*, 2020).

Key data were systematically extracted from each article to support a detailed analysis. Extracted information included authorship, publication year, journal, study objectives, methodologies, and findings specific to LMS effectiveness (Gavinolla *et al.*, 2022). This structured extraction enabled a thematic analysis, identifying trends and insights across the selected studies (Muhisn *et al.*, 2022).

A bibliometric analysis was conducted on the final dataset using VOSviewer, a tool for visualising connections within research data, which highlighted publication patterns, thematic clusters, and keyword relationships, thus allowing for an in-depth understanding of research trends in LMS (Van Eck & Waltman, 2010). Key metrics analysed included publication frequency, which examined annual publication numbers to reveal trends in LMS research interest. Top journals were identified to highlight key sources of high-quality LMS research (Mostafa & Alghamdi, 2022). Influential authors were analysed to help identify key researchers in the field. Main themes such as learning outcomes, engagement, and user satisfaction were mapped to provide insights into central themes in LMS research (Saputro *et al.*, 2021). This structured data collection and analysis approach facilitated a comprehensive review of recent LMS studies, enhancing the understanding of how LMS technology supports and impacts learning effectiveness.

RESULT AND DISCUSSION

This section will present the findings of our analysis, followed by a brief explanation of the data. At the end of this section is an analysis of the findings, which compares the findings of this study with those of previous relevant studies.

A. The result of the study

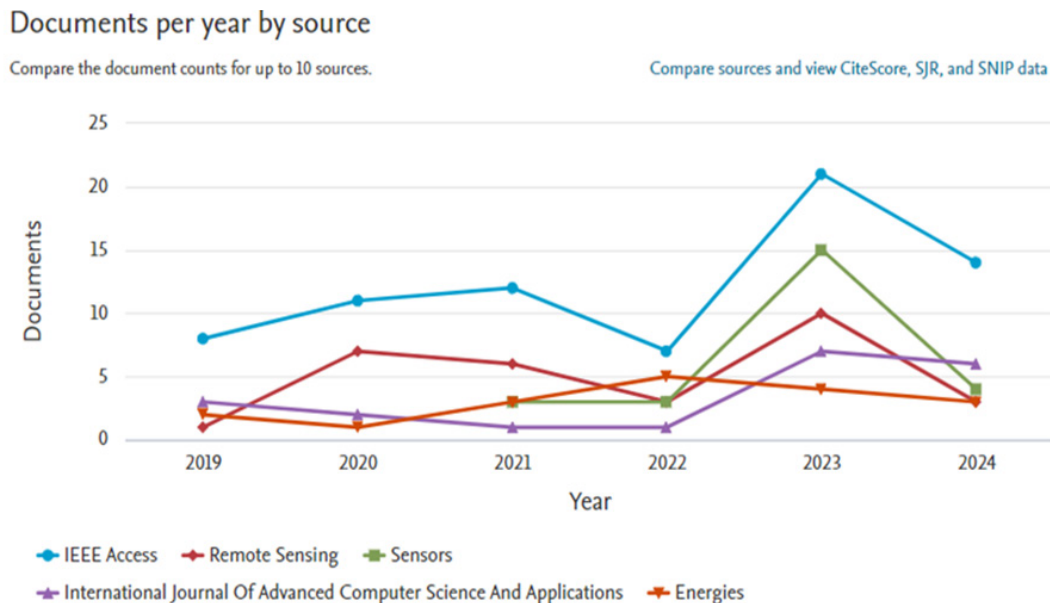
Figure 2 provides a ranking of journals most actively publishing research on the effectiveness of Learning Management Systems (LMS). The data reveals that IEEE Access leads significantly, publishing 21 documents on LMS effectiveness in 2023 alone. This journal's prominence in LMS research suggests its role as a preferred platform for studies that blend educational technology with applied research, which may include empirical studies, theoretical models, and innovative applications of LMS in academic settings.

The number of LMS-focused articles in IEEE Access aligns with its interdisciplinary approach, especially given its focus on computing and engineering technologies applied to education. The figure also indicates a preference for journals with a technology and engineering orientation among researchers exploring LMS effectiveness. These findings underscore the importance of IEEE Access as an influential source for researchers and practitioners in educational technology, providing critical insights and advancements that drive LMS applications in diverse educational contexts.

Moreover, figure 3 below identifies the top contributors to LMS research on Scopus by publication volume, specifically highlighting Gomes, Osco, Ramos, Liesenberg, and Goncalves. This concentrated contribution from a few researchers indicates their substantial influence and ongoing dedication to the field. Gomes for instance, has consistently contributed high-impact stu-

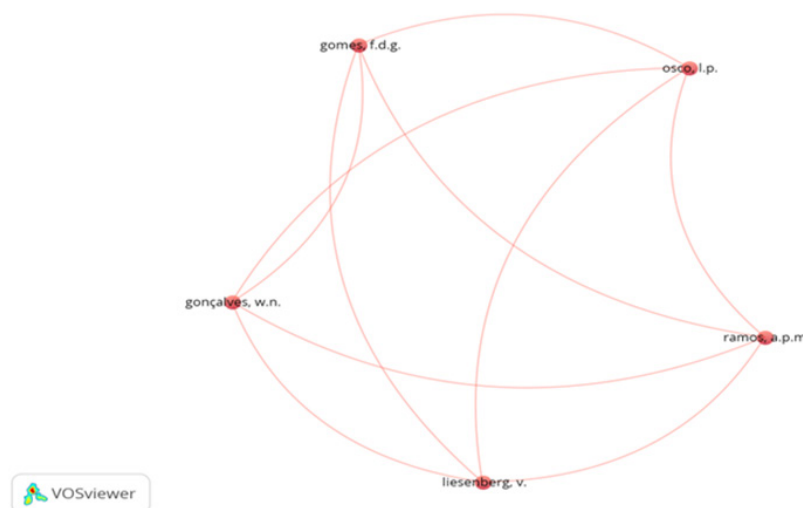
dies that explore LMS implementation, effectiveness, and integration within institutional contexts.

Figure 2 Journals most aligned with the research theme

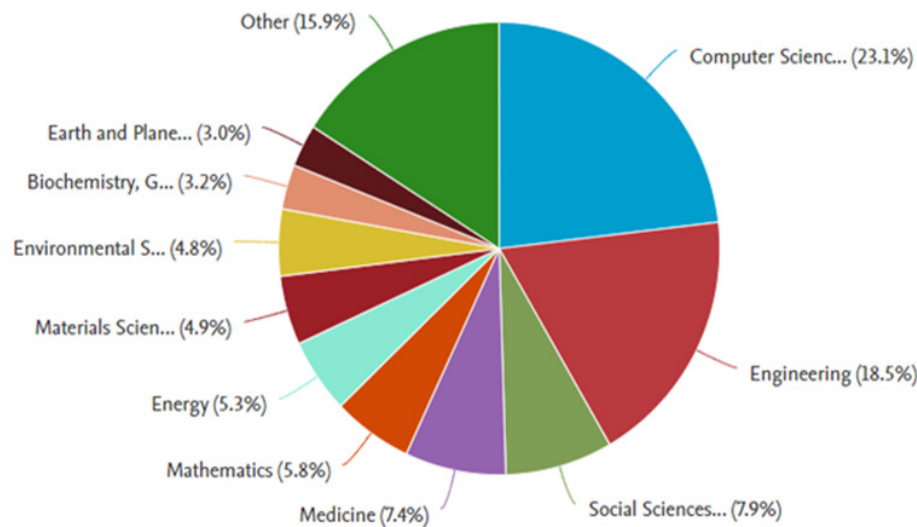


Moreover, figure 3 below identifies the top contributors to LMS research on Scopus by publication volume, specifically highlighting Gomes, Osco, Ramos, Liesenberg, and Goncalves. This concentrated contribution from a few researchers indicates their substantial influence and ongoing dedication to the field. Gomes for instance, has consistently contributed high-impact studies that explore LMS implementation, effectiveness, and integration within institutional contexts.

Figure 3 Authors with the most contributions



Regarding the articles' authors, most have each contributed foundational work that has helped define key challenges, implementation strategies, and evaluation frameworks for LMS. Their publications cover a range of critical issues, from system usability and learning engagement to the technological infrastructure necessary for LMS deployment. This clustering of prolific authors also points to collaborative networks and shared research agendas that help push the knowledge boundaries in LMS, reflecting the interconnected nature of LMS research as it grows in scope and complexity.

Figure 4 Subject areas related to the theme

The distribution of subject areas, shown in Figure 4, reveals that "Computer Science" dominates with 23.1% of publications, followed closely by "Engineering" at 18.5%, and smaller percentages across disciplines like "Social Sciences" and "Education." The strong representation of Computer Science and Engineering reflects LMS's foundation in digital and computational technologies, underscoring the importance of technical innovations in LMS development. This subject distribution indicates that LMS research is primarily technical, focusing on system design, functionality, and algorithmic advancements to improve learning outcomes. The smaller proportions within Social Sciences and Education highlight LMS's interdisciplinary nature, where research on user interaction, cognitive engagement, and educational impact complements the technical aspects. The figure also implies that, while LMS research is heavily technology-focused, there is room for more contributions from pedagogical and psychological perspectives to address holistic educational experiences.

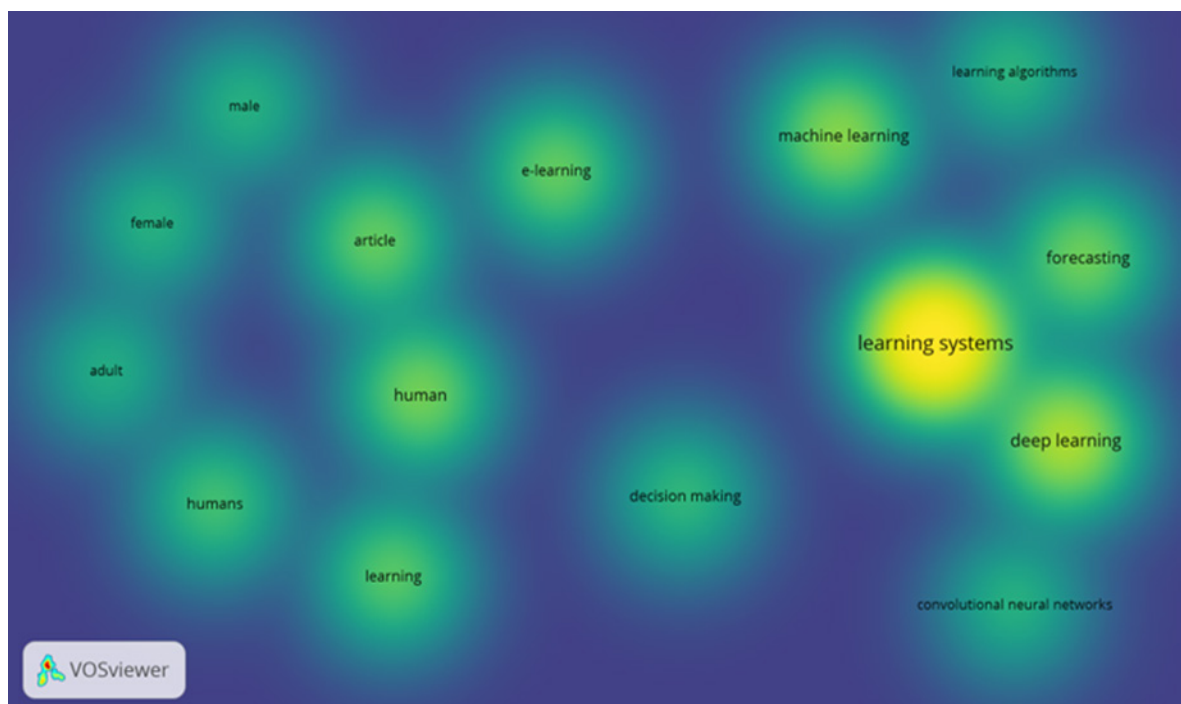
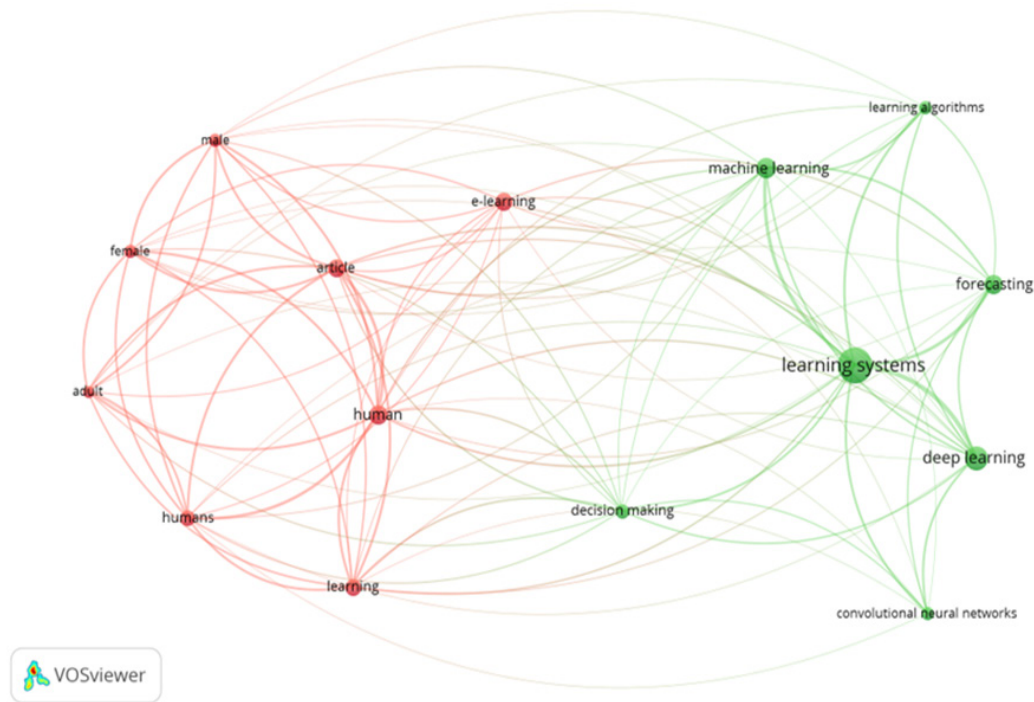
Figure 5 Potential topics based on theme

Figure 6 Main topics based on theme (clusters)



The density visualisation from VOSviewer (see figure 5) prominently illustrates that "Learning Systems" constitute a well-established research area within Learning Management Systems (LMS), with considerable literature focusing on LMS frameworks, their roles in educational systems, and their essential functionalities. This suggests that a robust foundation has been laid in understanding how LMS can support educational delivery. Nearby clusters around "e-learning," "machine learning," and "deep learning" indicate emerging research interests in integrating advanced technologies to enhance LMS functionalities, such as personalised learning pathways and analytics for optimising learning experiences. However, the visualisation also highlights underexplored areas, such as adaptive learning technologies and specific applications across different educational levels, which present opportunities for future research. These gaps suggest potential for studies on how adaptive algorithms can create responsive LMS platforms, using multimodal learning analytics and developing more inclusive and accessible LMS platforms. Addressing these could bridge formal education with vocational and lifelong learning needs, thus enhancing the overall impact of LMS in diverse learning environments.

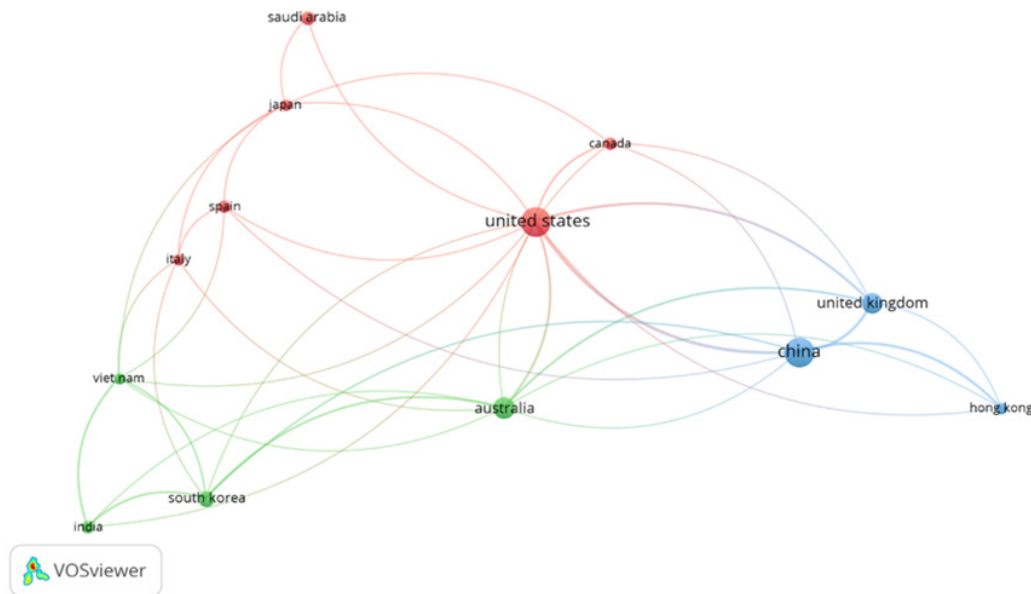
Next, figure 6 presents a cluster analysis, dividing key LMS research themes into two main clusters: the red and green clusters. The red cluster, including keywords like "article," "human," "e-learning," "adult," "male," and "female," points to research themes associated with human-centred approaches to LMS, including demographic considerations, e-learning design, and user engagement across various learner profiles. This cluster emphasises LMS's role in user experience, engagement, and accessibility, suggesting a focus on the human factors essential to successful LMS implementation and use.

The green cluster, with terms like "learning system," "deep learning," "machine learning," "learning algorithms," "forecasting," "decision-making," and "convolutional neural networks," represents a more technical focus on advanced methodologies for LMS. This cluster suggests a significant interest in applying machine learning and artificial intelligence to LMS, aiming to create adaptive learning environments that respond to students' needs in real-time. These themes indicate a trajectory toward LMS that can deliver content and analyse student behaviour and outcomes, potentially guiding instructional strategies. The existence of these two clusters demonstrates the dual focus in LMS research, balancing human-centric design with technological

advancements to enhance learning effectiveness.

The last finding of the study in Figure 7 categorises the publication origins of LMS research articles grouped into four primary clusters. Cluster 1 (red) includes Canada, Italy, Japan, Saudi Arabia, Spain, and the United States, indicating these countries as dominant contributors to LMS research. This cluster's prominence suggests that institutions in these regions have robust infrastructure and resources for educational technology research, likely driven by significant investments in digital education and a policy environment conducive to LMS implementation.

Figure 7 Countries of publication origin



Cluster 2 (green), comprising Australia, South Korea, and Vietnam, signifies an emerging focus on LMS within Asia-Pacific, potentially fuelled by regional educational reforms and the shift toward online learning during and after the COVID-19 pandemic. Cluster 3 (blue) includes China, Hong Kong, and the United Kingdom, indicating these countries' significant contributions. China and the UK are particularly active in integrating LMS technologies into their national educational systems.

This clustering highlights geographic differences in research focus and volume. It suggests that LMS research is a globally shared priority, with variations in approach influenced by regional educational needs, technology access, and policy frameworks. The broad international interest in LMS effectiveness underscores its critical role in transforming education, providing insights that can guide institutions worldwide as they adopt and optimise LMS solutions.

B. The discussion of the findings

This study provides an in-depth understanding of the trends and developments in Learning Management Systems (LMS) research over the past five years (2019–2024). The findings reveal a significant rise in publications, peaking in 2023 with 219 documents, indicating the growing attention among researchers toward the potential of LMS in digital learning environments. This acceleration is primarily attributed to the COVID-19 pandemic, which forced educational institutions to rapidly transition to online learning models.

LMS has evolved from an essential management tool to a comprehensive platform integrating advanced technologies such as adaptive analytics and machine learning algorithms to enhance learning outcomes (Ioannou-Sougliridi *et al.*, 2024). This study identifies two primary

research focuses: the technological advancement of LMS functionalities and a user-centric approach prioritising engagement and accessibility (Pramono, 2023). This dual emphasis presents significant opportunities to align technological innovation with pedagogical needs, ensuring LMS remains efficient and inclusive (Subiyantoro *et al.*, 2024).

The dominance of LMS research in Computer Science (23.1%) and Engineering (18.5%) underscores its technological foundations, particularly in developing system architecture, algorithms, and interfaces for adaptive learning. Concurrently, Social Sciences and Education contributions emphasise the pedagogical dimensions of LMS, including user engagement, curriculum design, and the evaluation of learning effectiveness. This multidisciplinary approach is crucial for creating LMS platforms that address global educational challenges, supporting formal education, professional training, and lifelong learning.

The thematic analysis revealed two key clusters in LMS research: human-centred and technology-driven approaches. The human-centred cluster highlights the importance of user experience, satisfaction, and accessibility, exploring how LMS can cater to diverse learners from varying socio-economic and cultural backgrounds. This aligns with the broader goal of creating inclusive learning environments (Lyon *et al.*, 2020). Conversely, the technology-driven cluster integrates adaptive algorithms, machine learning, and real-time analytics into LMS to deliver personalised and data-driven learning experiences (Sepeng & Moleko, 2024). These clusters form a holistic framework, balancing technological advancements with pedagogical relevance.

Geographically, LMS research is predominantly led by North America, Europe, and Asia-Pacific. The United States and Europe emphasise technological innovation, supported by advanced digital infrastructure and educational policies. Meanwhile, Asia-Pacific countries like South Korea and Australia focus on scalable LMS solutions to accommodate larger student populations. These regional priorities reflect varying needs, with developed regions prioritising advanced features and developing regions emphasising accessibility and scalability. This geographic distribution highlights the potential for cross-regional collaboration, combining technical expertise with local adaptations to create more inclusive and context-responsive LMS platforms.

Despite the significant benefits of LMS, its implementation faces several challenges. Technical limitations, such as inadequate digital infrastructure and internet access, remain barriers in many developing countries. Developing suitable learning content is often time-consuming and resource-intensive for educational institutions (Hassan & Hassan, 2023). These limitations require increased investment in technology infrastructure and comprehensive training for educators to optimise LMS usage. Furthermore, the integration of emerging technologies like artificial intelligence, virtual reality (VR), and augmented reality (AR) into LMS is still limited due to high costs and implementation complexity (Mohamed, 2024). Future research must explore ways to incorporate these technologies effectively to enhance the learning experience.

The findings carry essential theoretical and practical implications. Theoretically, this study enriches the understanding of how LMS can improve learning effectiveness by integrating technological and pedagogical approaches. Practically, it guides educational institutions in adopting LMS as a core learning tool. Institutions can leverage these insights to develop more interactive and personalised LMS platforms, utilising adaptive analytics and multimedia content. Training educators in LMS can also address technical challenges and enhance system efficiency, fostering a flexible and supportive learning environment.

This research also identifies several directions for future studies. Longitudinal research is necessary to evaluate the long-term impact of LMS on learning outcomes, particularly as educational needs and technological capabilities evolve. Interdisciplinary studies combining pedagogical theory with technical innovations could yield LMS platforms that are not only advanced but also pedagogically sound. Future research should also focus on integrating emerging technologies like AI, VR, and AR to create immersive and personalised learning environments. Furthermore, developing inclusive LMS platforms that address diverse socio-economic and cultural needs re-

mains a critical area for exploration.

In conclusion, this discussion emphasises the critical role of LMS in transforming digital education. By combining technological advancements with inclusive pedagogical approaches, LMS holds significant potential to support more effective and personalised learning experiences. This study contributes substantially to the LMS literature, providing new insights into its trends and future possibilities while offering strategic recommendations for research and implementation. Global collaboration and multidisciplinary approaches will be instrumental in accelerating the development of LMS as a cornerstone of 21st-century education.

CONCLUSION

This study highlights the growing importance of Learning Management Systems (LMS) in modern education, driven by post-COVID-19 digital adoption and the demand for flexible learning environments. A bibliometric analysis of research from 2019 to 2024 reveals increased publication volume, prominent journals like IEEE Access, and contributions from Computer Science and Education. Key findings show a dual focus on human-centered themes—engagement, accessibility, and inclusivity—and machine-learning topics like adaptive learning and personalized assessments. Geographically, North America, Europe, and Asia-Pacific lead LMS research, with opportunities for greater regional diversity and collaboration.

This study emphasizes that successful LMS implementation depends on robust institutional support, adequate infrastructure, and comprehensive user training, enhanced by interactive, multimedia-rich content to foster engaging learning environments. While the reliance on the Scopus database highlights the need for broader data sources in future research, underexplored areas such as AI-driven assessments, VR/AR integration, and the long-term impacts of LMS merit further investigation. Interdisciplinary collaboration between educators and technologists is essential to develop LMS that are both pedagogically robust and technologically advanced, addressing diverse learner needs in a digitalizing world. The findings offer valuable insights for aligning digital tools with modern educational demands, benefiting educators, administrators, and policymakers.

REFERENCES

- Abad-Segura, E., González-Zamar, M.-D., Infante-Moro, J. C., & Ruipérez García, G. (2020). Sustainable Management of Digital Transformation in Higher Education: Global Research Trends. *Sustainability*, 12(5), 2107. <https://doi.org/10.3390/su12052107>
- Abdullahi, A. M., Makhtar, M., & Safie, S. (2019). The patterns of accessing learning management system among students. *Indonesian Journal of Electrical Engineering and Computer Science*, 13(1), 15. <https://doi.org/10.11591/ijeecs.v13.i1.pp15-21>
- Anastasopoulou, E., Angeliki Tsagri, Eleni Avramidi, Konstantina Lourida, Evangelia Mitroyanni, Danai Tsogka, & Ioannis Katsikis. (2024). The Impact of ICT on Education. *Technium Social Sciences Journal*, 58, 48–55. <https://doi.org/10.47577/tssj.v58i1.11144>
- Animashaun, E. S., Familoni, B. T., & Onyebuchi, N. C. (2024). Strategic project management for digital transformations in public sector education systems. *International Journal of Management & Entrepreneurship Research*, 6(6), 1813–1823. <https://doi.org/10.51594/ijmer.v6i6.1167>
- Gavinolla, M. R., Livina, A., & Swain, S. K. (2022). State of the Research on Teacher Education and Sustainability: A Bibliometrics Analysis. *Journal of Teacher Education for Sustainability*, 24(2), 147–165. <https://doi.org/10.2478/jtes-2022-0022>
- Hassan, M. G., & Hassan, G. (2023). Technology and the Transformation of Educational Practices: A Future Perspective. *International Journal of Economic, Business, Accounting, Agriculture Management and Sharia Administration (IJEBAAS)*. <https://doi.org/10.54443/ijebas.v3i1.1136>
- Higgins, J. & Green, S. (2011). *Cochrane Handbook for Systematic Reviews of Interventions*. Wiley.

- Holmes, K., Prieto - Rodriguez, E., & The University of Newcastle. (2018). Student and Staff Perceptions of a Learning Management System for Blended Learning in Teacher Education. *Australian Journal of Teacher Education*, 43(3), 21–34. <https://doi.org/10.14221/ajte.2018v43n3.2>
- Ioannou-Sougleridi, E., Kopsidas, S., Vavougiou, D., Simos, C., Avramopoulos, A., & Kanapitsas, A. (2024). Revolutionizing Learning Management Systems: Architecture of an AI-Based LMS with Instructor-driven Personalized Content Generation. *International Journal of Advanced Multidisciplinary Research and Studies*. <https://doi.org/10.62225/2583049x.2024.4.4.3169>
- Krleva, R., Sabani, M., & Krlev, V. (2019). An Analysis of Some Learning Management Systems. *International Journal on Advanced Science, Engineering and Information Technology*, 9(4), 1190–1198. <https://doi.org/10.18517/ijaseit.9.4.9437>
- Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., Clarke, M., Devereaux, P. J., Kleijnen, J., & Moher, D. (2009). The PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of Studies That Evaluate Health Care Interventions: Explanation and Elaboration. *PLoS Medicine*, 6(7), e1000100. <https://doi.org/10.1371/journal.pmed.1000100>
- Lyon, A. R., Brewer, S. K., & Areán, P. (2020). Leveraging human-centered design to implement modern psychological science: Return on an early investment. *The American Psychologist*, 75 8, 1067–1079. <https://doi.org/10.1037/amp0000652>
- Mishra, L., Gupta, T., & Shree, A. (2020). Online teaching-learning in higher education during lockdown period of COVID-19 pandemic. *International Journal of Educational Research Open*, 1, 100012. <https://doi.org/10.1016/j.ijedro.2020.100012>
- Mohamed, A. (2024). Exploring the Role of AI and VR in Addressing Antisocial Behavior Among Students: A Promising Approach for Educational Enhancement. *IEEE Access*, 12, 133908–133922. <https://doi.org/10.1109/ACCESS.2024.3433531>
- Mostafa, N. M., & Alghamdi, J. (2022). Effectiveness of Learning Management Systems in Developing Essay Writing Skills as a Form of Creative Writing for Undergraduate Students in Saudi Arabia. *International Journal of Education and Practice*, 10(4), 393–410. <https://doi.org/10.18488/61.v10i4.3229>
- Muhisn, Z. A. A., Almansouri, S., Muhisn, S., Ahmad, M., & Omar, M. (2022). The Effectiveness of Knowledge Combination in e-Learning Management System (eLMS). *International Journal of Emerging Technologies in Learning (ijET)*, 17(16), 33–42. <https://doi.org/10.3991/ijet.v17i16.31873>
- Pedro, F. X., & Teixeira, A. C. (2021). The Impact of Accelerated Digital Transformation on Educational Institutions: In S. M. C. Loureiro & J. Guerreiro (Eds.), *Advances in Educational Technologies and Instructional Design* (pp. 1–26). IGI Global. <https://doi.org/10.4018/978-1-7998-6963-4.ch001>
- Peirats Chacón, J., Marín, D., & Vidal, M.-I. (2019). Bibliometría aplicada a la gamificación como estrategia digital de aprendizaje. *Revista de Educación a Distancia (RED)*, 19(60). <https://doi.org/10.6018/red/60/05>
- Prahani, B. K., Alfin, J., Fuad, Ah. Z., Saphira, H. V., Hariyono, E., & Suprpto, N. (2022). Learning Management System (LMS) Research During 1991–2021: How Technology Affects Education. *International Journal of Emerging Technologies in Learning (ijET)*, 17(17), 28–49. <https://doi.org/10.3991/ijet.v17i17.30763>
- Pramono, L. H. (2023). User Experience in Cloud Computing Services-Based LMS: a Case Study. *Journal of Information Systems and Informatics*. <https://doi.org/10.51519/journalisi.v5i4.600>
- Rahmi, U., Ramadhani Fajri, B., & Azrul, A. (2024). Effectiveness of Interactive Content with H5P for Moodle-Learning Management System in Blended Learning. *Journal of Learning for Development*, 11(1), 66–81. <https://doi.org/10.56059/jl4d.v11i1.1135>
- Ratnaningsih, S., Hady, Y., & Nisa, M. (2024). Adaptation of the Learning Process for Students in the Post New Normal Era: Learning Management System (LMS) Innovation Efforts in Indonesia. *International Journal of Religion*, 5(7), 356–366. <https://doi.org/10.61707/gb9xwq11>
- Sanusi, N., Kamalrudin, M., & Mohtar, S. (2019). Student Engagement using Learning Management System in Computer Science Education. *International Journal of Recent Technology and Engineering*, Volume-8, Issue-2511, 743–747.
- Saputro, B., Tortop, H. S., Zuhri, M., Mansur, M., & Saerozi, M. (2021). The Effectiveness of the Learning Management System of Saqural Learning Application on the Scientific Interpretation Learning Outcomes. *Jurnal Pendidikan IPA Indonesia*, 10(1), 111–120. <https://doi.org/10.15294/jpii.v10i1.27677>

- Saroia, A. I., & Gao, S. (2019). Investigating university students' intention to use mobile learning management systems in Sweden. *Innovations in Education and Teaching International*, 56(5), 569–580. <https://doi.org/10.1080/14703297.2018.1557068>
- Sepeng, P., & Moleko, M. M. (2024). Embracing the Data-Driven Paradigm: A Comprehensive Framework for Effective Teaching and Learning in Higher Education. *E-Journal of Humanities, Arts and Social Sciences*. <https://doi.org/10.38159/ehass.202341218>
- Subiyantoro, S., Degeng, N., Kuswandi, D., & Ulfa, S. (2024). Developing Gamified Learning Management Systems to Increase Student Engagement in Online Learning Environments. *International Journal of Information and Education Technology*. <https://doi.org/10.18178/ijiet.2024.14.1.2020>
- Sumardi, D., Suryani, N., & Musadad, A. A. (2021). Website-Based Learning Management System (LMS) as a Tool for Learning in the Covid-19 Pandemic Period for Junior High Schools. *Journal of Education Technology*, 5(3), 346. <https://doi.org/10.23887/jet.v5i3.38371>
- 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>